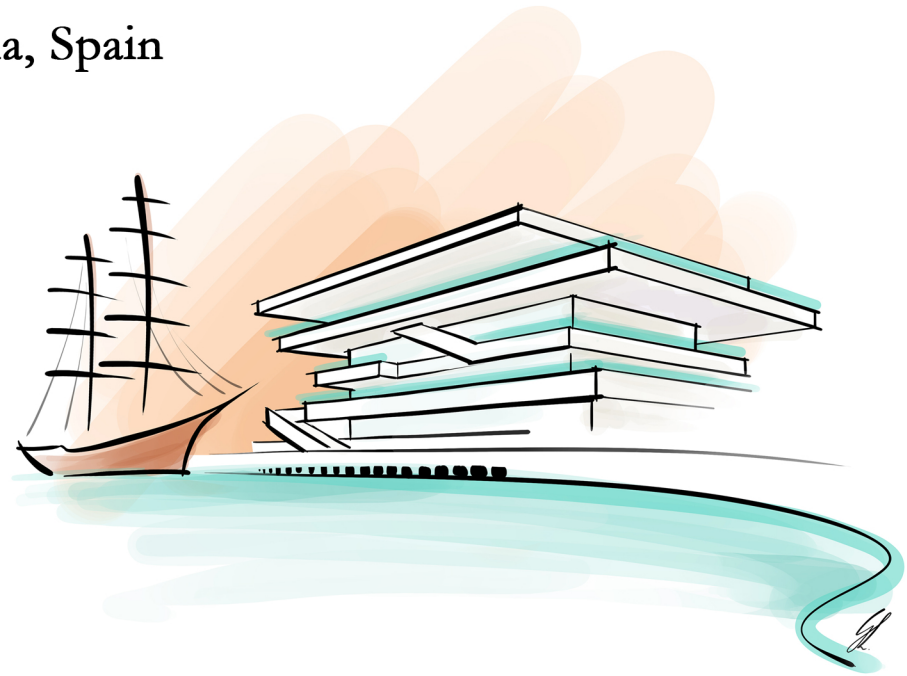
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HEAd '24

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Preface

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Abstract

This is the preface for the tenth edition of the International Conference on Higher Education Advances (HEAd). HEAd'24 brought together researchers, educators, students, and professionals from around the world to exchange ideas and research findings on student preparation and higher education systems. The conference facilitated thought-provoking discussions, innovative ideas, and collaborative efforts to advance teaching, learning, and the overall higher education landscape. The scientific program, curated by a committee of 219 members from 44 countries, received 288 full paper submissions. Of these, 81 papers were accepted for full-paper presentation, while 39 short papers and 40 posters were also included. The contributions covered diverse topics such as pedagogical approaches, technology integration, student engagement, assessment methods, curriculum design, and educational policies. Additionally, three keynote speeches and three pre-conference workshops enriched the conference experience.

Keywords: *Higher education; innovative materials; educational technology; evaluation and assessment; globalization in education.*

1. Introduction to HEAd'24

This volume contains the selected papers of the Tenth International Conference on Higher Education Advances (HEAd'24), a milestone anniversary event held in Valencia, Spain, from 18 to 21 June 2024. Celebrating a decade of academic excellence, HEAd'24 provided a dynamic platform for researchers, educators, students, and professionals from around the world to exchange ideas, experiences, and research results regarding the preparation of students and the organization of higher education systems. Over the past ten editions, the conference has attracted 2,200 participants and seen 3,086 papers submitted by 3,902 authors, underscoring its significant impact on the academic community.

The selection of the papers for the scientific program of HEAd'24 was conducted by a team of 219 committee members representing 44 countries on all five continents. Following the call for papers, the conference received 288 full paper submissions with authors from 56 different

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countries. All the submitted papers were reviewed by at least two program committee members under a double-blind review process. Finally, 81 papers were accepted as full papers for oral presentation during regular sessions, representing an overall full paper acceptance rate of 28 reflecting the conference's commitment to showcasing the highest-quality work. Additionally, 39 submissions were accepted for short paper presentations and 40 for poster presentations, all of them receiving high review scores, and were published by UPV Press in this volume. The organization committee congratulates all the authors for having their papers accepted in the proceedings of such a competitive conference.

The conference program highlights key topics shaping the future of higher education. This year, the focus is shift to the integration of artificial intelligence, underscoring its transformative role in teaching and enhancing academic integrity. A strong emphasis on health and psychological well-being points to innovative approaches in creating inclusive educational environments. Additionally, the agenda covers sustainability and global citizenship, preparing students to address global challenges effectively. Entrepreneurship and career readiness are also central themes, examining how education can foster entrepreneurial skills and professional development.

The conference program featured three keynotes covering significant and timely topics. The first keynote, “Designing Curriculum in the Age of Diversity,” delivered by Cesar Ortega-Sanchez (Curtin University, Australia), focused on helping students becoming the best possible version of themselves. The second keynote, “Leading the Way” by Andrea Ward (University of Derby, UK), emphasized the central role of higher education institutions and their staff in shaping the future of students. Lastly, the keynote titled “AI_ways for higher educations,” presented by Susanna Sancassani (Politecnico di Milano, Italy), explored the implications and opportunities of artificial intelligence in higher education. These keynotes provided valuable insights and sparked thought-provoking discussions, enriching the impact of HEAd’24.

HEAd’24 also hosted three pre-conference workshops to offer participants the opportunity to explore specific topics with a hands-on approach. The workshops included “Reinventing University: the Digital Challenge in Higher Education,” led by Stefania Capogna, Maria Chiara De Angelis (Link Campus University, Italy) and Erika Zuperkiene (Klaipeda University, Lithuania), “Optimizing University Module Design,” organized by Nataliya Romanyatova (SETU, Ireland), and “Hacking a Hackaton” by Janika Leoste (Tallinn University, Estonia) and Tomi Kauppinen (Aalto University, Finland).

The conference was supported and hosted by the Faculty of Business Administration and Management of the Universitat Politècnica de València, once again, as it has been since the first edition in 2015.

The organizing committee would like to extend heartfelt thanks to everyone who contributed to the success of this decade of HEAd conferences. Specifically, thanks are indebted to the invited

speakers, authors, scientific committee members, reviewers, session chairs, presenters, sponsors, supporters, and all the attendees. Our final words of gratitude must go to the Faculty of Business Administration and Management of the Universitat Politècnica de València for their unwavering support, which has been decisive in making the HEAd conference a significant event in the field of higher education.

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Measuring the effectiveness of a micro-credential programme: utilising the Kirpatrick's model for evaluation. A Case Study

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Abstract

The quality of microcredential programmes is mostly based on formal quality assessment standards. Still, even if all formal standards are met, how can the facilitators and learners evaluate the long-term effectiveness and impact of the MC programme? This case study provides an example of how to measure training effectiveness. We describe how to collect data and analyse it following Kirkpatrick's evaluation criteria (learners' reactions, learning process/outcomes, behaviour/practices, and results). The personalised approach of collecting learner reactions resulted in quite high satisfaction scores at the end of the programme. Successful completion of coursework as well as the development of competencies displayed in learning diaries provide evidence of the successful learning process. The high quality of submitted work gives proof of effective implementation of knowledge and competencies. Results criteria also indicated a high level of retention as well as implementation of competencies in their institutions.

Keywords: *microcredential programme; training effectiveness; evaluation criteria.*

1. Introduction

Micro-credential (MC) programmes are becoming more prevalent all over the world (Brown et al., 2021) and are becoming an excellent addition to the lifelong learning options. They provide possibilities for learners as well as professionals to enhance competencies, skills and knowledge in different fields while still being part of the labour market (Tammeleht et al., 2023). While quality criteria for MCs are set by the EU (EC, 2021) there is still uncertainty of effectiveness of MCs and their overall impact (Ha et al., 2023). Indeed, if the MC programme credits learning in ECTSs and the provider of the programme is an established higher education (HE) institution, this may ensure the quality of individual courses, but the question remains – what is the overall impact and effectiveness of the MC programme? Our goal is to provide an example of how to

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evaluate the effectiveness of a MC programme. This case study provides an example of how to utilise Kirkpatrick's framework of training effectiveness.

2. Theoretical background

While there are guidelines available that help develop MC programmes (EC, 2021; EQF, 2018; CMF, 2019), quality is mostly based on formal quality assessment standards (like formal instruments and assessment of procedures) (EC, 2021). External and most internal quality criteria can be taken into account during the design of the MC programme (like assessment of providers, the overall quality based on the standards, quality of the courses leading to MC). Some criteria, like learners' and peer feedback is usually collected during or after the course. In addition, MCs provided by approved HE institutions also follow *Standards and Guidelines for Quality Assurance in the European Higher Education Area*. Nevertheless, it seems that even if all formal standards are met, how can the facilitators and learners evaluate the long-term effectiveness and impact of the MC programme? Oliver (2019) highlights that considering the wide variety of MC formats (including e.g. MOOCs), assessment of what the participants are learning may be challenging. Oliver (2019) outlines that only online tests or formal evaluation criteria may be prone to skewed results, more authentic tasks and personalised feedback should be incorporated into the learning process and evaluation.

Prior studies about effectiveness of ethics training (e.g. Steele et al., 2016; Stoesz & Yudintseva, 2018) outline that most often learner reactions and knowledge testing is used to make assumptions about how successful the training was. Collecting data about the impact of the training on trainees' behaviour and consecutive institutional improvement is rare to non-existent (Steele et al., 2016). One of the reasons may be the feasibility of collecting such data as well as analysing it – in case of large learner groups and no connection with them after the course ends may make it difficult to keep track of the graduates' future activities.

Kirkpatrick's model (1959) has been in use for evaluating effectiveness of trainings in research ethics and integrity (REI) context (Steele et al., 2016; Stoesz & Yudintseva, 2018) as well as for programme evaluation in HE context (Praslova, 2010). Kirkpatrick's framework of training effectiveness includes the following criteria (Kirkpatrick, 1959; Praslova, 2010) and different kind of data may feed into those criteria: (1) *Learners' reactions* like participants' self-assessment; reactions may be collected by various instruments (students' affective reactions and utility judgements). (2) *Learning process and outcomes* (knowledge, content); this aspect can be measured by tests, performance tasks and other graded work. (3) *Behaviour and practices*, e.g. acting in the working community. Behaviour can be evaluated based on end-of programme integration papers or projects, diaries, documentation of integrative work at HE institution or society. (4) *Results*, e.g. institutional outcomes. Results can be monitored by alumni and employer surveys, samples of accomplishments, media coverage, awards, recognition.

While the formal quality assurance criteria were met during the programme development, evaluation of overall effectiveness and long-term impact of the programme was needed. We posed the following research question: how to evaluate the effectiveness of the MC programme based on Kirkpatrick's criteria?

3. Method

In our case study we used deductive content analysis of different kinds of data (from learner's self-reflection and course work to following the graduates' activities after graduation) based on Kirkpatrick's evaluation criteria (learners' reactions, learning process and outcomes, behaviour/practices, and results) to make assumptions on the effectiveness of the programme. The MC programme met all the EC and institutional standards of MC programmes (CMF, 2019), but we felt that to measure the effectiveness of the programme, we should use a variety of measures.

Context of the study: The MC programme aimed to educate REI leaders who could solve various issues in their institution, and who could guide others. Learning outcomes included recognising ethically sensitive issues of scientific and academic ethics; improving REI competencies; knowing the main values and principles underlying academic and research ethics and good science; and implementing good research practices in the organisation.

Participants. In the beginning there were eight learners in the MC programme (two dropped out) and one joined in the second semester. Eventually, six participants successfully completed the entire program. Permission to use the learners' feedback and coursework for evaluating training effectiveness was sought after the first and second semester – a digital information letter and a consent form was sent to all learners and volunteers digitally signed the consent form. Permission to share the feedback and coursework material had no impact on the passing of the programme. All results are presented in a generalised form and anonymously. Out of nine learners seven granted permission for their data to be used.

Data collection. During the development and piloting of the MC programme (see Tammeleht et al., 2023) we planned to collect different kinds of information from learners' reactions to learning process. There was also a general university-wide feedback survey for those who completed the programme. Five people responded to this questionnaire and in the case of open-answer questions, four of them agreed to publish their answers. After the end of the programme, we kept in contact with our graduates. Seven months after graduation we sent out a follow-up questionnaire about how they had applied the skills and competencies acquired during the MC programme; the changes in RE within their institution due to their work after studies; the feedback from their employer and colleagues about participating in the MC programme.

4. Results

Learners' reactions. During the first semester, we held monthly online sessions (N=4) to meet with all learners and share important information, but to also gather feedback from learners and give them a chance to share ideas about the highs and lows of their studies. In addition to this, after the end of the first half of the MC programme, the programme coordinator compiled feedback from learners (N=8). We have already described the reactions from learners during the first semester in Tammeleht et al. (2023).

After the learners had presented their final projects and completed the MC programme, we organised a focus group discussion with the learners to gather reactions and feedback about the second semester and the whole MC programme. We found that a lot had improved, compared to the first semester, and overall, the learner's experiences about participating in the MC programme were very positive. The learners stated that the programme met their expectations, and they found the acquired knowledge valuable and helpful for their work. The learners appreciated the format of the MC programme, which contained theory as well as practice. The learners appreciated people – fellow-learners, lecturers, and programme facilitators. The learners were thankful that the facilitators considered the feedback about the timetables that was given after the first semester, and the learners found the second semester schedule with fewer meetings but more intense seminar days to be far more convenient. The learners also provided some suggestions: there could be even more online information sessions, since these help to keep up with the studies and increase the learners' motivation.

After the end of the MC programme, a general university-wide MC programme feedback survey was also conducted (five learners provided feedback there). While most feedback coincided with the focus group interview, there were some additional ideas. The survey asked about the motivation for participating in the programme and participants outlined the desire to acquire new knowledge and for intellectual growth. All respondents acknowledged that learning in the online environment effectively supported their learning experience, and teaching was varied. They highlighted outstanding lecturers who were experts in their field as well as supportive and flexible attitude of the facilitators. Improvement ideas included drawbacks of differentiated assessment which created tension and tight schedule during the autumn semester.

Learning process and outcomes were monitored by tracking course completion rate, analysing learning diaries (kept during the first semester) and following submissions in the online learning environment (during the second semester). The simplest of these measures was monitoring the course completion results. It was also simple to follow task submissions in the online learning environment in the second semester – learners had to make a submission once a month right before a face-to-face seminar day. All submissions were read by one or two facilitators and feedback was provided during the seminar day – this way the learning process of all participants

was supported and monitored. Based on course results and submissions we can determine that the learning progress corresponded to the set outcomes.

Throughout the first semester learners kept a digital learning diary that they filled about once a week. During the first half of the semester the entries were submitted individually, but in the second half of the semester (by the request of learners) the entries were submitted in the forum format (meaning that learners could read each other's entries and respond to them). The topics pertained to RE generally and were not solely related to any course. The goal was to monitor development of ethical sensitivity (recognising ethical principles, using ethical analysis and ethical approaches to deal with various dilemmas) (Tammeleht, 2022). The content of the learning diaries was analysed using deductive content analysis in MaxQDA (2022) programme and we monitored the levels of understanding (SOLO taxonomy) of content knowledge (ethical principles, approaches and analysis) (Tammeleht et al., 2024). Figure 1 displays the content knowledge and levels of understanding of individual (A) and forum format (B) diary entries.



Figure 1. Screenshots of display of development of understanding and content knowledge in learning diaries, A – individual diary entries, B – forum format entries (P0-P5 indicate participants who granted permission to use their learning diaries for analysis).

As displayed in Figure 1, initially the levels of understanding (SOLO levels, see a detailed description of the SOLO taxonomy use in REI training context in Tammeleht et al., 2019) were adequate (on multistructural and relational levels), but only some ethical principles were displayed. Forum format entries (B) show a much more varied recognition of ethical sensitivity aspects and also levels of understanding are higher. Based on learning diaries we could conclude that there was adequate development of ethical competencies of learners.

Monitoring *behaviour and practices* of individuals is more challenging. We needed to make conclusions whether learners could implement knowledge and competencies they had acquired during their studies. According to Praslova (2010) an integration project or an out-of-class task could be used to measure this aspect. We used two measurement points to examine this criterion:

first, five months after the integrative diary-keeping we asked learners to do a case study where they had to integrate all the competencies they had acquired throughout their studies (ethical principles, ethical analysis and ethical approaches) and we monitored if they had retained their levels of understanding (based on the SOLO taxonomy) of the topics we had measured in their learning diaries.

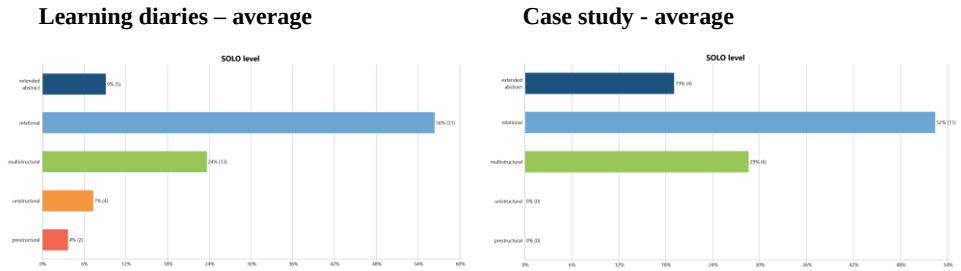


Figure 2. Screenshots of levels of understanding in submitted documents.

As illustrated in Figure 2, not only had the learners retained their high level of understanding, but they had also improved it. It should also be noted that throughout the five months that were between the measurement points, the learners had mostly dealt with individual reading and meeting once a month for lectures and discussion sessions (which were designed to increase their ethical sensitivity but did not directly teach solving cases).

The second measurement point for behaviour was the final assignment of the MC programme – each learner had to devise an ethics infrastructure element for their institution and present it during the defence session. All participants created an element that was specifically needed in their institution, e.g. analysis of RE support for institutional accreditation, analysis of RE competence among academics, data management guidelines, etc. A board of experts evaluated the final assignment and its defence. All work submitted and defended was of high quality.

Results. Measuring the impact on the institutions is more difficult to achieve. We carried out a small-scale media search to find if our graduates were present in the local media. We found examples of two of our graduates being actively involved in a larger REI discussion in the society by, for instance, writing an article, participating in public seminars, and publicly sharing best of their institutional RE practices. One participant won a reward from the professional association.

In addition, to get first-hand information, we sent out a small feedback survey to our participants. Seven months after the end of the MC programme we inquired how they had applied the skills and competencies acquired during the MC programme. Results indicated that all of the respondents (N=6) had been actively applying the acquired skills and competencies on a daily basis in their professional as well as personal lives. Four people highlighted their work concerning teaching of ethics, e.g. creating new research ethics courses, being confident

in focusing on ethical questions and discussing ethical topics in the existing courses. Two people mentioned applying research ethics competencies in the field of research and research project applications by assisting colleagues as well as being more sensitive while applying research ethics guidelines in compiling a new nation-wide study. Three participants noted that they had successfully applied the knowledge, skills, and competencies in their work in ethics committees and can now better identify ethical conflicts and solutions. One person became a member of an institutional ethics committee after finishing the MC programme, one participant joined a working group for updating the code of conduct in their institution and one became a consultant for issues related to open science and data management in their institution.

5. Discussion and conclusions

Our goal with this case study was to explore means to evaluate the effectiveness of the MC programme and we utilised Kirkpatrick's criteria of reactions, knowledge, behaviour, and results. Learners' reactions were collected throughout the programme both orally and in written form as part of the programme activities and a university-wide survey. Participants were active to share their problems and ideas for improvement, and the programme facilitators tried to consider them as much as possible. This personalised approach of collecting learner reactions resulted in quite high satisfaction scores at the end of the programme. Learning progress was evaluated as part of course assessment but also by monitoring learning diaries that were kept during the first semester of the programme. Successful completion of coursework as well as the development of REI competencies displayed in learning diaries provide evidence of the successful learning process. Behaviour and practices were monitored via one case study and the final assignment of the learners. Both pieces of work expected learners to integrate their acquired competencies and display the integration of various aspects learned during the programme. The high quality of submitted work gives proof of effective implementation of knowledge and competencies. Results aspect was measured during the year after the end of the programme – facilitators monitored the graduates in the local media as well as collected feedback after seven months of graduation. Results indicate a high level of retention as well as implementation of competencies in their institutions.

Limitations of the study include a small sample size and possibly facilitators of the programme measuring the effect. In truth, the small sample size may also be our advantage. In our context, the minimum for opening a MC programme is five participants (due to the small population and HE context). The small number of participants enabled us to monitor the progress of each individual as well as keep in touch with them after graduation. This way data for various Kirkpatrick's criteria could be collected.

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Can Artificial Intelligence Complete My Assessment? A Student Led Initiative to Stress Test the Academic Integrity of University Assessment Using Generative AI

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Abstract

The ability of Generative AI (GenAI) to perform complex tasks has caused mixed feelings within the field of education. The most significant concern is the implications of GenAI for academic integrity. In this study, students applied GenAI to complete past university assessments adapted as research tests, with the goal of achieving a pass grade when graded by an academic, undetected by an AI writing detection tool. The study reveals that from a sample of 21 valid research tests, 23.8% (5) passed when graded by an academic achieving grades between 40% and 60%, with AI writing detection scores ranging between 0% and 14%. AI writing detection scores lower than 20% are potentially a false positive in the context of investigating breaches of academic integrity. The researcher concludes that many traditional methods of assessment in universities are obsolete in the face of increasingly undetectable AI generated solutions.

Keywords: *Generative Artificial Intelligence; GenAI; Assessment; Academic Integrity; Artificial Intelligence Writing Detection.*

1. Introduction

Generative AI (GenAI) known as ChatGPT developed by OpenAI, and released publicly in November 2022, has become the fastest growing consumer application in history (Marr, 2023). The ability of GenAI to perform complex tasks (Liu et al., 2023; McKinsey, 2023) within the field of education has caused mixed feelings among educators (García-Peñalvo, 2023; Halaweh, 2023; Kohnke et al., 2023; Malinka et al., 2023; Rudolph and Tan, 2023; Sawahel, 2023). Integrating GenAI in education raises concerns about assessment and evaluation, as some traditional methods may become obsolete in the face of GenAI solutions (Fowler, 2023; García-Peñalvo, 2023; Hockly, 2023; Lancaster, 2021). The most significant concern about GenAI in

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the field of education, is the implications of GenAI for academic integrity (Firat, 2023b; Fowler, 2023; Lancaster, 2021; Malinka et al., 2023; Roe and Perkins, 2022). This paper presents the results of a study where students applied GenAI to complete past university assessments, adapted as research tests, with the goal of achieving a pass grade when graded by an academic, undetected by AI writing detection tools.

2. Literature Review

Artificial Intelligence (AI) is now firmly rooted in our daily lives. Since November 2022 a form of generative AI (GenAI) known as ChatGPT developed by OpenAI, has become the fastest growing consumer application in history. A report by Ofcom United Kingdom (Ofcom, 2023) reveals that 80% of British teenagers aged from 13-17 years old, and 40% of children between the ages of 7-12 years old have used GenAI tools and services for schoolwork or leisure. ChatGPT is the most widely used GenAI tool among internet users aged 16 and over (Ofcom, 2023). Education features strongly in the target audience interests of ChatGPT site visitors (Similarweb, 2023). ChatGPT's journey from concept to influential GenAI model exemplifies this rapid evolution of GenAI. This groundbreaking model has driven progress in GenAI development and spurred transformation of work practices across a wide range of industries (Marr, 2023). Thus, given the potential impact of GenAI on business and indeed all facets of life, it is critical that this technology becomes part of the educational experience of students particularly as it heavily influences their future careers.

The ability of GenAI to perform complex tasks within the field of education has caused mixed feelings among educators as it disrupts existing educational praxis (Baidoo-Anu and Owusu Ansah, 2023). However, as studies are only emerging with respect to the uses and benefits of GenAI for education, it is not yet possible to assert a consensus among academics with specific reference to GenAI in education (Firat, 2023a). Integrating GenAI in education raises concerns about assessment and evaluation, as traditional methods may become obsolete in the face of GenAI solutions (Rudolph and Tan, 2023; Sullivan et al., 2023). Furthermore, as GenAI can contain factual inaccuracies and biases (Baidoo-Anu and Owusu Ansah, 2023; Sullivan et al., 2023), it can only enhance student learning if academics are experts in their field and can detect such inaccuracies and biases. Furthermore, to use GenAI as a tool, educators must address significant gaps in digital competencies to use it ethically and effectively to support learning (Kohnke et al., 2023). GenAI education literature also raises significant concerns with respect to academic integrity (Amini-Salehi, 2023; An et al., 2023; Malinka et al., 2023; Zhai, 2023).

While OpenAI released an AI writing detection tool in February 2023, it was withdrawn as it was ineffective in July 2023 (OpenAI, 2023a). In April 2023, Turnitin launched an AI writing detection tool embedded in the Turnitin Feedback Studio (Caren, 2023). The Turnitin AI writing detection tool quickly established itself as a key tool for academics to detect GenAI writing in

assessments including essays, presentation slides, and narrative analyses. However, this AI writing detection tool is fallible and can generate false positives (Fowler, 2023).

The ability of GenAI to paraphrase texts and reduce plagiarism detection (Amini-Salehi, 2023) also raises concerns as it conceals work that is not original and results in a distorted perception of the student's academic writing abilities. Wang (2023) found that college students with higher metacognitive levels were better able to describe their goals and processes using GenAI prompt engineering and were better able to critically adapt the answers given by GenAI. By contrast, students with lower metacognitive levels were found to rely more heavily on GenAI, rather than just using it as a support tool. Thus, GenAI can potentially provide some students with an advantage over others, particularly if it is used to conceal plagiarism, or indeed if it is used surreptitiously in the generation of an entire solution to an assessment. GenAI also raises concerns that students may outsource assessment tasks to those capable of rapidly producing high quality outputs (Zhai, 2023). Despite this important debate, extant literature pertaining to GenAI use among students is scarce in the field of education. Furthermore, the student's voice is poorly represented in research to date (Sullivan et al., 2023).

3. Research Method

This study explores the existing capabilities of students to use GenAI to complete academic assessment. The implementation of the study is quite simple and easily replicated. The Principal Investigator (PI) first invited university academics to submit a sample of past assessments from 2020-2022. The past assessments were from modules including Fund Reporting and Risk Management; Personal, Professional and Academic Skills; Business Research and Communication Skills; Business Strategy; Global Business Ethics; Organisational Behaviour; Management Skills; Professional Development; and Behavioural Finance. The assessments included written essays; analysis of spreadsheet data; written reports; presentation slides; reflective learning diaries; and discursive analysis. These past assessments were then adapted as research tests removing cover sheets and submission details/dates but preserving the original questions/instructions. Twenty-six (26) research tests were generated from the past assessments.

The PI posted invitations on the university course management systems (CMS) for students to voluntarily enroll in two GenAI research events in April and September 2023. The goal of these GenAI research events was to challenge students to apply GenAI to complete the past assessments adapted as research tests, with the goal of achieving a pass grade when graded by an academic, undetected by GenAI writing detection tools. Each research event had a duration of 2 hours. This is important as the original assessments gave students several weeks to complete their submissions. The students were all 1st year, 2nd year and 3rd year business students.

The students submitted their research test solutions to the CMS. Two (2) of the twenty-six (26) research tests submitted were spoiled and inadmissible in the analysis. The valid research tests (24) were processed using GenAI writing detection software to determine an AI writing detection score. The PI then distributed the research tests for grading using the original marking scheme to the academics who volunteered the original past assessment samples. The academics were not provided with the GenAI writing detection score when grading the tests. Of the 24 valid research tests, 3 were not graded by the academic who provided the original assessment due to time constraints. Thus, the results of the data analysis are confined to 21 valid research tests from the two GenAI research events. Once the 21 research tests were graded by the academics, the PI held informal interviews lasting 40 minutes to 1 hour, with each academic to discuss their experiences of the research tests, the grades they awarded, and their thoughts on the challenges of GenAI for academic integrity.

The PI considers this research methodology an appropriate and easily replicated benchmarking test of GenAI and GenAI writing detection tools, so that as academics, we can establish a clear understanding of the challenges GenAI poses for academic integrity.

4. Results

The AI writing detection tool vendor warns that low AI Detection Scores (less than 20% GenAI writing detection) have a higher likelihood of being false positives and are thus insufficient grounds upon which to raise an academic integrity enquiry. In this study, the AI writing detection tool was successful in detecting high AI Detection Scores (>20%) in 75% (18/24) of the research tests. Thus, all of these tests would have been flagged to the academic and would have warranted further investigation for breaches of academic integrity.

The analysis shows that 25% (6/24) of the research tests achieved an AI Detection Score of 14% or less, and would not have been flagged to the academic, and would not have been investigated for breaches of academic integrity. Analysis of these six (6) research tests, reveals that four (4) achieved a 0% AI Detection Score, while two research tests yielded 10% and 14% AI Detection Scores. Three (3) of these research tests were submitted by first year students and three (3) were submitted by second year students. None of the third year students submitted research tests that evaded the AI writing detection tool.

Five (5) of the six (6) research tests with no/low AI Detection Scores received a pass grade from the academic who provided the past assessment. This is equates to 23.8% of all test submissions corrected by an academic (n=21). The average grade for research tests achieving a no/low AI Detection Score and achieving a pass grade from the academic was 53%, with 60% the highest grade and 40% the lowest grade. It is worth noting that one other research test submitted by a first year student achieved a 0% detection rate but only achieved a 32% grade from the

academic. Thus, although the research test received a fail grade, the GenAI content was not detected by the AI writing detection tool. It is important to highlight that the five (5) (23.8%) research tests with no/low AI Detection Scores that achieved a pass grade were not attributable to a specific academic, module or submission type as they were evenly dispersed.

The AI writing detection rate decreased significantly from 90% to just 37% between GenAI Research Event 1 in April 2023 and GenAI Research Event 2 in September 2023. It is also critical to highlight that the five (5) research tests (23.8%) that achieved no/low AI Detection Scores were submitted during AI Research Event 2. This may be an indication of how well GenAI has been adopted and mastered by students since its launch in November 2022, and the PI holding AI Research Event 1 in April 2023 and AI Research Event 2 in September 2023.

In this study, GenAI struggled to work with Microsoft Excel spreadsheet analysis. None of the research tests passed when graded by the academic. Initially trained on data up to September 2021, ChatGPT's training set continues to be upgraded and it is now integrated with Microsoft Bing search engine. Initially, ChatGPT responded to just text based questions, but it now incorporates image-based requests, and its integration with Microsoft Office and Microsoft Bing now enables Microsoft Excel Spreadsheets to incorporate micro-app AI agents capable of extracting a table of data, cleaning up the data, and analysing the data (OpenAI, 2023b). Thus, the difficulties encountered by students undertaking research tests requiring analysis of Microsoft Excel data in this study no longer exist. Thus, GenAI poses an ever-greater challenge to academic integrity if these issues are not considered when assessments are being set.

Following the collection and analysis of all AI Detection Scores and research test grades, the PI held informal meetings with each participant academic. These academics contend that as GenAI improves, and students increasingly engage with it, academics will have to be subject matter experts to detect GenAI content. However, a counter-argument could be that with the evolution of GenAI, will it indeed replace the need for any academic to be a subject matter expert? Participant academics were concerned that students can use GenAI to create a bibliography to accompany GenAI text, and that some or indeed all the bibliography may not be authentic. Participant academics are concerned they do not have the resources or time to follow every reference to verify if it is authentic, or indeed relevant to the text. Participant academics believe that fundamental questions need to be asked about what we are teaching, why we are teaching it, how we are teaching it, and what careers we are preparing graduates to enter. Students commencing university in 2023-2024 will emerge from degree programmes into an employment landscape transformed by AI, and much of what they are learning could be redundant if roles are supplanted by AI. Thus, participant academics contend that a bigger conversation must occur about the impact of AI on education beyond that of its impact on academic integrity.

5. Limitations

While all the aims, objectives and tasks were completed as per the research funding proposal, the study encountered several limitations which impacted its potential output including low levels of academic staff engagement and a lack support for the study by some senior academic managers. Fear of AI is pervasive, and some academics and academic managers appear to have adopted a head in the sand approach to the impact of AI on their teaching and learning strategies and indeed the impact of AI on the entire education system.

6. Conclusion

GenAI provides educators with an opportunity to redirect the achievement of learning outcomes through students engaging in written tasks, to instead focusing on how students develop higher-order critical thinking skills and mentoring their learning and progress (Sullivan et al., 2023). Educators must explore GenAI applications to significantly improve inclusion for people with communication disabilities (Hemsley et al., 2023; Starcevic, 2023; Sullivan et al., 2023) and enhance participation and success for students from disadvantaged backgrounds (Sullivan et al., 2023). However, educators must first address the significant gaps in digital competencies for ethical and effective use of GenAI to support learning (Kohnke et al., 2023).

From a strategic educational perspective, GenAI compels educators to adapt teaching, learning and assessment practices that incorporate the new reality of living, working, and studying in a world where GenAI is widely available (Halaweh, 2023; García-Peñalvo, 2023; Liu et al., 2023; Rudolph and Tan, 2023; Sullivan et al., 2023). It is essential that policy makers, researchers, educators, and technology experts work together and start conversations on how these evolving GenAI tools can be used safely and constructively to improve education, and support learning while maintaining academic integrity. In UK and US universities, working groups have already been set up to assess the challenge of GenAI. Provisional outcomes indicate that methods of teaching, learning and assessment will have to radically change. This study provides tangible evidence that GenAI is disrupting education, and the global education system must adapt to meet these disruptive challenges and opportunities.

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Student Experiences with Continuous Assessment in DCU Futures at Dublin City University

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Abstract

The COVID-19 pandemic and the arrival of generative AI have accelerated a shift towards Continuous Assessment (CA) in higher education. This paper uses data from a broader evaluation of the "Futures" initiative in Dublin City University (DCU) to explore student experiences of different forms of CA. DCU Futures aims to transform the undergraduate experience, in part by a much stronger focus on CA. Survey data from 546 *DCU students were used to examine how different models of undergraduate programmes related to student satisfaction with CA. Compared to traditional exams, CA was perceived to be fairer, comprehensive, and less stressful, but a minority viewed it as less accurate. For most forms of CA, increased exposure was associated with higher satisfaction levels. Exceptions were CA formats that required groupwork. The outcomes show the importance of sharing detailed assessment rubrics with students, and of providing ongoing guidance on groupwork.*

Keywords: *Continuous assessment, assessment approaches, higher education.*

1. Introduction

Continuous assessment (CA) and traditional exams have long been the two primary methods of evaluating student learning in higher education. CA involves ongoing evaluation of students' knowledge and competences *throughout* the academic year, using different methods such as written reports, quizzes, presentations, and group projects (Ariza et al., 2013; Bengoetxea & Buela-Casal, 2013), while exams typically occur at *the end* of the semester or academic year. There has been a growing movement towards adopting CA as an alternative or complement to traditional exams (Combrinck & Hatch, 2012). This shift is driven by the recognition that CA can provide a more comprehensive and authentic assessment of student learning, promote active learning, and enhance student engagement (Holmes, 2018). While the COVID-19 pandemic accelerated the shift towards online learning in higher education, it also exposed some limitations of traditional exams and highlighted the need for flexible and adaptable assessment

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methods. This, coupled with the subsequent advent of generative AI, has contributed to the shift towards CA (Łodzikowski et al., 2023; Montenegro-Rueda et al, 2021). While AI offers potential benefits for improving written communication skills (Osorio, 2023), concerns exist regarding its misuse for plagiarism in assessments (Rudolph et al., 2023). AI's ability to solve problems raises the possibility of students misusing it not only for essays and written work but also for different assessments formats, such as online quizzes. This paper examines CA from the student perspective, linking perceptions to the relative emphases placed on CA, as well as the implementation of CA and implications for academic integrity.

2. DCU Futures

In 2020, Dublin City University (DCU) launched the DCU Futures initiative, designed to transform undergraduate education. It is the largest innovation in teaching and learning in the history of DCU and aims to use educational innovation, industry engagement, and digitalisation of learning to transform *what* students learn and *how* they learn it, embedding Transversal Skills into all aspects of the student experience. A key change in *how* students learn is a much stronger emphasis on CA and on relevant and authentic forms of assessment of student learning, including Challenge-Based Learning.

DCU Futures is funded by the Human Capital Initiative (an Irish Government initiative for higher education which aligns innovation with national strategy objectives). Over its lifetime from 2020 to 2025, Futures will create 1000 additional student places on 10 new programmes, with the aim that it serves as a template for wider DCU change. The 10 programmes are divided between entirely new programmes, and new "specialisms" for existing programmes. An example of a new programme is the BA in Climate and Environmental Sustainability, which bridges natural and social sciences. In contrast, the BSc in Chemistry with AI is a new specialism, where students share a common first year programme with other chemistry undergraduates, but in subsequent years specialise in the application of AI to chemistry.

Students in common entry programmes experience aspects of the Futures approach in their first year, but to a lesser extent than those on one of the five new programmes, or than those in the second or third year of their specialism programme.

To complement external funder evaluations, DCU commissioned an internal evaluation, with a focus on sustainability and scalability. This paper presents selected findings from that evaluation, focusing on Futures students' views and experiences of continuous assessment.

3. Methodology

This paper draws on a subset of data from a survey of students on Futures programmes and on a small group of "comparison programmes" within DCU. While 639 students completed the

survey, this paper presents data only from the 546 students who agreed that their data could be used for broader dissemination. Students completed the survey during March and April 2023, and their data were grouped into the following three categories:

- **Non-Futures:** Traditional DCU programmes (146 student respondents).
- **Futures Light:** New programmes with a common entry first year, and a Futures specialism in later years (297 student respondents).
- **Futures Core:** New programmes adopting a Futures approach (101 student respondents).

There were 267 students in the first year and 279 students in the second year of their programme.

In addition to the evaluation survey, the paper uses DCU data from the 2023 cycle of a national survey of undergraduate students in higher education, called StudentSurvey.ie (https://studentsurvey.ie/). It is conducted annually and aims to explore student engagement and experiences. Data from the survey are used in this paper to provide insights about students' perceptions of academic integrity and plagiarism.

4. Results

The evaluation survey included statements designed to gauge student attitudes to CA in a general sense, to specific forms of CA, and to the preferred balance between continuous assessment and traditional exams.

4.1. Attitudes towards CA in general

Figure 1 provides an overview of students' attitudes towards CA. It shows that the vast majority of students (92%) believed that CA was fairer than exams, while 87% felt it provided a more comprehensive assessment of their skills and was less stressful. However, 25% acknowledged that CA could be less accurate than exams, and 15% expressed a preference for exams over CA.

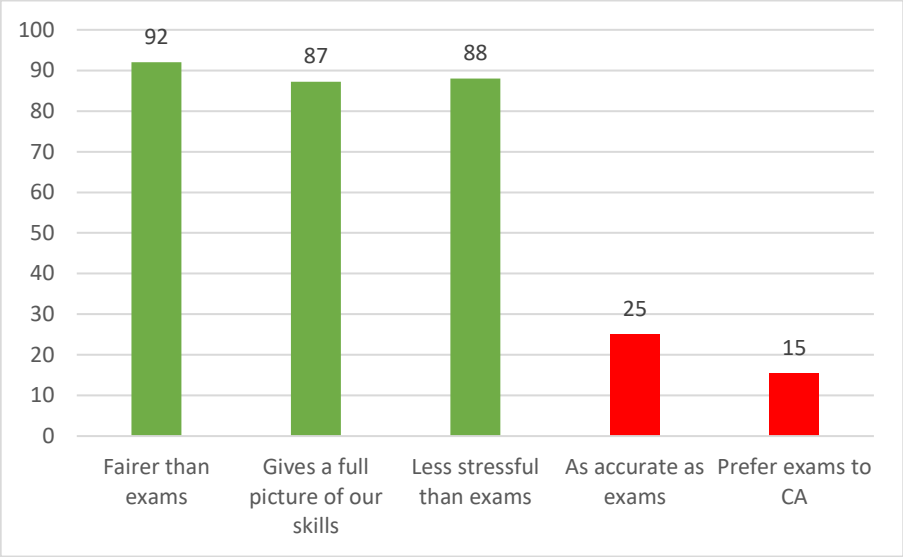


Figure 1. Percentage agreement with statements about CA, overall

Irrespective of programme type, year of study, or student gender, students typically expressed positive views on CA in general. That noted, second year students on Core Futures programmes are the group with the greatest exposure to CA, and they were also the group that expressed the most positive attitudes. Almost all (98%) believed that CA was fairer than exams and that it provided a fuller picture of their skills. They were also far less likely to believe that CA was not as accurate than exams (only 7% expressed this view, compared to 22-29% in other groups).

4.2. Attitudes towards the balance between different forms of CA

Regarding different forms of CA, students generally expressed satisfaction with the balance between the different forms (Figure 2). Large majorities were pleased with the amount of work assessed via Loop (DCU's digital learning platform) quizzes, reports and essays, labs and practicals, and presentations. Labs and practicals, along with Loop quizzes, emerged as the most popular assessment forms, with very few students seeking a reduction in the amount of work assessed by them.

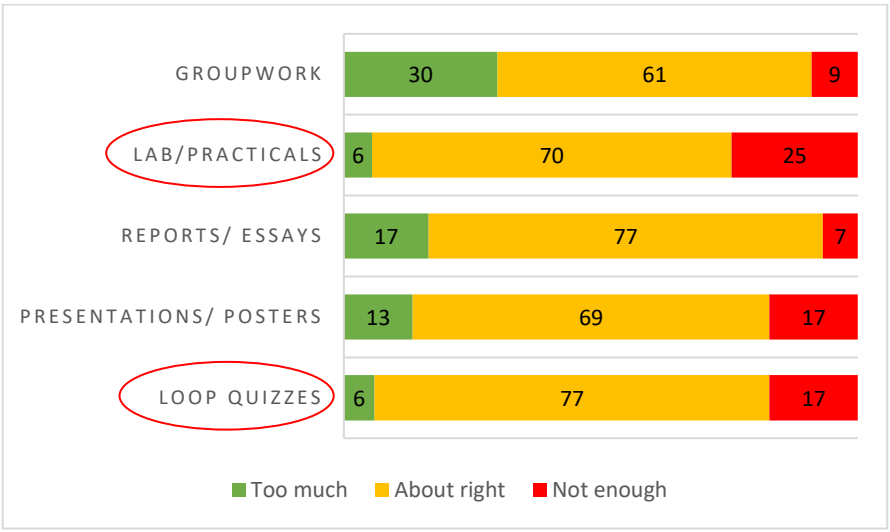


Figure 2. Satisfaction with amount of work assessed by different means, all respondents

Of the five forms of assessment listed in Figure 2, groupwork was the only one for which a large minority thought was allocated too much time. Use of groupwork also varies by programme type, featuring very strongly in Futures Core programmes, relative to other models. Thus, Figure 3 looks at attitudes to groupwork, by programme type. Half (50%) of all Futures Core students felt that too much of their work was assessed using groupwork (vs 23-30% in the other groups). Looking only at second year Core Futures students, 61% were dissatisfied with the amount of time allocated to groupwork.

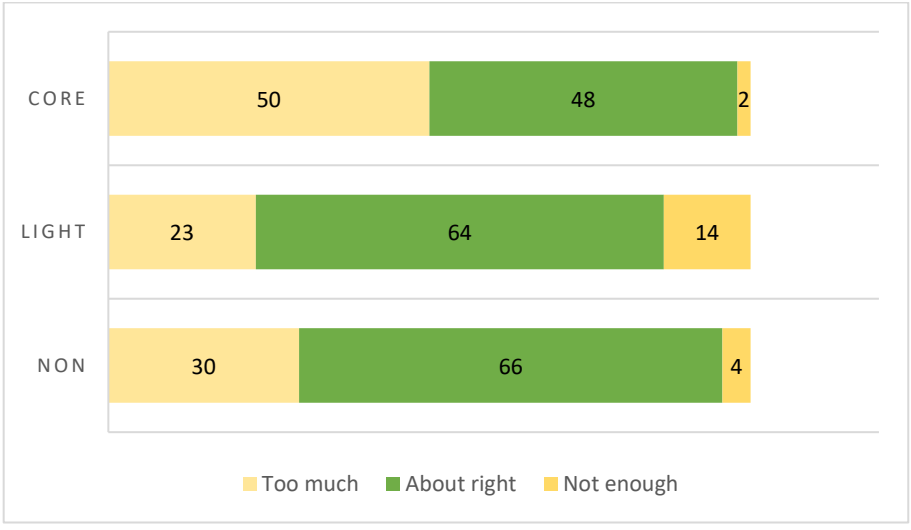


Figure 3. Amount of work assessed by groupwork, by Futures category

Because groupwork is a frequently used element of the Futures approach to how students learn, the survey included several questions exploring the student experience of groupwork. These showed that, irrespective of programme type, students preferred face-to-face groupwork over virtual meetings (90%). A majority in each group (83-85%) also expressed concerns about the potential stress of groupwork, and a smaller majority (54-65%) agreed that certain individuals could dominate group activities.

Students in non-Futures programmes (who typically had far less exposure to groupwork) were most likely to express a desire for guidance on working in groups. Conversely, those who were in second year on Futures Core courses were by far the most likely to feel that they had too much groupwork, and to agree that some did not contribute to activities.

4.3. Attitudes to Challenge-Based Learning:

Challenge-Based Learning (CBL) is a particular form of authentic, group-based assessment, and is a core element of the DCU Futures model. Few non-Futures students had experienced CBL, compared to 82% Futures Core and almost half of Futures Light students. Thus, this section focuses on Core and Light only. Students who had experience of CBL were generally very positive, agreeing they learned from others and were able to use skills from their course. Least positive ratings related to contributions of others on their team. While almost all (94%) Futures Core first year students agreed that they learned from others on their CBL team, only 64% of Futures Core second years did so. In a related vein, 76% of Futures Core second year students agreed some of their team did not contribute, as did 44% of their first year counterparts.

4.4. Students' preferences for CA and exams

When asked about their ideal assessment approach, students overwhelmingly favoured a predominantly CA approach (Figure 4). However, Futures Light students were less inclined towards entirely CA assessment, opting instead for a mixed approach that incorporated mainly CA and some exams. While close to two-thirds of Futures Core and non-Futures students preferred to be assessed entirely by continuous assessment, only 27% of Futures Light students selected this option. Conversely, 61% of Futures Light students opted for assessment mainly using CA, but with some exams (an option chosen by only 26-36% of students from the other two groups).

Examined by year, second year Futures Core students were the group most likely to prefer assessment to be entirely based on CA, with no exams (77%). This is also the group that has had greatest exposure to being assessed by CA.

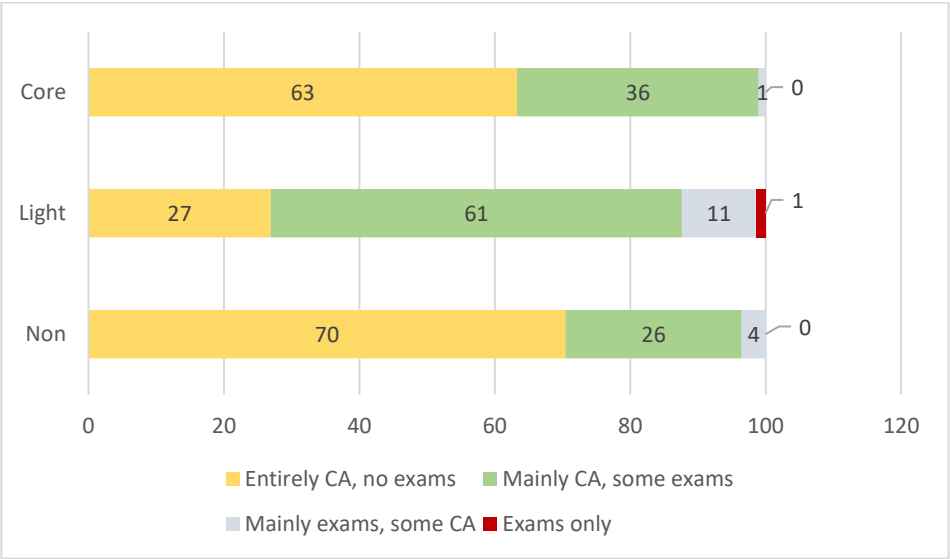


Figure 4. Preferred forms of assessment, by Futures category

4.4. CA and academic integrity in Futures

Lim (2022) has flagged how assessment practices increasingly need to include non-traditional methods (such as presentations), because AI can be used to subvert the process of assessment via traditional written essays and examinations. The Futures approach uses diverse and multi-modal continuous assessment methods (e.g., combining written, presentation, and oral skills), and the online quizzes incorporate at least some course-specific content. This suggests that it is more difficult to use AI to undermine student assessment within Futures. Support for this view comes from the findings of the national StudentSurvey.ie 2023, where Futures Core students were those most likely to perceive their assignments and assessment methods as being tailored to reduce cheating (92% agreed, versus 77% of Futures Light and 85% of non-Futures students).

5. Conclusions and recommendations

Using the opportunity afforded by the DCU Futures initiative, this paper investigated how student perceptions of CA were related to their exposure to CA overall, and by different forms of CA. The results highlight many positive attitudes towards CA. Relative to traditional exams, it is seen as fairer, more comprehensive and less stressful. Broadly, increased exposure to CA is associated with more positive attitudes towards most dimensions of CA. Exceptions arise when CA requires working as part of a team. The findings may have wider relevance, but in the specific context of DCU, they are being addressed by a targeted groupwork toolkit for Futures programmes, and by efforts to improve student understanding of the nature of continuous

assessment and of assessment rubrics, their design, their use, and their fairness. Finally, by using a variety of continuous assessment methods, Futures programmes aim to minimize concerns about AI-enabled plagiarism, and to enhance academic integrity.

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Using online peer feedback tools to improve undergraduate group interaction and assessment quality

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Abstract

In higher education, sophisticated online learning management systems offer educators unprecedented opportunity to design and implement assessment-specific feedback rubrics with relative ease. In 2022, Feedback Fruits, a flexible, online feedback tool, became available at Flinders University (Australia) with system migration to Canvas. This study evaluated the acceptability and impact of online peer feedback rubrics introduced to a group assessment in a 3rd year, undergraduate, medical science topic. In this study, online feedback participation rates were high (range 84.3-96%), with participants preference for anonymous feedback (77%). Mean peer evaluation scores improved for information sharing, task completion and discussion at final assessment; with feedback received ranked 'high' by 56.8% of students. Mean group evaluation scores improved for topic coverage, poster format and referencing at final assessment; with feedback received ranked 'high' by 59.1% of. students. In summary, online peer feedback improved student engagement and group assessment learning in this topic.

Keywords: *Feedback; peer; Feedback Fruits; assessment; quality.*

1. Introduction

In education, 'feedback' refers to a compilation of post-response information that communicates to the learner about their actual performance. Importantly, feedback from equal-status learners guides learning processes towards high-quality educational goals (Narciss, 2012) by progressively strengthening self-assessment (Kim-Godwin *et al*., 2013), metacognitive learning and deep course content analysis (Kwon *et al*., 2018); skills underpinning core graduate qualities in higher education.

The importance of feedback in tertiary education has been highlighted as topic delivery has shifted from face-to-face classes to primarily teaching via online learning management systems. In online settings, student connection (McVay Lynch, 2002), learning quality and community

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of practice (Corgan *et al*., 2004) are enhanced through feedback-rich learning; with 'feedback paucity' often associated with online course withdrawal by students (Ertmer *et al*., 2007). However, the facilitation of adequate online feedback intensity by teaching staff alone has been reported as difficult (Dunlap, 2005) and, as such, alternative feedback mechanisms have developed over the past decade (Aviles *et al*., 2012). In fact, with the application and sophistication of learning management systems now commonplace, educators have an unprecedented opportunity to apply flexible and robust, online peer feedback rubrics with relative ease.

'Feedback Fruits' is an online learning tool offering flexible feedback rubric formats, student anonymity and auditing functionality. Feedback Fruits has been reported as an easy and excellent online student tool with staff assistance (van Popta *et al*., 2017), facilitating peer-to-peer communication (Schillings *et al*., 2020) and lowering peer feedback quantities for student learning uplift (Nicol, 2014). At Flinders University, Feedback Fruits became widely available in 2022 following migration of the University's online learning platform from Moodle (Moodle HQ) to Canvas (Infrastructure). The aim of this study was to design, implement and evaluate online, peer feedback rubrics introduced to a group assessment for 3rd year, undergraduate, medical science students.

2. Methods

2.1. Study Cohort and Demographics

Undergraduate, 3rd year Bachelor of Medical Science/Laboratory Medicine and Bachelor of Public Health students enrolled at Flinders University, Australia in Semester 2 of 2023 were eligible for the study. Student demographic data was accessed using the University's Intelligence Portal.

2.2. Group Assessment

The group assessment consisted of a research project, produced over 8 weeks. Submission comprised of a research poster and a 5-minute poster presentation. Randomly allocated groups (11) of 4-5 students, researched an infectious disease test/device. Research on the test/device performance was evaluated against 'ideal' REASSURED benchmarking criteria (Land *et al*. 2019). The assessment was worth 15% of the topic grade, with allocations for group marks (4%), individual marks (6%) and feedback activities (5%). Final grades were moderated in accordance with the University's assessment policy.

2.3. Assessment Feedback

2.3.1. Feedback Fruits Rubrics

Academics designed a 'peer-to-peer' (within-group) and a 'group-to-group' (across-group), analytic assessment feedback rubric for Feedback Fruits. The focus of the peer-to-peer feedback rubric was group interaction (Table 1). Students completed peer-to-peer feedback (0.5% of assessment mark) at draft and final poster submission.

Table 1. Indicative* Peer-to-Peer Feedback Rubric in Feedback Fruits

Interaction	Beginning (1)	Emerging (2)	Proficient (3)	Experienced (4)
Sharing information	No information shared	Minimal	Moderate	Maximal
Discussion Skills	No participation	Occasionally spoke when encouraged	Contributed most of the time	Consistently contributed
Listening Skills	Did not listen, acted autonomously	Occasionally listened	Listened most of the time	Actively listened to incorporate ideas
Task Completion	No task completion	Completed some assigned tasks	Completed most assigned tasks	Completed all assigned tasks

**Truncated peer responses shown. Numerical evaluation scores (1), (2), (3) or (4) were used for analysis.*

The focus of the group-to-group feedback rubric was topic coverage and formatting (Table 2). Students completed group-to-group feedback (0.5% of assessment mark) at draft and final poster submission.

Table 2. Indicative* Group-to-Group Feedback Rubric in Feedback Fruits

Poster Criteria	Beginning (1)	Emerging (2)	Proficient (3)	Experienced (4)	Highly Experienced (5)
Topic Coverage	Insufficient	Variable	Satisfactory	Complete	Advanced
Collaboration	Limited	Emerging	Satisfactory	Effective	Outstanding
Referencing	Limited	Variable	Satisfactory	Complete	Precise

**Truncated poster criteria descriptions shown. Numerical evaluation scores (1), (2), (3), (4) or (5) were used for analysis.*

2.3.2. Student Evaluation of Feedback using Canvas Quiz

Students evaluated feedback received at completion of the assessment using an online Canvas quiz (Table 3) worth 3% of the assessment mark. Open text commentary was reviewed by topic academics.

Table 3. Indicative* Evaluation of Feedback Rubric in Canvas quiz

Feedback Evaluation Catergory	Response
Peer-to-Peer and Group-to-group feedback value	Low/Medium/High
Assessment Changes Made	Open Text
Feedback Preference	Anonymous/Identified

**Truncated feedback evaluation categories shown.*

2.4. Student Feedback Process

Students accessed feedback rubrics with a Flinders Access Number (FAN) and password. Academics educated students in safe learning environments, trusted peer relationships and provided guidance on the use of Feedback Fruits and Canvas.

2.5. Data Extraction and Analysis

Deidentified data was extracted from Canvas for analysis. Numerical rankings were applied to peer-to-peer (Table 1) and group-to-group (Table 2) feedback responses to generate draft and final evaluation scores, analysed using two-sided, paired t-tests.

2.6. Ethics and Funding

The University Human Research Ethics Committee approved the study (HEL6549-6). Students could 'opt-out' from Feedback Fruits and completed online consent for the evaluation quiz. The study received no funding.

3. Results

3.1. Student Demographics and Participation

Fifty-one students participated in the study (overall enrolled student response rate of 94.4%). The majority were aged 20-24 years (85%), female (59%), non-Aboriginal or Torres Strait Islander (96%), held Australian citizenship (96%) and spoke English only at home (69%). Student feedback participation rates were high, irrespective of poster stage or feedback type (Table 4).

Table 4. Student Feedback Participation Rate

Poster Stage	Feedback type	Percentage (%) of students (n=51)
Draft	Group-to-group	84.3%
Draft	Peer-to-peer	86.3%
Final	Group-to-group	94.1%
Final	Peer-to-peer	88.2%
Final	Evaluation Quiz	96.1%

3.2. Impact of Peer-to-Peer Feedback

Mean peer evaluation scores significantly improved for information sharing (3.53 vs. 3.73), discussion skills (3.44 vs. 3.68), and task completion (3.68 vs. 3.83) at final assessment (from draft) but were not significantly different for listening skills (3.69 vs. 3.83; $p<0.070$) (Figure 1).

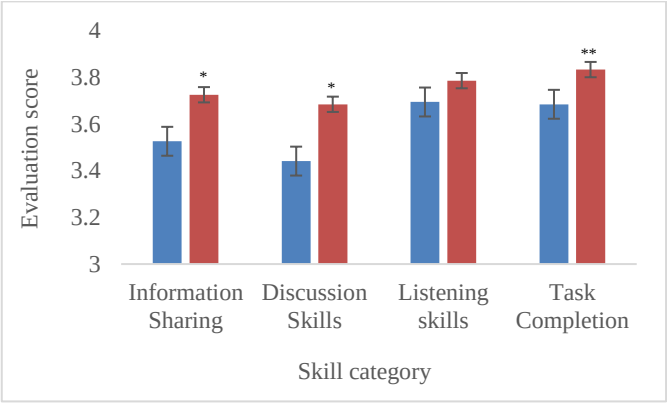


Figure 1: Mean evaluation score of group skill at draft (blue) and final (red) submission. Standard deviation (error bars) and significance ($p<0.005$, ** $p<0.008$) shown.*

3.3. Impact of Group-to-Group Feedback

Mean group evaluation scores significantly improved for topic coverage (4.15 vs. 4.69), formatting (3.95 vs. 4.58) and referencing (2.96 vs. 4.53) at final assessment (from draft) (Figure 2).

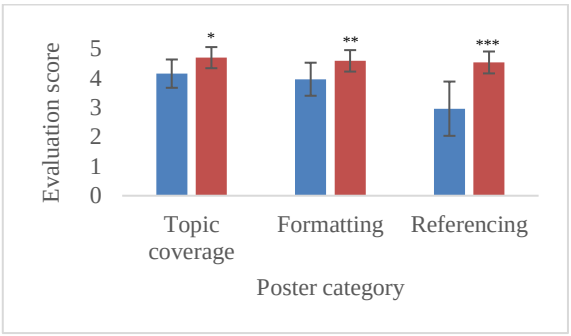


Figure 2: Mean evaluation score of poster categories at draft (blue) and final (red) submission. Standard deviation (error bars) and significance (p<0.005, **p<0.006, ***p<0.008) shown.*

3.4. Student Evaluation of Feedback

3.4.1. Value of Feedback

Peer-to-peer feedback value was considered 'high' by 56.8% (n=25) of students or 'medium' by 34.1% of students (n=15), with less than 10% (9.1%, n=4) rating the activity as 'low'. Similarly, group-to-group feedback value was considered 'high' by 59.1% (n=26) of students or 'medium' by 31.8% (n=14) of students, with less than 10% (9.1%, n=4) rating the activity as 'low'.

3.4.2. Assessment Changes Made

Students most frequently changed the poster layout (61.9% of students, n=26), content (28.5% of students, n=12) or both (7.1% of students, n=3) due to feedback received. Only one student changed topic coverage.

3.4.3. Feedback Preference

Most students (77.3%, n=34) preferred anonymous feedback as to identified feedback (22.7%, n =10).

4. Discussion

Process design that is consistent and considers the key factors supporting high-quality feedback has been deemed essential to provide students with an opportunity to view their own work through an objective lens (Topping, 2009). Academics facilitating online courses have a responsibility to deliver high-quality, supplementary peer feedback activities. In this study, assessment-specific, analytic feedback rubrics were implemented with guidance from Feedback Fruit best-practice documentation and Canvas training experts. Importantly in this study, factors

required to create safe and trusted learning environments for student understanding, such as consistent evaluation criteria and clear student instruction on the giving and receiving of constructive feedback, were able to be included in the feedback activity (Evans, 2015; Ohaja *et al*., 2013). Whilst the allocation of assessment grades for student feedback participation in this study may have artefactually elevated feedback participation rates, nearly 60% of students valued both the peer-to-peer and group-to-group feedback as 'high', and few (n=5) students who did not consent to their evaluation survey responses being included in this study. In addition, the open text feedback in this study reviewed by academic staff confirmed the use of highly objective peer commentary, although students knew their feedback was anonymous. This supports the delivery of safe and reciprocal guided peer feedback activities as achievable using Feedback Fruits and Canvas, with these conditions previously reported as highly advantageous to overall student learning (Nicol, 2014).

Previous studies have reported the benefits of peer feedback as overall skill improvement and enhanced interpersonal communication (Hodgson *et al*., 2014; Sethares & Morris, 2016). Group mean peer evaluation scores in this study significantly improved for information sharing, discussion skills and task completion, but not listening; however the authors acknowledge individual student trends within assessment groups may have been masked by calculated mean scores and the student sample size was limited. Study replication in 2024 may strengthen these findings, as the student cohort enrolment is estimated to at least double that of 2023, with inclusion of the topic as compulsory for Bachelor of Clinical Science students. Nonetheless, the reported improvement in mean evaluation scores were also supported by the frequency of changes in assessment layout, content or both, and the student open text commentary. Following group feedback one student remarked: *"I made sure to improve my communication with group members and increase my contribution"* and another commented: "*I needed to listen to others ideas more. This was something I have struggled with in the past"*. Whilst students demonstrated confidence in interpreting feedback and processing conflicting feedback a minority of students reported difficulty in understanding the feedback received, so further consideration for English as a second language (ESR) may be beneficial for future studies. Another improvement to future activities would include changes to the timing of draft and final assessment feedback, as highlighted by one student "*having the feedback earlier in the assessment…would give more opportunity for change*".

5. Conclusion

Online peer feedback improved student engagement and group assessment learning in this topic. More broadly, peer feedback in online learning environments can improve opportunities for student self-reflection and deliver educational quality improvements during the assessment process.

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Financial Advisory in Classroom: Educational Innovation Based on Project-Based Learning (PBL)

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Abstract

This paper aims to describe an educational innovation in teaching-learning based on Project-Based Learning (PBL) carried out in the subjects of "Basic Finance" taught in the Double Bachelor's Degree in Management, Business Administration, and Law of the Public University of Navarre (UPNA). These are Financial Markets and Instruments, Corporate Finance I, and Corporate Finance II. Specifically, in each of the subjects, the project consisted of preparing an advisory report. Thus, the classroom becomes a financial consultancy covering its different areas of work.

Furthermore, this study evaluates the educational innovation, analysing both quantitative and qualitative aspects across subjects and gender. In summary, there is a significant improvement in grades after the introduction of PBL. Students also support the implementation of PBL, with gender differences found. Our findings motivate the continued use of dynamic teaching methods and underline the importance of adapting approaches to improve educational outcomes.

Keywords*: Educational innovation; PBL; financial advisory; finance classroom.*

1. Introduction

The European Higher Education Area (EHEA) is undergoing a transformation, emphasising student-centred approaches over traditional lectures. Project-based learning (PBL) plays a central role in this process, reshaping educational experiences and promoting 21st century skills. Several authors, such as Ausín et al. (2017), argue in favour of PBL in the EHEA, citing its role in promoting problem-solving and creativity. Guo et al. (2020) further highlight the positive perceptions of students, associating PBL with autonomy, self-confidence and increased motivation.

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This paper explores a PBL-focused pedagogical innovation implemented in the 'Basic Finance' subjects of the Double Bachelor in Management, Business Administration and Law at the Public University of Navarra (UPNA). Supported by a UPNA Educational Innovation Project, the initiative transforms finance classes into different facets of financial advisory work. Additionally, the study evaluates the impact of PBL on grades and shows a significant improvement compared to the period before the innovation.

The following sections follow this structure: Section 2 outlines the theoretical framework of PBL. Section 3 provides a detailed account of the PBL project in the Basic Finance subjects at UPNA. Section 4 presents the results. Finally, section 5 summarises the main conclusions, confirming the value of PBL in improving the teaching-learning process within the EHEA context.

2. Project-Based Learning (PBL)

In response to the evolving demands of the labour market, higher education is faced with the urgency of preparing students with the cognitive, instrumental and attitudinal skills necessary to face advanced challenges and make effective decisions in the 21st century. Fleming (2000) emphasises that PBL enables students to improve their cognitive and critical thinking skills through collaborative problem analysis and the application and organisation of knowledge. Wu et al. (2020) and Kłeczek et al. (2020) point out that cooperative learning and reflection are encoraged. The emphasis on the acquisition of technical competences has often overshadowed the importance of transversal or soft skills. Silva and Maturana (2017) highlight the shift from content to activities, emphasizing the alignment for successful implementation. Teachers engage students as sources of mutual learning, involving them as protagonists in the learning process. Formative assessment strategies guide pathways during the week (Leenknecht et al., 2021) whereas Power (2019) highlights the crucial role of student participation and collaboration in consolidating newly acquired knowledge. We believe that PBL in finance encourages the practical application of financial concepts in real-world contexts more than other active methodologies, enhancing the development of problem-solving and decision-making skills, essential in this dynamic and complex field.

3. Financial Advisory in the Classroom: Transformation of the Educational Model

3.1. Starting Point

The innovation presented in this paper consists of a change in the teaching methodology of the subjects of the "Basic Finance" area, including Financial Markets and Instruments, Corporate Finance I and Corporate Finance II, in the Double Bachelor's Degree in Management, Business Administration and Law. This transformation incorporates the active methodology of PBL. The

initiative came from the UPNA Financial Economics teaching team when they presented the project "Financial Advisory in the Classroom: Transforming the Educational Model" which is part of the PINNE 21[1] project. The chronological details of the project implementation are shown in Figure 1[2]. To find out more information on the development of the projects, see Abinzano et al. (2022 and 2023).

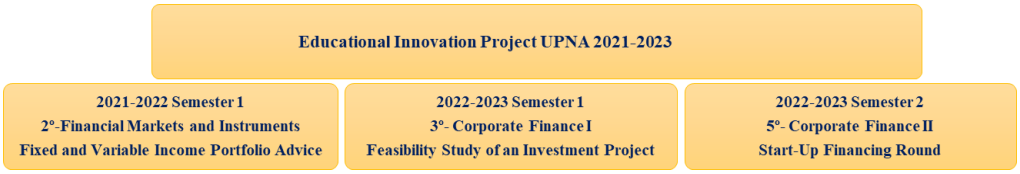


Figure 1. Implementation of PINNE 21

3.2. Key Element: The Project

The project design followed the methodology outlined by Dickinson et al. (1998) to ensure a project structure that guarantees effective learning. The project involved transforming the classroom into a financial consultancy, in which the students have to produce a financial report.

Regarding the Financial Markets and Instruments course, the project consists of a fixed and variable income portfolio advice. Students have to propose the optimal investment of €100,000 in the Spanish financial markets, building a diversified portfolio according to the investor's risk profile. The autonomy allows students to choose a client profile and take into account different contexts. The Corporate Finance I course involves preparing a financial feasibility study of an investment project. For this course, a company located in Navarre that wishes to invest in a low-carbon bus, using the government aid outlined in the BOE of 16 November 2021. The Corporate Finance II course guides a financial round in which students advises a start-up company headquartered in Barcelona, which seeks 1,500,000€ in 2023 and 2,300,000€ in 2024 for project committed to the Sustainable Development Goals 11 and 1.

The result of the consultancy is a comprehensive report presented to the client, consisting of a dossier (6-page PDF document with annexes) and an Excel file with calculations and analyses. A PowerPoint presentation of the report is also provided. The project is carried out in seven weeks and constitutes 50% of the first unit of the course, with the remaining half (Unit 2) using traditional methodologies.

[1] In 2021, the Public University of Navarra issued the first call for Educational Innovation Projects (PINNE-2021)

[2] The PINNE' subjects are developed over 15 weeks, all of them of 6 ECTs.

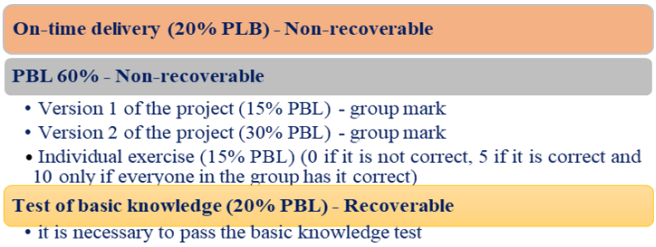
3.3. Work Dynamics: The Puzzle Method

Students form teams of three members, and organise themselves into advisory teams with defined roles. Each member becomes an expert on each of the subjects. Interaction and collaboration between experts are crucial. The project begins with a puzzle activity aimed at covering three syllabus topics. Each team member was randomly assigned a piece of puzzle corresponding to one of these topics, requiring them to become experts through individual study and subsequent collaborative exploration in small groups. Once each member mastered their puzzle piece, they joined forces to assemble the puzzle collectively. During this phase, each member shared their expertise with the team, ensuring that all members gained a thorough understanding of all three topics.

3.4. Project Evaluation

Table 1 shows the evaluation system for the project, which is the first unit of the course.

Table 1. Project Evaluation



At the beginning of the course, students are given a rubric containing the assessment criteria for versions 1 and 2, which also includes aspects related to the delivery of the project, and written and oral presentation skills. Table 2 shows an example of the final rubric, with a number of items for subject-specific appropriateness. In all subjects, report structure is assessed with 9 items and general skills are assessed through 7 items.

Table 2. Final Rubric

		Item	Score	Mark
Adequacy (4 points)	Version 0	Nº Item	0	
	Version 1	Nº Iten	0	
	Version 2	Nº Item	0	
	Total		0	
Structure of the Report (2 points)	Version 0	9	0	
	Version 1	9	0	
	Version 2	9	0	
	Total	9	0	
Generic Competencies (2 points)	Version 0	7	0	
	Version 1	7	0	
	Version 2	7	0	
	Total	7	0	
Total Mark				

4. Assessment of the Innovation

Evaluating the impact of PBL compared to traditional methodologies is crucial for improvement. Quantitative analysis and qualitative surveys, including a gender perspective to address inequalities in the finance profession, will inform future course improvements.

4.1. Quantitative Results

The results for Unit 1, post-PBL application compared to pre-PBL, are shown in Table 3. Across the three subjects, PBL has had a positive impact on marks, both in the final exam and in the final mark. This increase is more significant for the female gender. The statistical *t*-test shows significant differences between pre-PBL and PBL means, with minor exceptions for the male gender[3].

Table 3. *Pre*-PBL vs PBL results

Course		Total Sample			Female			Male		
	Nº Obs	Unit 1	Exam	Final Mark	Unit 1	Exam	Final Mark	Unit 1	Exam	Final Mark
Corporate Finance I		**8.03**	**7.22**	**7.65**	**7.96**	**7.22**	**7.62**	**8.21**	**7.22**	**7.73**
Pre-PBL (21-22)	30	7.34	6.96	7.20	7.18	6.79	7.04	7.72	7.34	7.56
PBL (22-23)	41	8.94	7.56	8.25	8.93	7.76	8.35	8.95	7.04	8.00
t-test		0.00	0.26	0.01	0.00	0.14	0.01	0.08	0.75	0.45
Corporate Finance II		**6.37**	**7.28**	**7.32**	**6.31**	**7.22**	**7.35**	**6.49**	**7.40**	**7.28**
Pre-PBL (21-22)	34	5.72	6.73	7.26	5.54	6.69	7.16	6.27	6.84	7.57
PBL (22-23)	35	6.97	7.80	7.38	7.28	7.90	7.59	6.60	7.67	7.14
t-test		0.00	0.00	0.70	0.00	0.01	0.24	0.58	0.22	0.44
Financial Markets and Instruments		**7.76**	**6.37**	**7.21**	**7.85**	**6.27**	**7.17**	**7.56**	**6.60**	**7.32**
Pre-PBL (20-21)	39	6.41	5.59	6.45	6.41	5.37	6.26	6.42	5.92	6.74
PBL (21-22)	41	8.11	6.93	7.52	8.08	6.65	7.36	8.21	7.94	8.08
t-test		0.00	0.05	0.01	0.00	0.11	0.02	0.00	0.24	0.16
Total mark		**7.42**	**6.82**	**7.34**	**7.46**	**6.74**	**7.32**	**7.35**	**6.98**	**7.39**

[3] Before the implementation of PBL, traditional methodologies were employed. The results obtained could be due to innovation and/or a change in evaluation. The methodological change makes it difficult to distinguish between the two causes.

Table 4 shows the results for Unit 1, displaying comparatively higher marks for Version 2 than for Version 1 in all subjects. They suggest the influence of teacher feedback on the learning process. The mark of the essential knowledge test is relatively lower than the dossier/report mark, which requires further analysis for possible corrective measures. The average mark for project delivery and commitment is 9, with slight variations between subjects. No gender differences are observed, except for Corporate Finance II, where no significant difference is observed using mean difference tests.

Table 4. Project Marks (PBL Unit 1)

Subject	Nº Obs	On-time delivery	Version 1	Version 2	Individual Exercise	Basic Knowledge	Unit 1 (PBL)
Corporate Finance I		**9.89**	**9.26**	**9.63**	**8.80**	**6.80**	**8.94**
Female (22-23)	30	9.89	9.26	9.61	8.73	6.86	8.93
Male (22-23)	11	9.90	9.27	9.69	9.00	6.58	8.95
t-test		0.93	0.98	0.51	0.48	0.77	0.96
Corporate Finance II		**9.00**	**5.60**	**7.96**	**6.74**	**4.79**	**6.97**
Female (22-23)	19	9.47	5.97	8.11	7.13	4.94	7.28
Male (22-23)	16	8.44	5.16	7.78	6.28	4.60	6.60
t-test		0.08	0.06	0.20	0.44	0.70	0.17
Financial Markets and Instruments		**9.95**	**7.94**	**8.37**	**8.91**	**6.93**	**8.41**
Female (21-22)	32	10.00	7.19	7.83	8.28	7.06	8.08
Female (22-23)	25	10.00	8.59	8.90	10.00	7.07	8.87
Male (21-22)	9	10.00	7.94	8.11	7.78	7.08	8.21
Male (22-23)	12	9.67	8.61	8.91	9.17	6.17	8.51
t-test		0.21	0.03	0.21	0.55	0.38	0.85
Total Mark		9.69	7.54	8.46	8.33	6.36	8.13

4.2. Qualitative Results

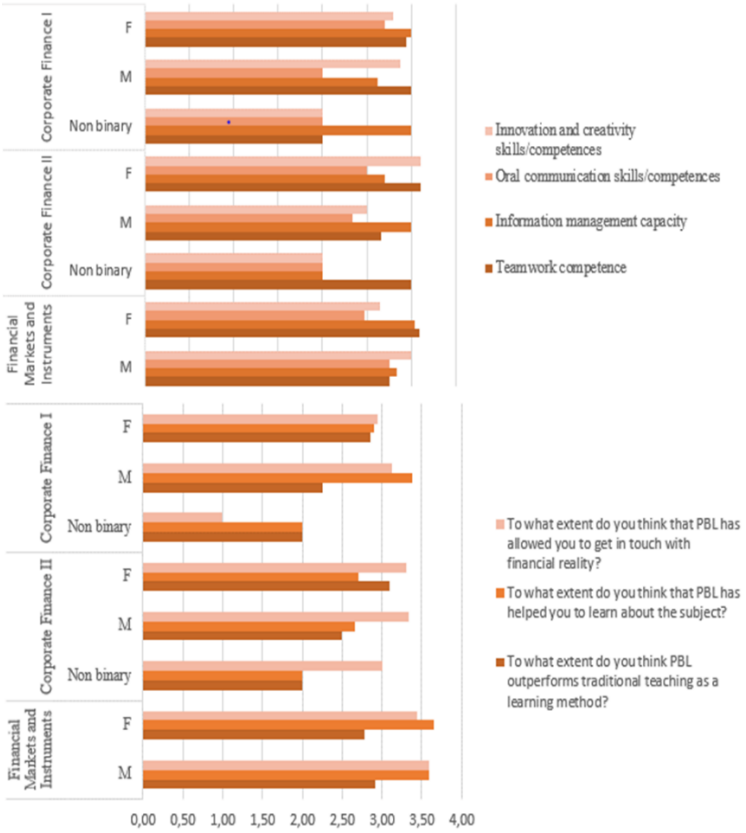
Students are surveyed about their opinion on certain qualitative aspects of the PBL methodology. First, the results suggest that the percentage of students that would recommend this teaching method ranges from 83.35% to 88.57% (Table 5).

Table 5. Commitment and Recommendation

Subject	Nº Hours/week	Recomendation
Corporate Finance I	6	86.21%
Female	6	90.00%
Male	6	75.00%
Non binary	3	100.00%
Corporate Finance I	6	82.35%
Female	6	90.00%
Male	7	66.67%
Non binary	6	100.00%
Financial Markets and Instrumen	7	88.57%
Female	7	86.96%
Male	6	91.67%
Total Mark	6	86.42%

Open-ended responses on methodology reveal concerns about high workloads, which reflects the weekly hours spent outside the class in Table 5. Despite this, students highlight autonomy and collaboration as strengths, bridging the academic and professional worlds.

Second, Graph 1 shows the results for questions assessing the usefulness of the methodology, with values predominantly close to 3[4]. Notably, female students express slightly higher receptivity. In open-ended questions, students perceive the high workload as a disadvantage, but emphasise the autonomy and collaboration as strengths, bridging the gap between academia and the realities of the workplace. Assessments of the relevance of the experience to the role of a financial advisor receive very positive scores above 3, with slightly higher marks for females.



Graph 1. Satisfaction Survey

[4] The satisfaction survey, on a scale of 1 to 4, measured students' perceptions of the PBL methodology

5. Conclusions

This paper outlines the implementation of Project-Based Learning (PBL) in the area of "Basic Finance" at UPNA, transforming classrooms into financial consulting firms. The courses involved are Financial Markets and Instruments, Corporate Finance I and Corporate Finance II. The pedagogical innovation resulted in an average score increase of more than one point compared to the previous academic year. The surveys reveal positive feedback on the acquisition of workplace skills, with workload identified as the main disadvantage. In terms of gender, female students generally outperform their male counterparts. Ongoing evaluation explores expectations of project development times.

Reflecting on the initiative, tutors express satisfaction at observing an actively engaged and motivated classroom. This increased student satisfaction and engagement could be an indication that innovation leads to improved student academic performance, which would support our initial results, supporting the arguments in favor of the PBL methodology. However, students perceive the increased workload as a disadvantage, placing a greater burden on teachers. The choice of active methods requires consideration of the optimum group size.

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From AI-Generated Lesson Plans to the Real-Life Classes: Explored by Pre-Service Teachers

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Abstract

ChatGPT is a powerful Artificial Intelligence (AI) technology that has the potential to revolutionize the way we study in education. It can be used in a variety of ways and we, on the other hand, focused on senior pre-service teachers' designing a mathematics lesson plan to implement in primary schools. Four voluntary participants attended, as half of which designed a mathematical task by asking AI while the rest used traditional methods in planning the task. In the next breath, participants implemented their lesson plans in a public school and collected the data relating to tasks they used. At the end, we compare the outcomes concerning the lesson plan and implementation in schools, and determine the strengths and weaknesses of each approach. This research offers valuable insights into using ChatGPT in teacher education to be used in practice and considering the teachers' task designing role in classrooms with and without ChatGPT.

Keywords: *Artificial intelligence; ChatGPT, teacher education, pre-service teachers, mathematics lesson plan*

1. Introduction

Once, it was education leading the way in paradigm shifts. Now, propelled by research and development activities— in other words, by riding the wave of artificial intelligence's [AI] meteoric rise—it has become inevitable to compel the four horses of education to pursue novelty. AI-generated tools elegantly dance onto the stage. Generative AI is stirring up quite the excitement, thanks to using the magical blend of natural language processing and extensive language models. Because AI has this superpower to grasp and spit out human language which is known to be the pinnacle of sophistication in system development, to spot patterns; the trained-up versions of this AI can shuffle through language constructs (Bozkurt, 2023). While it took humans approximately six million years to evolve, we now possess a polyglot and talkative genius at our fingertips, capable, if trained proficiently, of swiftly solving previously unsolved problems in mathematics.

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Generating quite the mojo with its content-creating prowess, generative AI has sparked a flurry of scholarly debates, prompting researchers to dive into its potential perks and pitfalls (Johinke et al., 2023). Authorities in the realms of education and innovation proclaim that given the burgeoning presence of generative AI tools in the lives of young individuals, a strategic endeavor is imperative to blend them seamlessly into educational frameworks. Knowing that AI is used in numerous fields (Kasneci et al., 2023), we attempt to answer this question in the educational scope. This research seeks to explore the effects of incorporating AI-generated lesson plans into the teacher education program, center upon the viewpoints and encounters of future educators.

One of the AI tools that can be employed for educational purposes is ChatGPT AI language model developed by OpenAI. It's designed to understand and generate human-like text based on the input it receives. Using a vast amount of data and machine learning techniques, ChatGPT can engage in conversations, answer questions, generate text in various styles, and assist with a wide range of tasks, from providing information to creative writing. What makes ChatGPT unique is its ability to produce high-quality text for broad input, constant learning capabilities, and partly free usage. ChatGPT showcases its capacity to bolster student writing through multiple avenues: offering outlines, scaffolding knowledge, generating summaries, paraphrasing content, providing feedback on diverse submissions, and even facilitating practice quizzes on specified subjects (Halaweh, 2023).

ChatGPT offers a spectrum of support in educational settings, from automated feedback, discussion starters, and grammar/spelling corrections to crafting syllabi, lesson plans, and developing curricula (Cope et al., 2021; Lin, 2022). Numerous recent studies have proposed that the utilization of ChatGPT within educational contexts presents opportunities for enhanced teaching methodologies and improved learning experiences (Adiguzel et al., 2023; Cooper, 2023; Kasneci et al., 2023). When it comes to core subjects, the integration of lesson plan preparation within teacher education programs, with a particular focus on mathematics may affect the classroom setting at the schools. Hays et al., (2023) found that the majority of teachers do not use any AI tools and ChatGPT either in their lessons. And the minority use it for the lesson plans/substitute plans, letters of recommendation and asking how to teach with it.The AI platform, by identifying a student's areas of struggle in mathematics, can dynamically adapt the lesson (Graham, 2023). Spot on the present research, Hong (2023) and Phillips (2023) have discussed aspects of lesson planning. However, no research articles that focus on GPT-generated lesson plans in mathematics and also carry out the plans in primary schools to see if it works in real practice. This study aims to investigate the impact of integrating AI-generated lesson plans into the teacher education curriculum, focusing on the experiences and perspectives of pre-service teachers. Based on this, we specify the research question:

1) What similarities and differences exist between Chat-GPT and the traditional mathematics lesson plans created by pre-service teachers?

2) What implications arise from varying learning plan applications for pre-service teachers and primary students?

2. Methodology

This research is comparative case study which is a research approach to formulate or assess generalizations that extend across multiple cases. Yin (1984) states that case studies in qualitative research assist in researching complex phenomena (cases) or those that we do not know much about. The cases in this research are designing a mathematical task by the aid of ChatGPT and without the ChatGPT support. Research trajectory is explained below.

AI-generated lesson planning workshop and creating the lesson plan: We conducted a two hour-workshop where pre-service teachers are introduced to ChatGPT and guided in using the AI model to generate lesson plans. Three pre-service teachers participated in this training while the other three participants who will conduct the lesson with traditional methods were out in that part of the research. Pre-service teachers created the lesson plan in accordance with their topic in accordance with the 5E model from constructivist approach and right after the workshop and sent it to the researchers. We specify to study "fractions" as a mathematical theme so that all participants are coherent with the implication of the theme. We employed three fraction concepts for every two of the pre-service teachers (one uses AI, one uses a traditional method) to design a lesson: i) Instruction of unit fractions' magnitude, ii) Instruction of proper fractions' magnitude, iii) fraction comparison.

Implementation in school visits and observations: Whole process takes place in the same public school where the classrooms include 24, 4th grade students on average. Each attainment was implemented in the same classroom subject to two different lesson plans. In other words, one attainment was assigned to a class and the attainments were implemented as two practices in 3 different classes. Researchers gather observations and feedback from both pre-service teachers. As a sum, the observation form is filled by researchers and by pre-service teachers regardless of implementer or observer.

Comparative analysis: Texts generated by ChatGPT and tradition-based lesson plans were utilized for document analysis. The researchers ensured that, through credibility, the data were collected from the official ChatGPT site. Participants' reflections, their notes, and researchers' observation notes were assessed, and all data were cross-checked for better implications. All data were analyzed collectively by the researchers, and decisions were reached by consensus.

3. Findings

3.1. Assessment of lesson plans

The lesson plans with a traditional lens and with the support of ChatGPT were analyzed according to the six criteria on Table 1.

Table 1: Assessment Results of Participants' Lesson Plans

Method & Techniques		**Originality**	
AI-generated	*Traditional*	*AI-generated*	*Traditional*
-Question & answer -Narrative -Discussion -Group working	-Question & answer -Demonstration	-Highly original	-Mostly conventional tasks and activities -Depends on the planner
Functionality		**Suitability**	
AI-generated	*Traditional*	*AI-generated*	*Traditional*
-Supporting various strategies -Promoting peer teaching and sharing -Giving otantic example -Offering accessible materials -Rule-based approach	-Emphasis on visual representation and modeling -Detailed explanations	Inappropriatenes s to student level and grade level -Redirection to arithmetic processing	-More flexible to arrange the plan according to the suitability

According to Table 1, ChatGPT offers group working and discussion regarding methods and techniques. Question and answer methods are standard for both tools. Oppositely, ChatGPT generates more original ideas. Besides, traditional lesson plans offer more convenient content and require less inference. As for functionality, supporting various strategies, promoting peer teaching and sharing, and giving real-life examples are considered positive features of AI-generated tools. Emphasis on visual representation and modeling and detailed explanations are positive sides of traditional lesson plans. It can be accepted that quite similar lesson plans were created by offering easily accessible materials such as papers, cardboard, and visual models.

3.2. Assessment of Pre-Service Teachers' Implications

The lessons with a traditional lens and with the support of ChatGPT were analyzed according to the strengths and weaknesses based on the observations of researchers and participants themselves.

According to Table 2, while the ChatGPT lesson plan stands out for providing creative and varied ideas and saving time, the weaknesses observed by both the researchers and the participants were the lack of depth/superficiality in the subject matter, the predominance of the narrative technique, and the plans that were not suitable for the grade level and the level of the students. The timing of the plan stages is a deficiency because it gives very short time for essential tasks, for example, while it gives much longer time for the reminder stage. As a weakness, it was also noteworthy that it did not provide any technological support and did not

Table 2: Assessment of Participants' Implications with AI-generated Lesson Plan

Implications with AI-generated Lesson Plan			
Strengths		**Weaknesses**	
To implementers	*To observers*	*To implementers*	*To observers*
-The predominance of the question & answer technique -Saving time -Offer different perspectives and diversity	-Proposing number line activities -Providing examples of effective reminders -Suggestions on material	-Superficiality -Dominance of narrative techniq -Inappropriate for grade level -Inappropriate for student level -Lack of joy -Timing	-Superficiality -Dominance of narrative technique -Inappropriate for grade level -Not offering technology support -Proposing number line activities -Inadequate contextual problem -Professional knowledge deficiency -Direction to arithmetic process
Implications with Traditional Lesson Plan			
Strengths		**Weaknesses**	
To implementers	*To observers*	*To implementers*	*To observers*
-Leaving free space for the teacher -Supporting authentic learning	-Leaving free space for teacher -Classroom management effectiveness	-Offering single point of view	-Adherence to the textbook

suggest any contextual problems. Providing compelling reminder examples was interpreted as a strength because the comprehensibility of the topic needs to provide reminders about fraction concepts, as the last topic was seen about a year ago. Finally, the observers noticed a deficiency in participants' professional knowledge and redirection to arithmetic processing.

While the prominent strengths of traditional lesson plans are leaving free space for the practitioner, flexibility, and supporting authentic learning, the weaknesses are offering a single point of view depending on the decision of the implementer and adherence to the course materials. As a final step, participants were asked: *What are the differences between the lesson plan and implementation with the other method?*

PT1: "In the traditional plan, the pre-service teacher prepared a more flexible plan. When I stayed connected to the chatGPT, I felt as if I was making a presentation rather than teaching, so there was a one-sided communication."

PT4: "Tools such as ChatGPT may harm the teacher's productivity and creativity in the long run. But it saves a lot of time when preparing lesson plans. I think traditional and AI generated can be used together."
PT3: "A plan designed for 1 hour requires at least 3 hours. Timing is a big problem"
PT2: "Despite all the weaknesses, if I didn't know beforehand, I wouldn't have realized that it was prepared with AI."

4. Discussion and Conclusion

In this research, while asking about the differences between traditional and ChatGPT-supported lesson plans, we wanted to answer the question, "Which one provides more effective teaching?" It is not easy to give a simple answer to this. Traditional does not always mean unuseful and old, but it does not mean that we should always stick to it. This proposal not only explores the practical implications of AI in lesson planning but also delves into the perceptions and experiences of those directly involved in the educational process—student teachers. It adds a valuable dimension to the ongoing discourse on AI in education and teacher training.

The suggestion of visuals and modeling as a common strength of ChatGPT and the traditional lesson plan is essential because visual representations in mathematics teaching make the subject concrete and comprehensible (Goldin, 2008). Contrary to traditional lesson plans, ChatGPT presents various viewpoints and diversity, offering imaginative and diverse suggestions. Delving deeper into the concept of creativity is valuable, as aspiring educators highlighted its role in generating innovative lesson plans and fostering their professional expertise. Compatible with this result, van den Berg & du Plessis (2023) assesed that ChatGPT can serve as a potent resource in honing educators' abilities for critical thinking. This tool empowers them to assess, modify, and enhance their teaching methodologies, thereby catering more effectively to their students' requirements. Considering the activities generated by ChatGPT can certainly expand teachers' viewpoints and nurture creativity by introducing various approaches to teaching fractions. This exposure inspires educators to explore inventive methods which can captivate learners in dynamic learning endeavors. Nonetheless, educators may face challenges, as specific curricula necessitate adherence to strict guidelines and designated textbooks. Therefore, while embracing creative strategies, teachers must tread carefully within these constraints.

Along with the positive sides of AI-generated lesson plans, considerable weaknesses exist. The prominent situation is that plans are only partially suitable for the grade level and the level of the students. It offers different and effective content, but the implementers should reconsider its offer before using it. The participants stated that chatGPT had one-way communication and were in a situation where the way of presentation was active in the implementation process, contrary to the interactive environment required by constructivism. The situations that emerged in practice due to the limited flexibility and the predominance of narrative support these pre-service teachers' views. According to some participants, ChatGPT may harm the teacher's

productivity and creativity in the long run. While ChatGPT excels in offering precise and pertinent information, it lacks the capacity for emotional support and the essential human interaction necessary in teaching (Javaid, et al.,2023). We did not observe such a result in this study, probably because it required a longer data collection process. As a result, AI-driven technologies should be used in teacher education to make teaching and learning practices more effective and efficient. However, teachers should reassess the plans or instructions in ChatGPT to make it more useful and suitable. The results show that candidates do not want to turn their backs on Chat but want to use it in a way that allows them to intervene. ChatGPT should be seen as tools to enhance and supplement teachers' work but not replace the teachers.

As a remarkable result, the AI's suggestion of number line activities is both a weakness and a strength. It is a strength because the number line is an essential and vital tool for understanding many subjects in mathematics (Kieran, 1988; Siegler et al., 2011). It is a weakness because using the number line is a problematic tool for preservice teachers and students (Tunç-Pekkan, 2015). This study interpreted it as students' lack of professional knowledge. As another example of a negative situation, the contextual problem statement of ChatGPT was only proposed in the lesson on finding the fractional equivalent of a quantity. The lack of problems with unit fractions and fraction comparison tasks can make it difficult for students to understand fraction magnitude and force them into rote learning.

Time and duration are also prominent and can be interpreted differently. ChatGPT is a very effective and powerful feature at the point of plan preparation and saves much time in the lesson plan preparation phase. However, it appears to be a limitation and weakness in the implementation phase. It requires intervention because it gives too many things at the same time in the same lesson plan. As an echo of this result, according to Duha (2023), the lesson plan in ChatGPT is at a rudimentary level and requires significant editing. Saving time for the practitioner can be very useful for a teacher at the beginning of his/her career. However, in almost all of the lesson plan examples requested from Chat, it was observed that it used the same way to determine the duration of the lesson sections. Designing lesson plans tailored to specific subjects and concepts is essential. Consequently, it is anticipated that standardized examples of the same plan could pose challenges in implementation.

This study has the potential to illuminate the effectiveness and implications of integrating such tools for prospective teachers. Maximizing the educational benefits of these models requires a careful approach, including a critical examination of their limitations and potential biases. Recognizing that these tools support teaching and learning is crucial, emphasizing the importance of a balanced evaluation to leverage their advantages (Duha, 2023) effectively. According to Kim & Adlof (2023), we should view ChatGPT as a tool to enhance the learning process in education rather than as an end in itself for generating artifacts. Despite the various concerns surrounding using and integrating ChatGPT in classroom settings, we believe that educators will continue to play central role in haping and guiding students' learning experiences.

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Using service learning to foster diversity competency of pre-service chemistry teachers at the University of Vienna

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Abstract

In order to feel better prepared for the challenges of teaching chemistry in multicultural and multilingual classrooms, the Institute of Chemistry Education (IDC) at the University of Vienna has launched a teacher training course in which pre-service teachers get the opportunity to engage in service learning at the UniClub. The UniClub is a programme offering learning support for pupils at upper secondary level with refugee and/or migration experience. The results of the qualitative evaluation study show that the course covers topics unique within the chemistry teacher training programme and provides insights into culturally and language sensitive teaching. It raises pre-service teachers' awareness for the needs of multilingual and multicultural learners and leads to a more reflective use of language in the chemistry classroom. The results also show that, although the course is an important step towards the development of diversity competency, the pre-service teachers still do not feel fully prepared.

Keywords: *service learning; diversity competency; STEM education.*

1. Introduction

Wars and social crises have led to an increase of migration in recent years. In Austria, current figures show increasing diversity in classrooms across the Austrian educational system (Statistics Austria, 2022). Therefore, monocultural and monolingual learners are little more than a misconception of the Austrian German-speaking majority society. Although 'Intercultural Education' has been anchored as an interdisciplinary and cross-curricular teaching principle in the curricula of all general education schools since 1992 by the Federal Ministry of Education Science and Research (BMBWF, 2023a), the acquisition of diversity competency has received little attention in science teacher training and particularly in the field of chemistry teacher training.

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For this reason, the IDC at the University of Vienna has launched a teacher training course, in which pre-service teachers get the opportunity to engage in service learning at the UniClub of the University of Vienna, which offers learning support for students at upper secondary level with refugee and/or migration experience. This service learning approach aims at providing first-hand teaching experience in linguistically and culturally diverse settings in order to increase pre-service teachers' diversity competence and thus advance their self-efficacy with regards to managing classroom diversity (Resch & Schrittwesser, 2023; Amaro-Jiménez, 2012).

2. Diversity competency & 'Intercultural Education'

Cross et al. (1989) identified the awareness of the wide array of difference as well as knowledge and acceptance of these individual differences as basic skills for successfully dealing with heterogeneity.

Diversity competency can, therefore, be regarded as a set of various competencies related to managing similarities and differences, including the ability to develop adequate and diversity-sensitive approaches and interventions. It also requires multidimensional and intersectional perspectives, comprising thorough knowledge of the concept of diversity as well as systematic and continuous reflection on one's own diversity. This involves knowledge, self-reflection skills, social competence and diversity-sensitive attitudes as well as action competence (BMBWF, 2023b; Thomas, 2006).

All these skills are summarized in the Austrian school curriculum as the interdisciplinary and cross-curricular principle 'Intercultural Education', which explicitly calls for the development of empathy and tolerance of ambiguity, a relaxed attitude towards heterogeneity, a critical and appreciative attitude and a constructive conflict culture without cultural attributions. It aims at respect towards social change processes, such as migration or diverse biographies, and lifestyles in order to create a framework for responding appropriately to the challenges and opportunities that arise from this in the school system (BMBWF, 2023a). Prospective teachers, therefore, need to sharpen their awareness of the heterogeneity of their future students by consciously perceiving diversity in the classroom (Anton, 2014). They need to become aware of their own attributions, stereotypes and generalizations and critically question and challenge them, in order to help ensure that learning in linguistically and culturally heterogeneous school environments can take place in an appreciative and respectful manner. Hence, teachers and learners shall develop intercultural skills regardless of origin, social status, age, gender etc. in order to contribute to combating exclusion and othering (BMBWF, 2023a).

Interculturally or culturally reflective competency is not only about rationally applicable knowledge though, but also about practical skills and an attitude that takes the complexity of human interactions into account, which are influenced by personal interests and desires, social positions, power relations and situational demands. Schondelmayer (2018, p. 52) argues,

however, that precisely this is not a skill "that can be taught in training courses in such a way that the people trained can deal appropriately with the experience of difference in every situation".

Nevertheless, diversity competency and intercultural sensitivity can be practiced by reflecting on one's own opinions and assumptions, as well as one's personal experience, in order to create an awareness of different interpretations of situations. At the same time, practical experience of cultural and linguistic diversity enables access to different patterns of interpretation and thus the development of intercultural as well as diversity competency (Doğmuş et al., 2016).

In order to feel prepared for managing the increasing cultural and linguistic diversity in the Austrian educational system, however, pre-service teachers need to acquire diversity competency, not only in theoretical teacher education courses, but also through organized encounters with people and joint action (Resch & Schrittesser, 2023).

3. The course *Intercultural Chemistry Teaching*

Pre-service teachers of science subjects often tend to neglect the importance of culture and language for learning, although these can have significant impact on the learning process (Rincke & Markic, 2018) and consequently on the understanding of subject knowledge. Consequently, the IDC at the University of Vienna has designed a teacher training course in which pre-service teachers are presented with the opportunity to engage in service learning at the UniClub of the university in order to gain better understanding of the needs of culturally and linguistically diverse learners.

3.1. Course Design

The objective of the course *Intercultural Chemistry Teaching* is to develop a competent approach to diversity in the migration society as part of the professional self-perception of pre-service chemistry teachers. Experience and attitudes related to migration, diversity and education shall be examined in order to understand mechanisms of inclusion and exclusion. At the same time, pre-service teachers acquire diversity competency by developing expertise on the topic of intercultural education and find methodological and didactic approaches for chemistry teaching (Marshall et al., 2015). Moreover, the course aims at combining the acquisition of technical, methodological and social skills with social engagement.

In order to bridge the gap between theory and practice, the course is designed according to the principles of service learning. The course *Intercultural Chemistry Teaching* links theory and practice by giving students the opportunity to participate in authentic service learning activities at the UniClub (see 3.2. UniClub) for about 25 hours (=1 ECTS) and to reflect on this involvement in class in order to gain deeper understanding of the underlying theory (Bringle &

Hatcher, 1996; Eyler & Giles, 1999). This way the pre-service teachers gain the often requested practical experience in authentic learning situations and develop strategies as well as a sense of self-efficacy in terms of dealing with the increasing heterogeneity in Austrian classrooms (Stewart, 2012). By supplementing the theoretical seminar content with practical experience at the UniClub, the students have the chance to successfully transfer conceptual knowledge they have acquired earlier to real teaching and learning situations. The reflection processes triggered by the new experiences will lead to lasting insights into the teaching and learning process (Butler & Christofili, 2014).

The seminar part of the course is structured in five theory blocks of three units, taking place approximately once a month for one semester. These units are designed to provide pre-service teachers with space for exchange and reflection on the one hand, and to enhance their pedagogic content knowledge on specific aspects of dealing with multilingual and multicultural students on the other hand.

Specific content includes basic considerations of culture and intercultural education based on the Intercultural Education Policy Decree (BMB, 2017). Furthermore, the dimensions of diversity in combination with different biographies and life plans associated with it are discussed in order to develop awareness of heterogeneity in schools and understand the opportunities and challenges this presents for chemistry education. To establish a foundation for mutual understanding across language and cultural barriers, a focus is set on multilingualism and linguistic diversity (Busse, 2017; Keim & Tracy, 2006) as a school reality as well as on the didactic principles of language-sensitive chemistry teaching (Schmölzer-Eibinger et al., 2020).

Additionally, aspects of trauma-sensitive pedagogy relevant for dealing with students having experienced refugee movements and/or migration are addressed in order to give pre-service teachers basic knowledge on the concept of trauma and potential trigger factors that might occur in everyday school life. In this context, it is particularly important to present pre-service teachers with various options when working with traumatized young people, where they can receive appropriate support, but also recognize and accept their limits regarding this matter (Siebert, 2020).

3.2. Uni Club

The UniClub is a learning support programme for young people between 13 and 20 years with refugee and/or migration experience attening upper secondary school in Austria (Children's Office of the University of Vienna, 2024). It offers three different support formats: StudyBuddies, LernClub and IntensivClub. StudyBuddies provide one-on-one learning support for approximately two hours per week for one particular student. Depending on the needs of the pupil, the study buddy helps reviewing school material, preparing for exams, tests, etc., and

organizing study time. This provides the opportunity to build and develop a personal (learning) relationship over the course of a semester.

In contrast, the LernClub is an open learning space for pupils taking place twice a week in the afternoon. Pre-service teachers usually work in pairs to help pupils with their studying and homework. The LernClub afternoons are coordinated by the UniClub team, so that the pre-service teachers can focus on the need of the pupils. There they workwith different young people and having to adapt spontaneously to their specific needs. Last but not least, IntensivClubs are a particularitiy of LernClub offered primarily in Maths, English and German, focussing on supporting pupils preparing for their final exams. Pre-service teachers who take part in an IntensivClub regularly work with a small group of young people for about two hours a week (Children's Office of the University of Vienna, 2024).

4. Course evaluation and first results

4.1. Course evaluation: data collection, sample & data analysis

The evaluation of the course is based on a questionnaire with a four-level Likert scale (1=fully agree; 4=fully disagree) and the analysis of the participating pre-service teachers' product portfolios. Each portfolio contains a tabular overview of all learning units held at the UniClub as well as reflection papers on three specific learning units and an overall reflection of the course, including the interpretation and critical evaluation of their teaching methods and learning gain.

Since the chemistry teacher program is considerably small, the number of participants in the course and therefore the sample size was rather small with just N=6 pre-service chemistry teacher students at different stages in their studies. The portfolios were evaluated and interpreted employing qualitative content analysis (Kuckartz, 2018), with inductively developed categories. As for the questionnaire, a simple frequency analysis of answers was carried out.

4.2. First results

The results of the questionnaire show that the course is unique in the canon of chemistry teacher education at the University of Vienna. All participating pre-service teachers fully agreed with the statement "In the seminar, content was discussed that is not discussed in any other course in the chemistry program" without exception (M=1,0). At the same time, the experience at the UniClub is also regarded as very positive, as the pre-service teachers can gain practical experience in the field (M=1,2) and are able to become aware of their own strengths (M=1,6) and weaknesses (M=1,2), but also get to know approaches for dealing with students with refugee and/or migration experiences (M=1,4).

It also turns out that the pre-service teachers are aware of the importance of language and culturally sensitive teaching (M=1,2), but they do not feel fully prepared and still see need to deepen their methodological knowledge in this area (M=2,6).

The reflection papers confirm that the pre-service teachers understand the importance of language and diversity competency for chemistry teaching. A majority of them says that they experienced the need to pay attention to their own language for the first time and recognized its significance for successful teaching and learning. All pre-service teachers state that they now use and reflect on their own language more consciously in teaching and learning situations, as a result of the course and their experience at the UniClub.

In addition, the work at the UniClub showed all pre-service teachers the importance of a systematic approach to teaching subject matter and that a didactically reflective approach is crucial for students' success. In this context, all pre-service teachers come to the conclusion that detailed subject knowledge alone is not enough to teach a subject. At the same time, they also realized that understanding larger contexts is much more important for long-term retention and the ability to explain content than highly detailed reproductive knowledge. This became particularly clear to the pre-service teachers when having been confronted with detailed questions and detected gaps in their own technical knowledge. Although they were not able to answer these questions spontaneously, the (mostly collaborative) research with the learners was sufficient not only to find correct answers, but also to frame and explain them to the learners.

5. Conclusion & Outlook

The results of the evaluation clearly show that the course *Intercultural Chemistry Teaching* was able to provide students with new insights in the area of language and culturally sensitive teaching. The experience at the UniClub made the participating pre-service teachers realize that language plays an important role in chemistry education, as it is not only a means of communication but also an obstacle to learning. They also understood that teaching chemistry involves much more than simply teaching students how to read and write chemical formulas and that subject-specific learning objectives can only be conveyed with the help of language. Especially for learners whose first language or current family language is not German, a lack of linguistic resources can lead to difficulties in dealing with specific chemical content. These findings show that language and culturally sensitive teaching contributes significantly to understanding the content of a lessons. The promotion of language education must consequently be a concern for all subjects and not only of the designated language subjects. By participating in the course described, the pre-service teachers had to reflect on their own language behaviour as well as attitudes towards culture, language and multilingualism.

Although the evaluation results show that one course alone is not enough to provide students with sufficient knowledge and methods to feel adequately prepared for the challenges of a

multilingual and multicultural classroom, they have been sensitized to the importance of language in chemistry education. The pre-service teachers also recognizd the need for good subject-specific and didactic training for the professionalization of teachers in general, but also for themselves and their future teaching activities. This insight will hopefully contribute to a greater acceptance of theory in teacher education and, as a result, of in-service training in the sense of continuous professionalization.

As the sample size was rather small, further research will have to be carried out and the results from courses of different semesters must be compared and contrasted. Additional information about the specific needs of pre-service teachers when dealing with multiligual and multicultural learners must also be collected. This way it is possible to address these particular aspects in greater detail in future courses and to help pre-service teachers to feel better prepared for language and culturally sensitive chemistry teaching.

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Language Teacher Education on Project-Based Learning and Teaching

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Abstract

This paper calls for language teacher education on project-based learning and teaching (PBLT) to respond to the changing needs of 21st-century language teachers and students. It discusses the rationale by introducing PBLT research and practice with global examples. Sample research findings on the benefits of PBLT are also discussed to illustrate how PBLT can address the more complex challenges of real-world needs. The paper also examines emerging teacher training efforts and presents arguments for scaling up these efforts with a systemic and robust education of teachers on PBLT. Such education should include the philosophical and theoretical foundations, principles, and procedures to better design and adequately implement PBLT, along with an array of curriculum content and professional standards, project modules, and digital tools such as AI, metacognitive strategies, and associated language form-function interface.

Keywords: *Project-based language learning and teaching; Language teacher education; 21st century skills; language, content, and skills development; real-world needs; teachers' needs; students' needs*

1. Introduction

The updates on language policies towards bilingualism and/or plurilingualism as well as technology advances have changed language education from emphasis on discrete language skills to higher-order skills and deeper and broader learning. The current language education professional standards such as the American Council on the Teaching of Foreign Languages (ACTFL), Cambridge Life Skills Competencies Framework (CLSCF), Teaching English to Speakers of Other Languages (TESOL), and the World-Class Instructional Design and Assessment (WIDA) recognize this shift. For example, the CLSCF (2020) encourages teaching creativity, collaboration, communication, and digital literacy to language learners. WIDA Standards Framework (WIDA, 2020) states that language teaching should occur in the "context

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of age-appropriate subject matter so that academic language and content can be developed simultaneously (TESOL, 2019)" (Slater & Beckett, 2024, p. 117).

Response to these needs and calls requires a holistic and robust language education approach to prepare well-rounded language teachers. Such an approach must be a departure from the discrete language skills (e.g., vocabulary, reading, and writing) teaching in isolation resulting from a formal linguistics view (Beckett, et al, 2020). A holistic and robust language education approach needs to include teaching and assessing language authentically, contextually, and situationally, using technology in alignment with content curriculum and language education professional standards. Authentic language is the language of the content subjects and metacognitive and social skills that students need for academic success within disciplinary contexts. At the heart of this endeavor is the project-based learning and teaching (PBLT) approach.

2. Why Project-Based Learning and Teaching?

PBLT is a sophisticated educational approach (van Lier, 2006) "for student-centered experiential learning in authentic contexts" (Slater & Beckett, 2024, p. 120). The PBLT approach is based on John Dewey's (1916) lifelong learning educational philosophy that endorses teaching how to learn to prepare students for changing society rather than having them memorize facts that can be outdated. PBLT has been advocated (Beckett & Slater, 2020) and applied as an ideal approach for simultaneous teaching of content subjects (e.g., social studies) and the English language (e.g., Beckett, 1999; Beckett & Slater, 2005) with technology (Beckett, 2022). It has also been proposed for teaching 21st- century skills—critical thinking, creativity, collaboration, communication, and competence in digital learning competency and language development (Beckett, 2023; Slater & Beckett, 2024). They can be taught and learned "through planning, researching (empirical and/or document), analyzing and synthesizing data, and reflecting on the process and product orally and/or in writing by comparing, contrasting, and justifying alternatives" (Beckett, 1999, p. 4) for projects. As such, projects can be language socialization activities or "sociocultural contexts for teaching and learning curriculum content, school and social cultures" (Beckett, in press, p. 12) as project-related language is taught and learned functionally (Dewey, 1926; Dewey & Dewey, 1915; Mohan, 1986). Language socialization (Ochs, 1988) through PBLT takes us beyond viewing language as decontextualized discrete skills to be taught and learned and seeing it as a meaning-making resource that needs to be taught and learned functionally (Halliday, 2004).

3. Research on Project-Based Learning and Teaching Research

Extensive reviews of PBLT literature indicate an increasing worldwide popularity of PBLT (Beckett et al, in progress; Garib et al, in progress), including nationwide curriculum reforms (Levi, 2008). A U.S. study conducted by Chaparro (2009) to explore international students'

perspectives found project-based learning helped participants gain general confidence. Additionally, the participants in the study reported project-based learning increased their leadership, language, and teaching skills. Mohamad's (2021) experimental study of project-based learning on cultural awareness conducted in Morocco found a public school project-based learning group substantially outperformed peers in the control group. The findings of the study also revealed a need for a radical change of assessment culture. McClurg's (2004) mixed-method study of U.S. middle school student achievement in reading and language arts with PBLT revealed 3.5 times greater improvement in the PBLT group than the nonPBLT counterpart. Zachoval's (2011) quasi-experimental research reported increased reading comprehension as the impact of a semester-long PBLT in a Russian course in the U.S. The findings of Sever's (2015) study showed that PBLT created a conducive context to linguistically and culturally appropriate learning for new ESL students. Liang et al.'s (2020) examination of PBLT in exam-oriented People's Republic of China (P.R.C) also found that PBLT motivated all students, especially usually reserved and quiet ones, to learn enthusiastically, tapping into their multiple talents.

Research also uncovered the need for teacher education on PBLT. For instance, Smith's (2005) two-year study of four teachers' and 136 students' experience with PBLT in Australia revealed a need for teacher training for better articulation all learning, particularly language learning that transpires through PBLT. Similarly, an in-depth case study of one English instructor and 25 students in Taiwan by Hsieh (2012) concluded that PBLT can be an effective approach for educational gain. Successful implementation of it, however, depends on sufficient guidelines and support for both teachers and students. Kuo et al.'s (2020) year-long multiple case study exploring three intermediate-level English language learners' experiences with PBLT in U.S. general education math, science, and social studies classes also found a need for more guided support for the successful implementation of PBLT. The findings of Slater's (2020) examination of technology-integrated project-based language teaching at a U.S Midwestern University Intensive English program confirmed similar needs. In showcasing the National Foreign Language Research Center (NFLRC) project-based learning initiative, Rodríguez (2016) also acknowledged foreign language teachers' needs for guidance in implementing PBLT, especially when it came to language, content, and the language of content teaching, in alignment with ACTFL standards.

4. Existing Support for PBLT Implantation

To address the aforementioned needs, scholars have conducted and published their research findings (e.g., Beckett & Slater, 2005; Mohan et al, 2015) and practical PBLT units (e.g., Slater & Beckett, 2019; Gleason & Link, 2020), and proposed assessment frameworks (e.g., Chen & Hirsch, 2020; Slater et al, 2006). Beckett and Slater (2005) discuss issues and illustrate the findings of a study on the successful implementation of PBLT in Canada with the Project

Framework. Mohan et al.'s (2015) study illustrates how adult students in Hong Kong worked with *action discourse*, *reporting discourse*, and *expounding discourse* as a way to help teachers understand how students can improve and articulate their learning of content knowledge linguistically. Slater and Beckett (2019) offer a practical curriculum unit designed as an example to help teachers understand and provide an example for a language socialization with a systemic functional linguistics informed project. It is a content-based technology-mediated project unit with specific language socialization activities for second/foreign language students interested in admission into U.S graduate programs (Slater & Beckett, 2024). Gleason and Link (2020) provide a framework that shows teachers and curriculum designers how content curriculum standards and language education professional standards can be addressed through PBLT.

Other efforts include Beckett's (2023) and Slater and Beckett's (2024) guidelines for teaching 21st-century skills and language development with PBLT. The NFLRC has PBLT training webinars and institutes for foreign language teachers interested in PBLT training. Chen and Hirsch (2020) and Slater et al (2006) provide teachers with much needed PBLT frameworks for assessing content knowledge, thinking skills, and associated language development with PBLT.

PBLT teacher training research is emerging. Garib (2022) showed that English as a foreign language (EFL) teachers participated in his research from middle eastern and north-African countries desired and learned PBLT to usefully develop and implement projects for their students but suggested that more training be needed. Garib (in progress) ethnographic case study reported more teachers from that region were also successful in receiving training, designing, developing, and implementing their projects. Similarly, Walton and Beckett (2023) studied 17 undergraduate preservice teacher candidates' learning of Knowledge Framework (Mohan, 1986) unit-plan projects. The analysis of students' projects and their reflections also showed success and a desire for more training.

5. Need for a Systematic Teacher Education on PBLT

We see that PBLT has been adopted and researched globally. Needs and desires for training teachers have been identified and are being addressed, with some guidance through publications and short-term training. With the available knowledge and other resources, including artificial intelligence tools that can help address some PBLT design and implementation challenges, time is ripe for scaling up. To do that successfully, a systematic teacher education on PBLT is necessary. Such education should include not only the philosophical and theoretical foundations, principles and procedures, and design and implantation of PBLT, but also project modules aligned with content area curriculum (e.g., mathematics, social studies) and language education professional standards (e.g., CEFR, TESOL, WIDA). Additional components of such education should include metacognitive, literacy, and digital, as well as research skills and associated language form/function through multimodal experiential learning. We believe that robust

assessment instruments designed, developed, and informed by theories in alignment with PBLT should be incorporated into every PBLT project module. Digital tools, including artificial intelligence, can be included in many aspects of PBLT. Such education empowers us with a more sophisticated and improved language education policies and pedagogies to guide teachers. Together, we can inclusively address the 21st-century language teachers' and their students' real-world needs by taking the field beyond outdated form-focused approaches contextually, critically, creatively, and responsibly. Higher education is where this is possible as it is equipped with intellectual and professional capital as well as material and human resources essential for achieving these goals systematically, collaboratively, and holistically, especially in increasingly dynamic post-truth and generative AI crazed era.

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The effects of virtual reality learning activities on student teachers' emotional and behavioral response tendences to challenging classroom situations

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Abstract

The use of Virtual Reality (VR) technology in teacher education training is seen as a promising approach to developing professional skills. The present study aims to analyse the effects of learning activities in VR on students' learning from emotional, cognitive and behavioural perspectives. Participants were student teachers (N=39) who attended a university course with two integrated VR teaching learning labs CLASIVIR 1.0. After playing the role of a virtual teacher during the VR lab, students reported feeling more pride, less bored and less anxious. In addition, participants whose behavioural responses were less appropriate for solving the challenging situations presented in the VR classroom simulations benefited more from CLASIVIR 1.0. The results showed some significant changes in participants' attitudes towards the use of digital media in the school context after participating in the course. The implications of these findings for innovation of teacher training programmes in a university context are discussed.

Keywords: *Virtual Reality; Student teachers; Professional skills; Teaching Learning Lab; Emotional experience*

1. Enhancing professional skills through virtual reality in higher education

Today, digital media have become an integral part of teaching and learning practices in higher education. The rapid development of technology, especially in areas such as virtual reality (VR), allows for a complete rethinking and redesign of university courses and learning opportunities enhancing the development of students' professional competences. In particular, for the field of teacher education, the implementation of VR technology is considered as a promising approach (e.g. Breitenbach, 2024; Stavroulia et al., 2018). Considering that the combination of theory and practice is essential for the acquisition of teaching skills (e.g. Hascher & de Zordo, 2015), it is

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assumed that the integration of VR technologies in learning activities, due to its high level of presence, allows to increase the theory-practice link in the training of teachers' professional competences (e.g. Hamilton et al., 2021; Radianti et al., 2020).

In particular, learning tasks aimed at training effective behavioural strategies can be supported by the implementation of VR technologies, as they allow students to respond to situational stimuli "in vivo" and to explore acquired knowledge and skills in direct interaction with the learner (e.g. Radianti et al., 2020). VR applications used in educational training enable hands-on interactions and reinforce procedural and declarative knowledge, for example by helping to memorise or internalise processes (Hamilton et al., 2021). In addition, high-fidelity simulations, such as VR-simulations, can depict learning and working environments of varying complexity in a highly realistic manner, deliver reliable feedback on learning progress, and provide controlled learning situations that can be kept absolutely constant for each participant (e.g. Radianti et al., 2020; Breitenbach, 2024). Findings in the field of embodied cognition and embodied emotion postulate the need to combine thinking, emotion and bodily experience to better support learning and performance, which can be realised through VR-enhanced learning environments (e.g. Wilson, 2002).

Positive effects of VR learning activities on learning success and professional skills development are well documented for different higher education contexts, such as medicine, engineering or military (Chavez & Bayona 2018; Pallavicini et al. 2016). Research has also identified characteristics of course design and instructional aspects of VR learning environments that favourably increase students' positive learning experiences and study interest (e.g., Radianti et al. 2020). Despite the existence of successful VR classroom simulations for student teacher education (e.g. Breitenbach, 2024; Fischler, 2006, Lugrin et al. 2016), very little is still known about how performing in VR learning environments affects students' learning at emotional, cognitive and behavioural levels and improves their professional skills (e.g. Stavroulia et al. 2018). Therefore, the present study (Grant number 01JA2025, funded by the German Ministry of Education and Research, BMBF) aims to analyse the impact of VR learning activities on student teachers' emotional, cognitive and behavioural response tendencies to challenging classroom situations.

2. University course for student teachers with integrated VR teaching learning lab 'CLASIVIR 1.0'

For the purposes of the study, a university course was developed for student teachers on 'Enhancing digital skills in teaching through virtual reality' which included both classroom sessions and VR teaching learning labs (e.g. Roth & Priemer, 2020). The course was divided into five themes: 1) digital skills for school teachers, 2) classroom management as a dimension of good teaching, 3) emotion regulation strategies, 4) application of VR in school education, 5)

development of VR classroom scenarios for school settings. Two VR teaching learning labs with reflection phases were integrated into the course: the first lab after the first topic and the second at the end of the course (Fig 1).

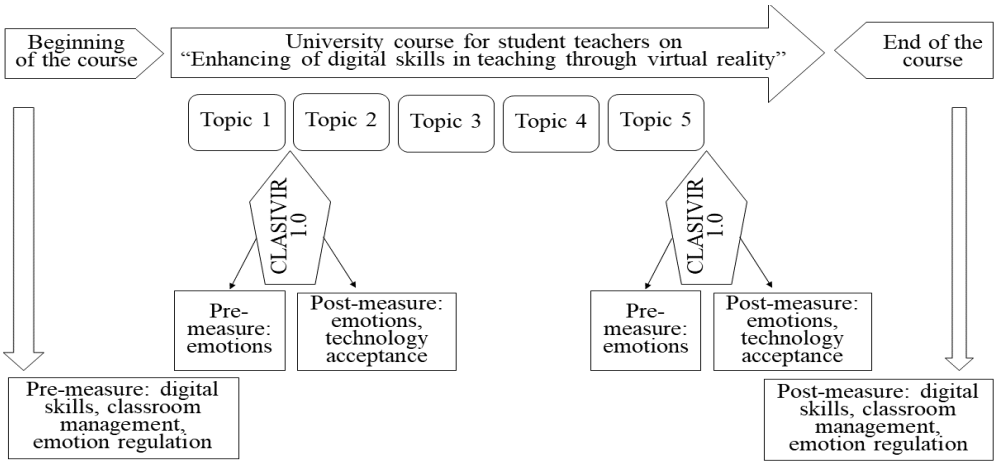


Figure 1. Course structure and study design

2.1. VR teaching learning lab 'CLASIVIR 1.0'

Based on the dimensions of good teaching (e.g. Helmke, 2012), three VR classroom simulation scenarios - 'CLASIVIR 1.0' (Fig. 2) - were developed for implementation during VR teaching learning labs and piloted in 2022 (Glocker et al., 2024). The scenarios focused on teachers' professional skills in classroom management, cognitive activation and constructive support (e.g. Baumert & Kunter, 2011) and were constructed as challenging situations. Following the decision tree approach (Breitenbach, 2024; Fischler, 2006), the scenarios were structured into three phases or levels. After each phase, the sequence was interrupted and the participants had to choose one of three options that they perceived as the most appropriate to deal with the presented situation. Depending on the choice made at the first, second or third level, the following behavioural alternatives were activated. In total, 39 response alternatives for the teacher's response were developed for each scenario whereas each set of three response options contained a most appropriate, a neutral or a less appropriate response for solving the presented problem. For example, in the scenario focusing on classroom management, the participants were confronted with a conflict between two boys who were involved in a physical conflict during a partner work. In their virtual teacher role, the participants were offered at the first level to choose one of the following three responses: a) "Ignore the conflict" (less appropriate response), b) Commenting: "Gabriel, Andreas, please get a grip on yourselves and continue working together" (neutral response), or c) Commenting: "Andreas, you must not hit your classmate! Please apologise to Gabriel!" (most appropriate response).



Figure 2. 'CLASIVIR 1.0' - VR classroom simulation

3. Participants, procedure, and measures

3.1. Participants

Participants were student teachers $N = 39$ ($N = 30$ female and $N = 9$ male) at a German university who attended a course on "Enhancing digital skills in teaching through virtual reality" in the summer term 2023. The participants were enrolled in different teacher training programmes (23% primary school track, 18% secondary school track, 46% grammar school track ("Gymnasium"), and 13% special needs school track). More than 80% of the participants reported that the had already had some teaching experience and that they had been involved in a teaching placement either as a substitute teacher or as part of the teaching practice semester as a part of their university studies. Participants were informed about the aims of the study and asked to participate on a voluntary basis without any consequences for their course credits.

3.2. Procedure and measures

The questionnaires were administered online and were completed by the students in class or in the VR teaching and learning labs. For the pre-post measurement of emotional experiences before and after performing in the VR teaching learning lab CLASIVIR 1.0, participants were assessed with the PANAS (Krohne et al., 1996). After CLASIVIR 1.0, students were also asked to complete a short questionnaire on technology acceptance (adapted from Davis, 1989) (Fig. 1). Students' responses during CLASIVIR 1.0 were recorded and coded according to their appropriateness for further analysis. In addition, at the beginning and at the end of the course, as pre- and post-measures respectively, participants were asked to complete the questionnaires 1) on attitudes towards digital skills (adapted from Vogelsang et al., 2018); 2) on emotion regulation strategies (German version of ERQ, Abler & Kessler, 2011); 3) on classroom management skills (LDK; Lenske & Mayr, 2015).

4. Results

We performed a repeated measures ANOVA with Greenhouse-Geisser correction to analyse the differences in the dependent variables between the pre- and post-measurements (T1 and T2).

4.1. Effect of VR teaching learning labs on emotional experience and technology acceptance

With regard to the first visit of the VR lab, the results showed a significant difference in the emotional experience reported by participants before (T1) and after (T2) completing the VR lab: Mean levels of boredom ($F(1, 38) = 8.520$, $p = .006$, partial $\eta^2 = .183$) and anxiety ($F(1, 38) = 6.587$, $p = .014$, *partial* $\eta^2 = .148$) decreased significantly from T1 to T2. For the emotion of pride, there was an almost significant increase ($F(1, 38) = 3.397$, $p = .073$, *partial* $\eta^2 = .082$). During the second visit of the VR lab, significant differences between two measurement times were found only for the emotion of anxiety: The mean level of anxiety diminished from T1 to T2 ($F(1, 37) = 4.353$, $p = .044$, *partial* $\eta^2 = .105$). Furthermore, the results showed a significant decrease in only one subfacet of technology acceptance: Participants were less motivated to use virtual reality technology themselves or to advise someone else to use it after the completing the second VR teaching learning lab ($F(1, 37) = 8.852$, $p = .005$, *partial* $\eta^2 = .193$).

4.2. Impact of VR teaching learning labs on performance

The results showed a significant increase in the level of appropriateness of the responses chosen by the participants between the first and the second visits of the VR teaching learning lab ($F(1, 37) = 5.507$, $p = .024$, *partial* $\eta^2 = .130$). To answer the question of who benefits more from the training effect of the VR teaching learning labs, we divided the participants – into two groups - "low performers" (below the median; $Mdn < 2.33$) and "high performers" (equal to or above the median; $Mdn \geq 2.33$) - depending on their response appropriateness score during the first visit of the VR teaching learning lab, using median split. We then calculated a MANOVA with the new group variable to identify the differences in response appropriateness between the "low performers" and the "high performers" during the course. The results showed a significant difference between the "low performers" and "the high performers" during the first visit of the VR teaching learning lab ($F(2, 35) = 96.895$, $p < .001$, *partial* $\eta^2 = .735$), whereas during the second visit of the VR teaching learning lab there were no significant differences between these two groups of students ($F(2, 35) = 2.977$, $p < .093$, *partial* $\eta^2 = .078$).

4.3. Impact of VR learning activities on attitudes towards digital skills, classroom management skills, and emotion regulation strategies

The results showed that attending a university course with integrated VR teaching learning labs did not significantly affect such subsets of attitudes towards digital media as perception of contextual demands or self-efficacy. At the same time there was a significant difference in motives for using digital media in general ($F(1, 15) = 7.675$, $p = .014$, *partial* $\eta^2 = .33$), and in class ($F(1, 15) = 5.184$, $p = .038$, *partial* $\eta^2 = .038$) between the measurement points. These subfacets of attitudes towards digital media decreased from T1 to T2. Furthermore, there were

no significant differences between pre- and post-measurements of emotion regulation strategies: Study participants reported no changes in either reappraisal or in suppression regulation strategies. In terms of self-reported classrrom management skills no significant differences were found between T1 and T2 as well.

5. Discussion and implications

The present study aimed to investigate the effects of completing tasks in VR teaching learning lab on student teachers' learning from affective, cognitive, and behavioral perspectives. CLASIVIR 1.0 was developed as challenging VR classroom simulation and implemented as two VR teaching learning labs at the beginning and at the end of a university course focused on improving teachers' professional competencies using VR. Summarising the results, the participants perceived the learning activities in the VR teaching learning labs as evoking positive emotions and reducing negative affect. As emotions experienced by learners during learning are considered to be crucial for study success (Camacho-Morles et al., 2021), this could be interpreted as a positive effect of VR teaching learning labs on affective aspects of student learning. In addition, the students' performance increased as a result of completing learning tasks in the VR teaching learning labs: In particular, participants with lower performance at the beginning of the course benefited more from the training effect of repeated visits of the VR teaching learning labs compared to the students whose performance was already high at the beginning of the course.

Contrary to our expectations, attitudes towards digital media and digital self-efficacy in general, and acceptance of using VR technologies on their own in particular, decreased towards the end of the course. This could be due to the lower number of participants who took part in the post-measurement, as participation was voluntary and therefore the number of students who completed the questionnaires varied between the different measurement points. Another reason, as stated by the participants in their reflections, is the better understanding of the challenges and obsticles of using VR applications in schools. It would be beneficial to further analyse the participants' perceptions and motivations for using VR educational technologies. We also found no significant differences in emotion regulation strategies and classroom management skills between two measurement points. One explanation for this finding could be related to the previous teaching experience of the students participating in the study. Thus, the student teachers in our study may have already developed strategies for emotion regulation and may perceive themselves as skilled in classroom management. On the other hand, even though the topics of the course were explicitly focused on the role of emotion regulation strategies and classroom management in teaching practice, the treatment of this content within the course was still from a more theoretical perspective. The duration of the two VR teaching learning labs was short and could not compensate for the theoretical part of this content. Therefore, these results

highlight the need to implement learning activities in teacher training programmes that include more balanced links between the theoretical knowledge gained and the practical skills acquired (Roth & Priemer, 2020). Finally, the costs (ca. 50.000 € for programming) involved in teaching and learning with VR applications (Radianti et al., 2020) should also be considered by stakeholders and educational policy makers. In summary, this study has demonstrated the potential of VR teaching learning labs to enhance the learning and professional skills of student teachers.

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Teacher Education Students' Visions Shaping Future Generations

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Abstract

Teacher education programs shape prospective teachers, and teachers (can) shape future generations. Teachers serve as multipliers for society; their beliefs and visions have a high influence on their teaching, independently from curriculum directives.

This paper describes a study in which we reconstructed teacher education students' (n = 113) visions of the future in general as well as their future visions on learning and teaching. Methodologically, we chose an open, explanatory free-writing approach (micro-articles) to provide room for emotional expression and creativity. The analysis shows a wide variety of themes, approaches, and dispositions. The results indicate that teacher education programs can build awareness on future visions of prospective teachers. Thus, it appears important to allow them room in their training to reflect and further develop their expectations and visions of the future, so they realize their responsibility towards the future in their role as teachers.

Keywords: *teacher education; future visions; higher education, society; future generations; responsibility.*

1. Introduction

The future lies with our young generations. Teachers (can) have an enormous impact on them (UNESCO, 2021) because what and how they teach influences and shapes students' knowledge and attitudes (Lee, 2019; Ross-Hill, 2009; Tang & Hu 2022; Hill, 1971). Thus, teachers serve as multipliers for society. Therefore, visions of teachers become important. They shape their professional believes (Lachner, Jarodzka, & Nückles, 2016) as well as behavior (Guerra & Nelson, 2009), and influence their performance (Muijs & Reynolds, 2015). In short: what teachers believe has a high influence on how and what exactly they teach, independently from curriculum directives (Bonner, Diehl & Trachtman, 2020).

With regard to the urging global societal and environmental challenges (Steger, 2020; Beck, 2000; De Haas et al., 2019; Barry, 2005; Rosa, 2015) but also ideas to tackle them (eg. SDGs,

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UN, 2015), the importance of *future visions of teachers* becomes apparent. (Positive) Future visions can create hope (Ginevra et al., 2017) and activate people to develop and implement solutions (Jørgensen & Grosu, 2007; Adam & Groves, 2007).

But teachers are not just born; they are shaped by higher education, specifically by teacher education (Darling-Hammond, 2016; Stolz, 2020). For all these reasons, we believe that teacher education should deal with and address prospective teachers' future visions (Sherin, Russ & Colestock, 2008; Sherin, 2014). A first step in this direction is to explore the field. Therefore, we conducted a study within a teacher education program with the aim to reconstruct teacher education students' (n = 113) future visions based on the research question, what teacher education students think of the world in 2040 in general and education (learning and teaching) specifically.

2. Theoretical Background

There is a long tradition in arguing the importance of teachers for society and its development. By teaching and educating, they ensure the dissemination of cultural heritage from one generation to the next. Formal education conveys and passes existing knowledge to the next generation, and, therefore, provides the basis of new knowledge, innovation, and change (Kraler, Bacher, & Schreiner, 2022). As important, teachers provide young generations with an objective, science-based picture of the world, to learn what humankind has gained as well as the challenges we face. Thus, optimally, data and facts are transformed to knowledge and competencies through learning. Both, together with creativity and visionary thinking build the fundament for innovations to master challenges and adapt successfully to an ever-changing world. Human beings and especially learners cannot be reduced only to their cognitive minds. Emotions play a crucial role in almost every learning process (Tyng et al., 2017). And together with knowledge and competencies, they are the catalyst for innovation (Mayer & Salovey, 1997).

A pivotal step leading to innovation is creating creative visions (Reid & Petocz, 2004). These visions also need to be emotionally loaded to be realized (Chiu & Kwan, 2010). Considering future visions in higher education in general and specifically of teacher education students – as argued above – we need to conceptualize visions and future thinking. Visions usually refer to an idea or mental image of something or an imagined mental image of something. Future thinking refers to the mental simulation of future events or circumstances specifically that one might be personally involved in (Atance & O'Neill, 2001). We can approach it in at least four different ways: biographically (e.g., life planning, cf. Brooks & Everett, 2008), with respect to different populations/groups (e.g., age, cf. Steinberg et al., 2009), topic oriented (e.g., climate change, cf. Norgaard, 2011) and especially timescale oriented (short- and long-term future, cf. Adam & Groves, 2007).

In the context of higher education – and here specifically in teacher education – we can especially refer to the rich corpus of teacher belief research that shapes their professional activities in everyday school life (Kagan, 1992; Zhihui, 1996; Guerra & Nelson, 2009). This theoretical approach offers a conceptual blueprint for studying future visions of teacher education students. Remarkably, we couldn't find any content specific references to future visions within teacher belief research. Therefore, we combined this approach with the concept by Ruth Levitas (2013), who understands utopia as a method rather than a goal. Hence, as a first step, we tried to reconstruct the topic empirically, to gain a better understanding and draw possible conclusions for teacher education programs. In this context, we also refer to Cook (2018), who did research on imagined futures of young adults in general.

3. Methodology

In the presented study, we chose an open, explanatory free-writing approach (Elbow, 1998) to provide room for emotional expression and creativity following the structure of micro-articles (Willke, 2004). In detail, teacher education students were asked to first write about their visions of the future in general (from a global, societal perspective) and, subsequently, about their future visions of school and their future role as teachers, both in about 15 to 20 years from now. We used a mid-term period to avoid slipping off into unrealistic scenarios based on science-fiction. Also, the concrete memories of the participants reach back to at least 15 years in the past.

The sample consists of 113 teacher education students (secondary schools). Approx. 20% were on the bachelor's and 80% on the master's level. Each student typically studies in order to teach two different school subjects, with 25 different school subjects being studied in the sample in total. Data collection took place between November 2022 and June 2023 during course.

The data was analysed computer-assisted with MAXQDA. A qualitative content analysis (Kuckartz & Rädiker, 2022) was conducted in form of triangulated coding with three coders. Main- and subcategories were derived inductively.

4. Results

Asked for an overall assessment of perspective on the future, 30% express an optimistic, approx. 20% a negative and about half of the students a neutral view.

The teacher education students' free-writing texts show a wide variety of themes, approaches, and dispositions in describing their visions of the world, schools, and themselves as teachers. Recurring themes are technology and digitalization, societal and economical changes, as well as sustainability and climate. Table 1 lists the main categories and their frequencies regarding to coded segments and the number of texts with such (a) coded segment(s).

Table 1. Future visions in general – main categories

MAIN CATEGORIES	per code	per text	% of all texts
Technologization and Digitalization	145	102	90%
Society	111	80	71%
Economy	80	59	52%
Sustainability and Climate	60	53	47%
Formal Education	43	32	28%
Conflicts, Crises, and Concerns	60	23	20%

The most frequent main category is *technologization and digitalization*, which occurred in 90% of the texts. A closer look reveals four major areas the students bring up: technology and the world of work (e.g., automatization and its effects on the labor market); technological advancement in general; technological advancements that lead to changes in everyday life (e.g., self-driving cars); technology and its impact on school and education.

The participants' visions of the future range from extremely negative to (deliberately) positive. How they expect technological progress to influence teaching and learning is one example for this diversity: On the one hand, they expect substantial change in school life and teachers' roles because of digitalization; on the other hand, some visions very much stress the stability of the school system using technology only as a tool in mostly unchanged settings. Some future visions are characterized by widely exploring opportunities of digitalization and technology; others very much ponder the effects of mobile devices and social media on students' wellbeing and social skills.

A high level of heterogeneity characterizes also other themes in the students' texts. Most pronounced differences in their visions for the year 2040 can be found regarding societal developments and climate-related issues. Approximately 30 segments coded in the main category *society* express a (very) pessimistic view, writing about (further) societal and/or socioeconomic division; in another 30 segments, students draft visions about an increase in tolerance and the appreciation of human rights. Half of the segments coded in the main category *sustainability and climate* talk about expectations of further advancement of climate change and its consequences on the earth, humans, and society; the other segments of this category concentrate on coping with climate challenges.

5. Conclusion and Outlook

The premise of this paper was that future visions held by teacher education students (can) have a significant influence on future generations. Their visions (can) shape the direction of their educational practices, and eventually, societal development.

The aim of the empirical study presented in this paper was to find out about future visions of teacher education students. We asked a sample of teacher education students (n = 113) to write about what they think of the world in 2040 in general as well as particularly regarding formal education and the teaching profession. The main findings show that the participants' basic tenor towards the future was mixed. About 30% of respondents express optimism, 20% negativity, and the remaining 50% a neutral stance towards the future. Thematically, we could identify specific categories that are relevant for most participants. The texts reveal diverse perspectives on technology, societal changes, and sustainability. Technology dominates the discussion, with both optimistic and pessimistic views about its impact on work, daily life, and education. Themes like societal development and climate change also elicit diverse viewpoints, with some emphasizing division and others promoting tolerance and sustainability. A closer look at these topics is essential because teacher education students' anticipations indicate a development trend with regard to future generations.

The method applied, the combination of micro-articles with freewriting, supports exploring students' mental landscapes (Tolman, 1932). In the context of the present study, micro-articles on what the world, schools and teaching will be like in 2040 were produced during a university course. The learners thereby got the opportunity to explore their own visions of the future, could explicitly span their personal semantic field on the subject and become aware of their state of knowledge and believes. This shows that teacher education programs have the potential to build awareness on future visions through reflection on the subject matter. Given the variety of future visions shaping teacher education students' expectations of school life in 15-20 years, it appears important to allow them room in their training to work and reflect on expectations and further develop future visions. By nurturing a reflective mindset among teacher education students, we believe that teacher education programs have the potential to empower prospective teachers to become catalysts for positive change, ensuring a brighter future for generations to come.

To gain a deeper understanding of the future visions of teacher education students, this study is currently undergoing an extension. The initial approach outlined in this paper was confined to a singular institution and a specific moment in time. By expanding the sample, we aim to transcend such limitations, encompassing both spatial and temporal dimensions: (1) With regard to space, we are currently extending the study to diverse geographical locations. Our next step is to include samples of students from at least one teacher education institution from each continent. This allows us to explore whether future visions among teacher education students remain consistent across different cultural contexts. However, factors such as cultural nuances,

educational systems, and societal norms may influence the transferability of our results. Thus, while seeking patterns and trends across diverse contexts, we must remain mindful of the limitations in generalizing our findings to a wider population. (2) With regard to time, we plan to conduct this study over successive years. Our goal is to examine not only whether but also how future visions of teacher education students evolve over time. We are particularly intrigued by how external circumstances, such as periods of stability versus times of crisis, impact the formation of their vision. Longitudinal analysis will allow us to track these changes and discern patterns in response to varying contexts.

As we delve deeper into understanding the evolution of future visions of teacher education students over time and across diverse contexts, on the long run, we aim to gain valuable insights into how to best prepare educators to meet the evolving needs of learners and societies. Ultimately, understanding the dynamic nature of future visions within the field of teacher education can provide valuable insights for curriculum development, policy-making, and fostering resilience within the teaching profession.

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Global Citizenship Education in Social Virtual Reality for Future English Teachers

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Abstract

This paper explores the potential of Social Virtual Reality (SVR) for Global Citizenship Education (GCE) as a transformative approach to English teacher training and EFL teaching. Given the increasing interconnected nature of our world, this paper investigates how SVR can enhance the development of global competences and cultural awareness in pre-service English teacher training. By immersing learners in cross-cultural experiences and collaborative learning environments, SVR offers a unique pedagogical opportunity to foster global citizenship competences such as openness and curiosity to participate in a global society. This contribution presents the results of the interdisciplinary research project "CoTeach – Connected Teacher Education," in which different disciplines, including foreign language teaching and human-computer-interaction research, collaborated to develop innovative teaching approaches for future teacher training.

Keywords: *global citizenship education; virtual reality; teacher training; foreign language teaching.*

1. Introduction

The project "CoTeach – Connected Teacher Education" is centered on the systematic and interdisciplinary collaboration among educational sciences, and different teaching methodologies, placing a specific emphasis on Human-Computer Interaction for the creation, design, and evaluation of innovative learning environments (cf. Wienrich et al., 2020). The specific focus of the presented research project within the scope of this contribution lies in the utilization of fully immersive learning environments for exchange and collaboration in the context of cross-cultural encounters in foreign language learning and teaching.

The societal evolution towards a cosmopolitan and open-minded community necessitates that students possess attitudes and competences enabling them actively participate in a global and diverse network. This encompasses knowledge about the diversity of community members, the

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cultivation of open and tolerant attitudes towards differences, and the ability to communicate and interact respectfully and constructively. As an integral part of modern English teaching, it is the responsibility of educators to impart this knowledge, skills, and attitudes to students.

Virtual reality now introduces an entirely new learning space in the English classroom. In a virtual environment, learners have the opportunity to assume roles and actively shape the learning content. Through social virtual reality, students engage in collaborative negotiations of meaning, interacting and communicating with each other in a protected learning space. This contribution illustrates the possibilities that social virtual reality can bring to the English classroom, fostering understanding and empathy while counteracting prejudice and exclusion as integral components of global citizenship education.

2. Global Citizenship Education in the EFL Classroom

Within the framework of the 17 Sustainable Development Goals, the United Nations (2016) advocate, as part of quality education, that all learners acquire knowledge and competences to actively shape a peaceful and diverse society. In this context, the appreciation of cultural diversity and one's own cultural identity also plays a crucial role:

> By 2030, ensure that all learners acquire the knowledge and skills needed to promote […] a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development (SDG 4.7, United Nations, 2016).

In the context of English language teaching in Germany, there are points of connection to the competence area of inter- and transcultural learning, a facet that has undergone further refinement in recent scholarly investigations to include the field of global citizenship education and a language pedagogy that is critical of racism (cf. Braselmann et al., 2021). Central to intercultural learning are three pillars: knowledge, skills, and attitudes. The focal point lies in learners acquiring cognitive, affective, and conative competences engaging with other cultures, coupled with their ability to reflect on these competences in relation to their own cultural identity (cf. Byram, 2021). In contrast, transcultural learning diverges from a more rigid binary framework, opting for a perspective that perceives culture as a dynamic and evolving construct (cf. Eisenmann, 2015).

The paradigm of global citizenship education introduces a fourth dimension to the areas of knowledge, skills, and attitudes. In this fourth dimension, learners are encouraged to use their acquired knowledge and competences to actively play a shaping role in their everyday environment inside and outside the classroom. This transforms learning into a sustainable experience, where learners grasp the relevance of the subject matter for their living environment.

UNESCO's (2015) model for global citizenship education delineates three distinct domains within this competency structure: cognitive, socio-emotional, and behavioral.

To make the learning experience tangible in real-world significance for the learners, exchange situations, where learners interact with other individuals, present themselves as suitable. Virtual reality opens up an additional learning space where learners, through embodied experiences, gain proximity to the subject matter and other learners.

3. The Potential of Social Virtual Reality for Foreing Language Teaching

The presented research project employs fully immersive technologies, specifically VR headsets with a 360° display and specialized gaming laptops. The chosen program is the social VR platform "ViLeArn" (Latoschik et al., 2019), developed at the University of Würzburg. This approach involves users interacting with one another in a virtual space, with tasks focusing on communication and collaboration.

The primary goal of the virtual reality teaching unit is to enable learners to apply their VR-based learning experiences to the real world. Only under this condition does learning in VR align with the sustainability concept. In the broader context of Virtual Reality, its potential is described as providing a "secure and regulated environment in which students can explore diverse perspectives and identities without the fear of adverse consequences" (Singha, 2023, p. 11).

In a social VR environment, learners operate as avatars alongside others, engaging in verbal communication, moving within the virtual space, demonstrating actions and interacting with objects. In the field of foreign language education, the potential of social virtual reality (VR) lies in its capacity to facilitate genuine and varied teaching and learning scenarios, granting students a considerable level of autonomy in their learning journey (cf. Steinbock et al., 2022). Moreover, social VR provides the opportunity for an immersive encounter with a situation, allowing learners to gain a firsthand perspective and actively participate in an experience that would otherwise be limited to observation from a third-person viewpoint.

Regarding global citizenship education in the foreign language classroom, students not only acquire knowledge from various perspectives but are also encouraged to cultivate empathy, embrace different viewpoints, and recognize similarities both at a societal and personal level. The subsequent model illustrates how the concept of global citizenship education and the potential of social virtual reality interplay in English language teaching.

4. Global Citizenship Education in Social Virtual Reality

To visualize the mutually beneficial relationship between global citizenship education and social virtual reality, we propose a model that seamlessly blends the UNESCO-proclaimed framework with the potentials of virtual reality tailored for the English language classroom (see Fig. 1).

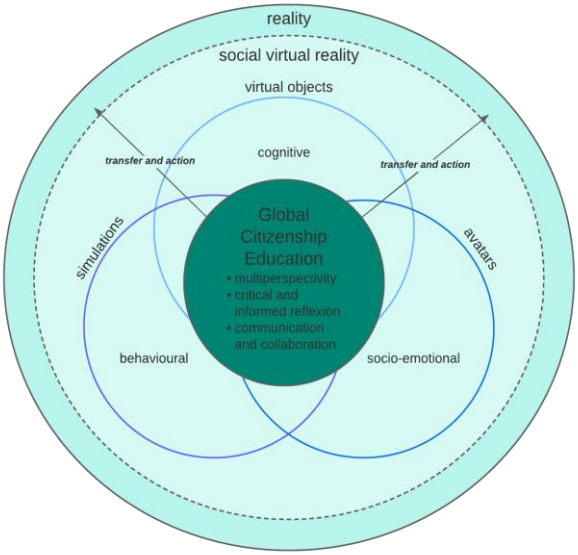


Figure 1. Model of Global Citizenship Education in Social Virtual Reality (GCE-SVR).

The model delineates its primary focus on advancing global citizenship competences in virtual reality, presenting it as a central objective. It describes this objective in terms of gaining multiperspectivity, engaging in critical and informed reflection, and cultivating skills related to communication and collaboration. These goals are substantively shaped by the three domains of global citizenship competence, and they are implemented through three tools in SVR: virtual objects, avatars, and simulations.

The model posits the permeability of boundaries in the context of social virtual reality, signifying an anticipation that learners will transfer the competences, attitudes, and acquired knowledge from VR to real-world situations and act according to these parameters. The subsequent elaborations provide a detailed insight into how the VR tools align with the learning objectives of global citizenship education.

4.1. Virtual Objects

The UNESCO (2015) characterizes learners under the cognitive domain of global citizenship education as "informed and critically literate" (ibid., p. 29). For instance, students may learn about the impact of climate change on both local ecosystems and the global environment. They might critically analyze the interconnectedness of economic systems at local, national, and international levels.

In the context of virtual reality, objects play a crucial role in facilitatating communication. Users can engage in discussions about local and global topics by manipulating virtual objects, they

can visualize personal connections and meanings. In a three-dimensional space, objects can become part of an exhibition on issues and collaborative approaches. The use of stereotypical objects can reveal biases and prompt critical reflection. The personal significance of various objects can foster multiperspectivity.

4.2. Avatars

Learners possessing global citizenship competences should be "socially connected and respectful of diversity" in the socio-emotional domain (ibid.). Not only can learners of diverse cultural identities meet in virtual reality embodying avatars, but also the assumption of roles with different cultural backgrounds is an intriguing aspect of learning sessions in VR. For instance, in an anti-racist context, learners may engage in virtual reality (VR) environments where they interact with avatars representing diverse cultural identities. In such settings, they can experience firsthand the richness of different perspectives and backgrounds. This immersive experience goes beyond theoretical understanding, allowing learners to witness and engage with cultural diversity in a meaningful way.

Moreover, the adoption of roles with various cultural backgrounds within VR learning sessions enhances the anti-racist dimension. For example, a learner might assume the role of a character from a historically marginalized community, providing them with a deeper understanding of the challenges and experiences faced by individuals from that background. This not only fosters empathy but also encourages learners to challenge stereotypes and biases, promoting a more inclusive and anti-racist mindset.

In this dynamic learning environment, learners not only gain a broader perspective but also develop attitudes through critical and informed reflection. They can actively analyze and question their own biases and preconceptions, leading to a more profound appreciation for diversity and a commitment to anti-racist values.

4.3. Simulations

In addition to cognitive and affective competences, conative competences play a crucial role in enabling learners to apply their acquired skills beyond the learning environment. This ensures that they become "ethically responsible and engaged" (ibid.). For instance, a student proficient in critical thinking and emotional intelligence (cognitive and affective competences) should also possess the conative competence to apply these skills in real-world situations, such as ethical decision-making in professional settings.

To effectively transfer skills obtained in virtual reality (VR) to the real world, it is essential to create virtual scenarios that closely mimic real-life situations. The more realistic the virtual environment, the more seamless the transition of skills to the real world. If the virtual environment closely aligns with real-world circumstances, users may struggle to distinguish

between the real and the virtual. This phenomenon is highlighted by Wiepke (2022, p. 43), who notes that the brain categorizes virtual stimuli as if they were real. Learning scenarios that mirror everyday life, especially those involving communication and interaction, contribute significantly to skill transfer. This is particularly beneficial in a virtual teamwork task where students with virtual avatars collaboratively solve a problem – the embodiment experience enhances their sense of presence and engagement, creating a more authentic learning environment.

5. Practical Implementation: Advanced Seminar for Future English Teachers

Within the context of the presented project, a framework was devised for the design and implementation of a university seminar focused on the pedagogy of foreign language instruction. This development occurred through a structured process encompassing three distinct cycles. The aim of the advanced seminar was to equip future English teachers with the requisite knowledge and skills to independently develop lesson plans aimed at building global citizenship competences with social VR.

The seminar sessions were structured to commence with a succinct thematic overview delivered by the lecturer, followed by the opportunity for students to autonomously select additional, in-depth learning units through learning modules provided on the university-wide platform. The individual learning modules included guiding questions to facilitate students' navigation through the provided materials. For instance, the learning module on "Inter- and Transcultural Learning and Global Citizenship" included thematic blocks such as "A Model for Intercultural Communicative Competence" (Byram, 2021), "Crossovers – Postcolonial Literature and Transcultural Learning" (Eisenmann, 2015), and "Ecology, Cultural Awareness, Anti-Racism and Critical Thinking: Integrating Multiple Perspectives in Foreign Language Teaching" (Braselmann et al. 2021). Following the exploration of these modules, students generated lesson ideas, which were subsequently organized and synthesized into a methodology map, which serves as a tool for the systematic description and categorization of various lesson plans (see Fig. 2).

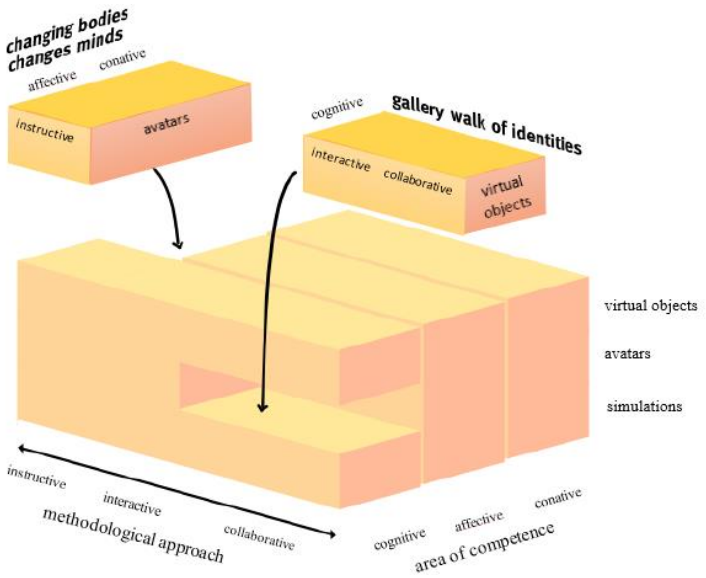


Figure 2. Methodology-Map of Foreign Language Teaching in Social VR (Steinbock et al., 2022).

Figure 2 exemplifies the categorization of two lesson ideas developed by students. The lesson unit titled "Changing Bodies Changes Minds," where users worked with different avatar appearances to reflext on stereotypes, adopted an instructive methodological approach with the aim of acquiring affective and conative competences. The second lesson idea titled "Gallery Walk of Identities" involved the use of virtual objects that users arranged into an exhibition about personality and culture. It was followed by an interactive and collaborative approach, targeting cognitive learning objectives.

6. Conclusion

For English teacher training, the integration of VR tools, such as avatars, virtual objects, and simulations, holds significant implications. By incorporating these technologies, English educators enhance the learning experience for their students. Virtual reality provides learners with unique opportunities to explore diverse perspectives, interact with others, and actively participate in cross-cultural scenarios. The emphasis on multiperspectivity, critical reflection, as well as communication and collaboration aligns with the goals of global citizenship education, encouraging learners to become informed, socially connected, and ethically responsible individuals. This innovative intersection of foreign language learning and virtual reality opens new avenues for preparing learners to navigate the complexities of a globalized society.

In light of these advancements, it becomes imperative for English teacher training programs to incorporate elements of virtual reality and global citizenship education. This not only ensures that educators stay abreast of the evolving landscape but also empowers them to prepare their students for a future where digital tools and global perspectives play a crucial role in language learning and beyond. Hence, ongoing attention and research in educational discourse should be directed towards the exploration and advancement of global citizenship education in the field of social virtual reality.

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Embedding Indigenous Perspectives: A Consideration of Place in Local and Transnational Education

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Abstract

This paper discusses a program of work undertaken by RMIT University, Australia, to embed Aboriginal and Torres Strait Islander perspectives in curriculum in both its Australian and off-shore campuses. It takes a first step in the consideration of the complexities that arise when First Peoples' knowledge systems and cultural practices are exported—and frequently collide—with the idea of the global. It does this through a consideration of 'place', place being so vital to Indigenous cultures. While the paper is case specific, its discussion of how to frame the significance of place in the context of higher education and understanding how this might translate globally has relevance for all education institutions wishing to create inclusive education environments.

Keywords: *Place; Indigenous perspectives; Transnational education; Inclusive education.*

1. Introduction

Commitment to the *United Nations Declaration on the Rights of Indigenous Peoples* (*UNDRIP)*, (2007) and more recent Australian national policies including the *Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS) Code of Ethics* (2020) and the Universities Australia (UA) *Indigenous Strategy 2017-2022* (2017) have led to a flurry of activity within higher education institutions as they attempt to redress their colonial past and develop research and learning and teaching environments that safeguard cultural heritage and foster Indigenous aspirations (*Royal Melbourne Institute of Technology Act* (*RMIT Act*), (2010). Much attention has been paid to the internationalisation of higher education (Denman, 2007; Kleibert et al., 2020); furthermore, the World Indigenous Network Higher Education Consortium (WINHEC) has posed a challenge to the barriers for First Peoples demanding inclusive education in western universities (Robertson et al., 2012). Discussion around the

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complexity of exporting Aboriginal and Torres Strait Islander culture via off-shore campuses, however, remains nascent.

This paper discusses a program of work undertaken by the Office of Indigenous Education, Research and Engagement at RMIT University, Australia, to embed Aboriginal and Torres Strait Islander perspectives in curriculum in both its Australian and off-shore campuses. It then offers a first step in the consideration of the complexities that arise when First Peoples knowledge systems and cultural practices are exported—and frequently collide—with the idea of the global. It does this through a consideration of 'place', place being so vital to Indigenous communities. While the paper is case specific, its consideration of how to frame the significance of place in the context of higher education, and how this may translate globally in the creation of inclusive environments in educational institutions.

2. Background and Context

RMIT University is a dual sector, global institution, and Australia's second largest university. It has over 90,000 students and more than 10,000 staff with campuses in Ho Chi Minh City, Hanoi, and Danang, Vietnam; it also offers programs through a range of Asian and European partners. The focus of this paper rests with RMIT's Melbourne campuses, which exist on Kulin Nation's Country, and offshore campuses in Vietnam, offshore being an independent form of transnational education whose colonial antecedence is shadowed in their 'full control' of curriculum, qualifications and campus development (Kleibert et al., 2020).

The university's governance of the Indigenous perspectives program of work was primarily driven by its commitment to *UNDRIP* (2007). Through its declaration, the United Nations recognises that Australia and its institutions have responsibilities to Aboriginal and Torres Strait Islander peoples, including the right to 'establish and control their education' without discrimination (Article 14, pp. 13-14), and the right to have Indigenous cultures and aspirations reflected in education (Article 15, p.14). At a national level, the UA *Indigenous Strategy 2017-2020* (2017) recommends that all students studying at Australian universities be given the opportunity to engage with Aboriginal and Torres Strait Islander content throughout their studies and develop cultural competency.

3. Embedding Indigenous Perspectives in Curriculum

The Indigenous perspectives program of work began in early 2019, initially with an environmental scan of Australian universities to gain insight into relevant strategies for curriculum development and learning and teaching models. A critical review was also undertaken of approaches for embedding Indigenous perspectives adapted in higher education institutions in Australia, as well as New Zealand and Canada. As the environmental scan and

critical review was being completed, a pilot study was established to set the foundations for the development of a framework of guiding principles for embedding Indigenous perspectives in curriculum. Discipline leads and program managers from RMIT University's three higher education colleges were invited to collaborate on this work. The participants included five staff from the College of Sciences, Engineering, Computing Technologies and Health and Medical Sciences, three staff from the College of Business and Law and six staff from the College of Design and Social Context. Participants initially completed a curriculum audit of all courses in one chosen program using guiding questions or prompts, which would later inform mapping activities. The next step involved collaborating with program managers and coordinators to create curriculum maps in the disciplines of Environmental Engineering, Surveying and Geospatial Science, Creative Writing, Early Childhood Education, Sustainability and Urban Planning and Human Resource Management programs (for further discussion see, Murray & Campton, 2023).

The purpose of mapping curriculum was to capture current initiatives and activities that involved Indigenous content and culturally safe behaviours occurring in disciplines, and to understand how best to develop the capability of educators to embed Indigenous perspectives in discipline knowledge, practices, protocols and skills (Uchiyama & Radin, 2009). Through curriculum mapping and collaboration a framework of Principles was developed, modelled on a helix with six domains of action: Belonging, Collaboration, Power dynamics, Relationality, Responding to context and Strength-based (see *Figure 1*).

The Indigenous perspectives program of work produced a framework of guiding principles to structure learning across disciplines and programs; and identified reflexivity, critical thinking, and relationality, detailed in *Figure 1*, as necessary capabilities for educators to accomplish this work (Bodkin-Andrews et al., 2018). Unsurprisingly, the implementation stage of the program of work was halted by the COVID-19 pandemic. In Melbourne, Australia, where RMIT University's main campus is located, the government's response to the pandemic was particularly severe for education institutions, with lockdowns, empty campuses, the departure of international student cohorts and ensuing staff losses. With a return to some kind of normality in 2023, a rethinking of the work and its initiatives was undertaken in response to new policies and changing learning environments. A review began in mid 2023 to assess whether the work was still relevant and fit for purpose in a rapidly, changing learning environment.

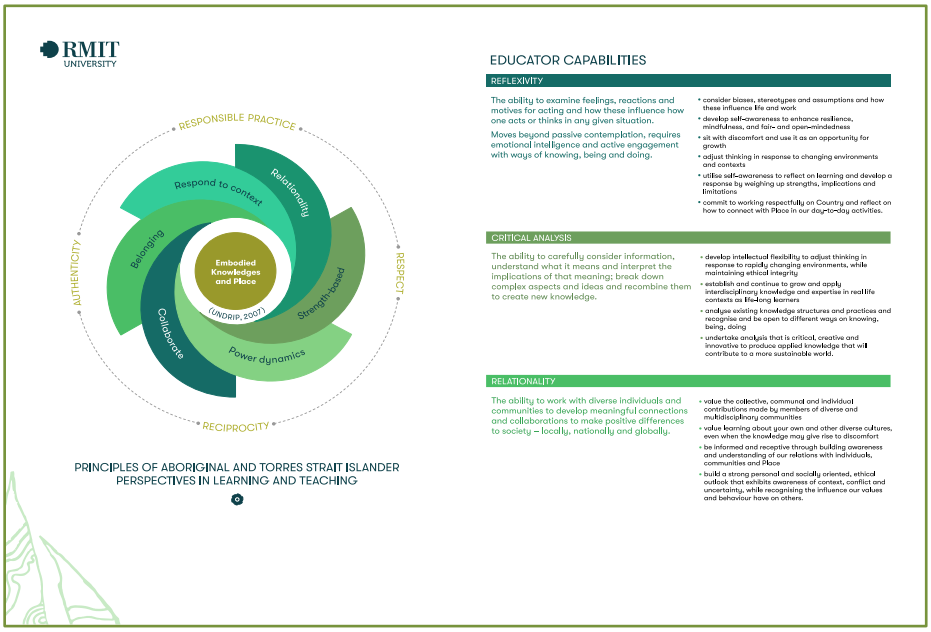


Figure I. Guiding Principles of Aboriginal and Torres Strait Islander Perspectives Framework.

4. A Rethinking of the work

The review surfaced two issues that required serious consideration; 1, had the exponential developments in artificial intelligence (AI) specially, for example, the Large Language Module, ChatGPT effected the behaviours and activities required by educators; 2, were the principles identified in the framework applicable in all RMIT's geographies, specifically the off-shore campuses in Ho Chi Minh City and Hanoi, Vietnam. To briefly attend to the first issue; including Indigenous perspectives in curriculum requires ethical integrity and a shared values proposition. At RMIT University, Aboriginal and Torres Strait Islander knowledge systems are understood as constructed by applying collective, community-based ways of knowing, being and doing to the production of knowledge (Moreton-Robinson, 2020; Watson, 2014). This knowledge, whether it be in the form of research or curriculum content, is owned by Aboriginal and Torres Strait Islander individuals and communities and protected from human and technological misuse by *Indigenous Cultural and Intellectual Property rights* (ICIP, Janke 2022) and *Indigenous Data Sovereignty* (AIATSIS, 2019).

Obviously, the ensuring of an ethical approach to Indigenous knowledge systems requires further discussion—perhaps the focus of another paper—however, in review, the framework of Principles fulfilled the requirement of guiding staff in ethical behaviour and developing their

critical and reflexive capabilities to engage with Indigenous knowledges with integrity. The discussion of RMIT's geographies and the relevance of place requires further attention.

5. Shifting Perceptions of Place

The initial focus of the Indigenous perspectives program of work was on curriculum development at RMIT University's Melbourne campuses. However, at off-shore campuses, students are taught the identical curriculum, often without consideration of the local learning environment. Students receive the same degrees which are recognised professionally within the home country's employment ecosystem (Kleibert et al., 2020). A workshop held in July 2023 with both RMIT Australian and Vietnamese based staff evidenced feedback from educators and students that there was a level of unease around the requirements to embed Indigenous perspectives in curriculum along with other cultural practices at the Vietnam campuses.

Connection to place is vital for Aboriginal and Torres Strait peoples' identities, but in many countries this relationship is less familiar. Vietnam is a multiethnic country that recognises 54 ethnic groups, 53 of which are ethnic minority groups—the 54th being Chinese. Although Vietnam voted in favour of *UNDRIP*, it does not recognise ethnic minorities to be First Peoples and nor has it ratified ILO Convention 169, the major binding international convention concerning First Peoples (International Work Group for Indigenous Affairs, (IWGIA, n.d.). Vietnam is a socialist republic with a one-party system led by the Communist Party—land rights do not exist in this ideological context. On the other hand, Australia, as a nation, has a bloody colonial history; one it is yet to fully deal with through truth telling and reconciliation (Birch, 2002; Reynolds, 2021). It also has an uncomfortable history in Vietnam through the actions and legacy of the Vietnam War (Young et. al., 2021). Beckwith (2022) notes that nationalism and the interconnectedness of global issues has 'intensified friction' for citizenship in the 'local and global spheres' (p. 87). She argues that further research into how the 'local is intertwined with global and how shared interests and issues can unite communities' elevates the idea of connectivity and helps develop ideas of global citizenship (p. 93).

The Principles are centered around the understanding that Indigenous peoples' knowledge systems are embodied. They are relational, interconnected, and embodied in and enacted through Country (Burgess et al., 2022; Harrison et al., 2016). For Aboriginal and Torres Strait Islander peoples, Country describes the lands, waterways and seas to which they are connected; being in relation with Country defines their sense of identity and belonging (AIATSIS, 2021). For Aboriginal and Torres Strait Islander peoples, Country is a deeply significant place. In this sense, place is a 'way of seeing, knowing, and understanding the world' (Cresswell, 2015. p. 18).

Place is 'a rich and complicated interplay of people and the environment' (Cresswell, 2015, p.18). However, as Lippard (1997) notes, it's 'common place in Western societies in the twenty-

first century to bemoan a loss of a sense of place as the forces of globalization have eroded local cultures and produced homogenized global spaces' (p.14). The focus on the capabilities of reflexivity and critical thinking enables the articulate of a shift in thinking from place as 'capital to be possessed', to place as a relational entity requiring considerations of reciprocity. This understanding requires us to respond to place in a way that shifts our perceptions beyond resource and utility to instead engage in a reciprocal manner with the singularity of each location as a relational entity. We see this relation being acted out as Escobar (2015) argues, in the desire for the 'reconstruction of communal spaces and for reconnecting with nature', actions that constitute the reactivation of relationality (p. 23).

6. Conclusion

As shown in *Figure 1*, by making embodied knowledges and place the central and core Principles for the framework, we celebrate the unique reciprocal networks of connection whereby Country embodies Aboriginal and Torres Strait Islander knowledges, and we make Aboriginal and Torres Strait Islander peoples' inclusion grounded and central. In RMIT's geographies, place offers learning opportunities open to all our disciplines through collective responsibilities and local communities, the physical environment, culture, history and sustainability. This acknowledgement demands a reconsideration of place, with which we are all entangled in mutual relations. So place becomes an opportunity for inclusivity that can potentially become common ground and establish future directions. Place as a meaningful location can bring us back to considerations of embodied, place and community-based ways of knowing, being and doing in the production of knowledge, no matter where education is being pursued.

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Bridging Continents: Exploring Cultural Dynamics in a COIL Experience

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Abstract

The purpose of this paper is to share the design, planning, and results of a COIL (Collaborative International Online Learning) experience that took place in the 2023-24 academic year, between two universities from different continents. This activity offered students the opportunity to work virtually to promote academic exchange, social growth, motivation and the development of competences necessary to face multicultural environments in their professional future. The methodology applied is qualitative in nature, as it describes the process of the COIL activity. In terms of results and implications, the activity highlighted the cultural differences between the participants and their capacity to manage and adapt, where 100% of the participants responded at the end of the activity that they had acquired communication skills, it has highlighted the cultural differences between the participants and their capacity to manage and adapt.

Keywords: *Intercultural competences; COIL; International experience.*

1. Introduction

In the changing landscape of global education, universities around the world have adopted internationalization and cultural exchange as key objectives given their importance of cultivating global skills and competences among their students (Gray et al., 2021). This transformation plays an important role for students to understand and appreciate diverse perspectives, enabling them to interact effectively across cultures and contribute to collective well-being (OECD, 2018).

Similarly, in the globalized business field, companies have also increased their interconnectedness. As businesses seek professionals with intercultural competences to face multicultural environments, they turn to universities not only for specific knowledge but also for enhancing skills beyond traditional hard skills. However, developing them within a lecture-

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centric environment poses challenges. To address this, universities are adapting their curricula by introducing student-centered innovations, classroom challenges, and hands-on experiences (Bozdağ, 2018).

The Collaborative Online International Learning (COIL) methodology, pioneered by the State University of New York's (SUNY) COIL Center, aims to fostering intercultural and international competences in higher education. This methodology offers various benefits, including the incorporation of new methodologies, technologies, and content into curricula, as well as the creation of academic and professional networks (Sercu, 2023). According to Knight (2017), COIL contributes to educational innovation by promoting the use of other languages, developing communication skills, facilitating collaborative and interdisciplinary work, and fostering the exchange of thoughts, knowledge, and cultures while respecting diversity. Thus, the COIL experience encompasses three core components: collaboration, internationalization, and online interaction. A typical COIL program spans four weeks to an entire semester, involving the formation of diverse teams comprising students from different institutions (Shoji and Okura, 2024).. These teams collaborate online, addressing group assignments while actively incorporating intercultural learning components. Educators must guide and foster intercultural collaboration along the activity (Hacket et al., 2023).

Considering this backdrop, this study presents the design, planning, and outcomes of a COIL activity implemented in a Spanish university (SP) within the subject of Project Management in the Master's Degree in Business Administration and Production Systems (MIMO) together with a South American (SA) university in the subject of Project Development and Control, part of the specialization in Project Planning, Development, and Management during the academic year 2023/24.

2. Materials and methods

2.1. Design

Due to the complexity given by intercultural competences, a mixed method approach was assessed to collect data (Deardorff, 2011). In addition, combining both quantitative and qualitative methods have been argued to be advantageous as they cancel out each other's weaknesses and result in superior research (Johnson & Onwuegbuzie, 2016). Thus, qualitative data was collected through focus group interviews and written student reflection reports; and quantitative data was collected through surveys answered by the participants before and after the course.

2.2. Participants

This study involved a sample of 52 undergraduate students, composed of 31 students from the Spanish university (SP) and 21 students from the South American university (SA). All students from the SP university were engineers, while of the 21 students at the university in SA, 19 were from different professions, and the rest, were also engineers, reflecting the interprofessional nature of the study (IPEC, 2023). This way of working allows each professional to contribute their specific knowledge and skills to achieve a common goal. The age distribution ranged from 21 to 54 years, with the majority falling between 21 and 29 years old. In terms of gender, there were 34 female and 18 male participants. Details on students and demographic data can be found in Table 1.

Table 1: Students and demographic data

Group	Variable	N (52)
Participant's occupation	Social Communication	5
	Administrator	3
	Engineer	33
	Bachelor of Education	2
	Architect	1
	Fiscal Sciences	2
	Accountant	1
	Economist	1
	International Studies	1
	Bachelor of Physiotherapy	1
	Bachelor of Nutrition and Dietetics	1
	Bachelor of Social Work	1
Age range	Between 21 and 29	43
	Between 30 and 39	4
	Between 40 and 54	5
Gender	Female	34
	Male	18
University of study	UIC	31
	UMA	21

2.3. Collaborative Learning Assignment and COIL Intervention

This project aimed to ensure the success of a project by considering various environmental variables, with a focus on competitors, stakeholders, and government regulations. The learning objectives included assessing the impact of the situational environment on the business model, analyzing different areas of the project, and understanding how these factors affect the estimated cost structure. Additionally, recommendations were made to maintain and enhance investor interest.

The methodology consisted of diagnosing intercultural competencies, presenting and socializing students, developing learning objectives and deliverables based on project-based learning, evaluating learning activities, and assessing intercultural competences. The professors at both universities held preliminary meetings for six months starting in May 2023 to establish essential requirements and activities.

The COIL Unit was designed based on Gibbons and Laspra's suggestions, incorporated into the subjects of each university for the academic period 2023-2024, and taught over six weeks from November to December 2023. The professors designed a case study related to the goals of the 2030 Agenda, which was solved by six mixed groups of students from both universities.

The professors jointly prepared the assessment plan, and the final grade assigned was the same for all. However, the value in the assessment plan of the subject in the SP and the SU was 20% and 15%, respectively. The technological tools used for communication were Google Meet, email, WhatsApp, and Classroom. The Unit COIL unfolded across three phases: Pre-COIL, COIL, and Post-COIL.

Pre-COIL (W1): Students completed an anonymous survey assessing prior COIL knowledge, intercultural competences, and expectations. Additionally, they created a short video introducing themselves, defining COIL classrooms, stating expectations, and detailing planned contributions. Teams were formed with a focus on multidisciplinary composition, gender equity, and representation from both countries. Professors presented the COIL activity's objectives, followed by a masterclass and group activities.

COIL:

- Work in progress Week (W2): Students and groups assumed responsibility for working on the case. Constant contact via instant messaging and online meetings was recommended for doubt resolution and case development.
- Checkpoint Week (W3): A synchronous joint session saw students presenting project progress. Groups then worked in secondary classrooms with professor support for more focused efforts.
- Submission Week (W4): The final phase involved students preparing a document, presentation, and video with proposed solutions asynchronously. Timely document delivery was emphasized.

Post-COIL: Feedback, reflection, and dissemination week (W5): the professors evaluate the delivered material and provide comments to each group of students during the feedback session. Besides, students also provide feedback and reflections about the activities. The activity concluded with students participating in a final anonymous survey to gauge satisfaction and record their reflection on their intercultural experiences, also sharing their experiences through social media posts.

3. Results

3.1. Quantitative data

We statistically compared the survey results. 52 (100%) students filled in the pre-survey, and 40 (75.5%) students filled in the post-survey; 12 students who did not complete the survey due to personal circumstances.

3.1.1. Development of cultural competence

Intercultural competence is defined as the ability to interact effectively with people from different cultures, and to understand and appreciate their perspectives, values and behaviours (Deardorff, 2006), and encompasses skills such as effective communication in intercultural contexts, cultural sensitivity, flexibility and adaptability to work in diverse environments, and critical awareness of one's own cultural attitudes and biases.

In terms of intercultural competence, the development of greater intercultural sensitivity is emphasised, highlighting awareness of and adaptation to cultural differences in interactions. Although participants were already aware, the activity reinforced the idea that, despite differences, it is possible to work together and adapt to new situations or working methods.

In the sphere of cultural awareness, there is less needed to wait before forming an impression of culturally different people. The activity has emphasized the importance of listening and understanding before judging, promoting greater tolerance, and understanding.

In relation to situations involving culturally different people, the activity has generated a significant change and confidence in the ability to socialize with natives of other cultures has remained, but there is now recognition of the complexity that can arise in work contexts.

Regarding the adaptability of verbal and non-verbal behavior, the ability to change according to the needs of the situation has been demonstrated. Experience has shown that, despite difficulties, participants can adapt their behavior, all of the above shows the development of cultural competence in the participants.

3.1.2. Developing and strengthening soft skills

Collaborative and teamwork has contributed positively to the development and strengthening of soft skills; specifically in communication skills, there is a decrease in the need to constantly search for what to say when interacting with people from other cultures. Furthermore, the activity has allowed greater fluidity in communication, with the use of fewer pauses, indicating greater rapport and joint work.

Open-mindedness toward people from other cultures has been tempered by the realization that working with them can present challenges, especially in evaluative and pressured environments.

This recognition has led to the development of skills such as negotiation, mutual respect and listening skills, essential for effective collaborative work.

In this way, the activity has contributed to the development of negotiation skills, respect for others and listening skills, especially in contexts where results are expected to be obtained under pressure.

3.2. Qualitative data

The insights gathered from the final reflections provide valuable perspectives on the learning outcomes of the COIL activity, particularly in the realm of communication styles across diverse cultures. Participants recognized the challenge posed by understanding and adapting to different communication styles, emphasizing the need for additional time to synchronize with the pace of work. This consensus among participants led to significant learning experiences and contributing to the improvement of their communication skills (Participants: 7, 13, 23, 34).

The activity described as enjoyable and as a distinctive experience that exposed participants to different perspectives, not only in terms of work methods but also in the project's overall approach. The engagement proved to be an enrichment of knowledge, introducing novel viewpoints to the project that had not been previously considered. Participants acknowledged the opportunity to explore alternative ways of working, and identify potential enhancements, fostering continuous development of the project idea (Participants: 17, 19, 22, 40).

Creativity and innovation with regard to the development of the tasks in collaborative groups was accompanied by: enjoying meeting people and briefly collaborating with students outside the usual classroom environment. I strongly believe that interaction with different perspectives is always enriching and interesting. It was a fun and different experience as it allowed me to have contact with different visions than I am used to, not only because of the way of working, but also because of the style of the project that was worked on. (Participants 17; 37)

Furthermore, the COIL activity served as a spotlight, highlighting cultural differences among participants and their adeptness in managing and adapting to both verbal and non-verbal communication nuances. The experience elevated the level of respect for other cultures and their values, showcasing the participants' heightened awareness and appreciation for the diversity encountered during the collaborative endeavor.

3.3. Student satisfaction with the activity

The assessment of the COIL activity yields valuable insights into the participants' international collaborative experience (see Table 2). With an overall satisfaction rating of 4.05 out of 5, the distinctive qualities of the COIL classroom are positively acknowledged. However, challenges arise in the interaction with students from the other university, scoring an average of 3.28. Language barriers, cultural differences, and technological challenges likely influenced this

perception, exacerbated by the time difference between the universities, emphasizing the need for improved coordination in future collaborations.

On a positive note, the overall usefulness of collaborative work, marked as 4.13, highlights its positive impact on the students' educational experience. This suggests that the COIL approach not only fosters communication skills but also facilitates the practical application of knowledge in real-world scenarios.

A noteworthy aspect is knowledge sharing, scoring an average of 4.25, indicating participants' recognition of the COIL activity's significant contribution to skill and competence development. This underscores the positive impact of international collaboration on academic enrichment, demonstrating the COIL methodology's relevance and effectiveness in providing a holistic and meaningful learning experience that extends beyond theory.

Table 2: Students satisfaction results

Item	Average	SD
Overall satisfaction	4,05	0,59
Interacting with students from another university is easy	3,28	0,87
Collaborative work allowed to develop communication skills	4,00	0,74
Collaborative work has been useful	4,13	0,71
The exchange of knowledge allowed to develop skills and competences	4,25	0,73

4. Conclusions

The purpose of this paper is to share the design, planning, and results of a Collaborative Online International Learning (COIL) experience. This approach provides a practical way of preparing students for the multicultural environments they may encounter in their future careers. Simultaneously, it contributes to fulfilling the learning objectives of the subjects in which it is used.

The results obtained show that implementing this type of activity not only improves the internationalization and globalization of the university but also helps to develop students' cultural and communication skills. Additionally, it enhances transversal skills such as problem-solving and teamwork, which are increasingly important in an increasingly complex and competitive world. By enhancing these skills, students can better prepare for international collaborations, ensuring effective communication and enriching cultural exchanges. Moreover, it can offer students real-time, actionable insights, enabling them to adapt dynamically within the collaborative environment.

Continuous research into COIL's long-term impacts on participants’ careers and competencies will further refine these educational strategies. This alignment will closely align them with

global educational policies and ensure that institutions are preparing a workforce adept at navigating a complex, interconnected world.

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"I should" vs. "I would" in International Graduate Students' Positioning as Global Talents

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Abstract

This mixed-methods study explores the transformative journey of international graduate students as educated newcomers, inspiring them to establish their presence in a new professional market. Focused on the personal, social, professional, and emotional dimensions of the BE-EDGE Model for students' investment in their boutique employability, the research unveils the nuanced needs of international students through surveys and focus groups. Findings reveal the dichotomy between aspirational "I should" and preferential "I would rather" mindsets. The study arrives at the design for a Center for Global Talents that can provide international students with a holistic platform and ecosystem for empowering individuals to shift from introspection and reluctance to integration and proactive engagement and establish their position as powerful contributors of diversity, customization, belonging, and meaning required for a future of work.

Keywords: *International Students; Career Ecosystem for Employability; Community of Newcomers; BE-EDGE Method; The Future of Work.*

1. Introduction

In the contemporary workforce landscape, career shifts and global mobility have become pervasive phenomena (Baruch et al., 2015). Research suggests a shift towards a more protean and boundaryless orientation among today's talent, driven by a pursuit of meaningful work and new challenges (Briscoe et al., 2006). Such organizations frame the future of work (McKinsey, 2023) as their new reality, which requires a new type of talent – the talents that possess boutique employability, coined by Ivy (2019) as individuals' ability to contribute their multidimensional backgrounds to the diversity and competitiveness of the modern workplace. Skilled immigrants, including international graduate students, become the best fit for the new reality and the future of work. High-skilled immigrants bring human capital, contribute to tax revenues, and are perceived as hard-working contributors to society (Helbling & Kriesi, 2014). However,

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immigrants face subpar outcomes in the labor market (Hakak & Al Ariss, 2013) due to systematic skill devaluation.

Our study posits that international graduate students and skilled immigrants require a platform to strategically leverage their employability and diverse backgrounds, catering to the demands of the *future workplace* (McKinsey, 2023). We propose the Center for Global Talents (CGT) as an ecosystem to foster newcomers' personal, social, and professional growth. CGT aims to offer a supportive community where individuals can discover strengths, build relationships, showcase value, and integrate into new markets. The objective of this study is to unveil the dimensions of such a system. By understanding international graduate students' needs and expectations, we aim to design and test a comprehensive career ecosystem tailored to our audience.

Our goal is to create a replicable empowerment model with global impact, emphasizing innovation and collaboration. As we address the multifaceted challenges faced by our target groups, key questions emerge: What additional support do international graduate students require beyond existing career services? Why do they need it? How can these needs be met within one platform, and how can this ecosystem become self-sustaining?

2. Literature Review

Employability is defined as "an individual's chance of a job on the internal and/or external labor market" (Forrier & Sels, 2003, p.106) and is proposed as a solution to job insecurity (Wittekind et al., 2010). Yorke (2004, p.8) defines employability as "a set of achievements—skills, understandings, and personal attributes—that make graduates more likely to gain employment and be successful in their chosen occupations, which benefits themselves, the workforce, the community, and the economy." In the gig economy and future of work, employability demands diversity and synchronization with employers' challenges (Ivy, 2019), termed boutique employability, where candidates synchronize with employers at personal, social, professional, and emotional levels.

In the effort to find dimensions of the platform that provide international students and other skilled immigrants with an opportunity to invest in their *boutique employability*, we zoom in on the literature on how communities impact us socially, professionally, emotionally, and personally. Before we dive into our detailed plan, we carefully examine what our audience truly needs. This section uncovers the essential reasons why building communities is vital, drawing valuable insights from various studies.

Research shows joining communities fulfills belongingness and identity needs, offering support in unfamiliar environments (Baumeister & Leary, 1995). For newcomers, acquiring local knowledge and connections is vital for integration and accessing opportunities (Magro, 2012). Mentorship accelerates professional growth, with career mentoring providing guidance and

psychosocial mentoring aiding socio-emotional adjustment (Deng et al., 2022). Professional associations are vital platforms for professionals, offering networking opportunities, skill development, and a sense of belonging (Lotkowski et al., 2004; Taylor, 2005). Access to resources such as conferences and publications facilitates ongoing learning and skill improvement (Lotkowski et al., 2004), while membership validates professional identity and cultivates connections rooted in shared experiences and values (Taylor, 2005). For emotional and personal connections, brand communities build loyalty by enabling belongingness and collective esteem (McAlexander et al., 2002). Participation incentives like learning and early access foster durable engagement and advocacy (Schau et al., 2009). A community-centered strategy boosts customer retention and referrals (Muniz & O'Guinn, 2001).

3. Methodology

This study utilizes a mixed methods approach combining surveys, in-depth interviews, and focus groups. To structure the survey questions, we apply Ivy's BE-EDGE Method (Ivy, 2019) as a framework for investments into individuals' *boutique" employability*. BE-EDGE refers to four dimensions of employability investment: "E" - elucidating one's professional core as an investment in individuals' personal capital, "D" - developing trust as an investment in individuals' social capital, "G - generating value as an investment in one's professional capital, and "E" - exciting the market and industry insiders as an investment in impression capital and ability for market signaling (Spence, 1973). We applied findings from the literature review on personal, social, professional, and emotional aspects of community building to frame the survey questions.

3.1. Instruments for Data Collection

Quantitative survey data provides initial breadth on key factors to understand the motivations of educated individuals joining a career development community. The voluntary, anonymous survey included multiple choice and open-ended questions across four sections exploring 1) social integration needs, 2) professional skill needs, 3) personal and emotional engagement motivations, and 4) interest in joining the CGT ecosystem. Descriptive statistical analysis identified preliminary patterns in skills, resources, and activities valued by this population with thematic analysis of decoded open-ended responses.

Qualitative focus groups and in-depth interviews enable us to probe emerging themes further and gain comprehensive insights into the cognition behind the needs of international graduate students entering new professional contexts.

3.2. Figures and Tables

An online survey was conducted with 43 international students representing diverse backgrounds, utilizing convenience sampling. Predominantly, participants were aged between 25-34 years, comprising both females and males. The majority hailed from India, China, and South Korea. These students are primarily pursuing careers in business, information technology, marketing and advertising, and healthcare, reflecting prevalent areas of study and professional aspirations within our community. Education levels range from bachelor's to doctoral degrees, with 9.3% holding doctoral degrees, 74.4% with master's degrees, and 16.3% completing bachelor's degrees. These demographic insights offer focused understanding, guiding our exploration of their distinct needs and aspirations.

4. Findings

4.1. Survey Findings: Interactions that Matter

The survey results provide insights that connect to key points from the literature review on building impactful communities across social, professional, and emotional dimensions. In the social realm, respondents valued relationship-building skills, mentorship, and small groups for newcomer integration and access. For professional needs, networks, skill-building, and community drove motivations mirroring associations' role in connections, learning, and belonging. Regarding emotional factors, brand reputation and shared values provided engagement and loyalty, while involvement and collective impact opportunities strengthened participation, empowering members. Overall, the findings demonstrated the multidimensional nature of impactful communities and the importance of customized, interactive elements for newcomers.

4.2. Interview Findings: "I Should" vs. "I Would" In Employability Investments

To delve deeper into the insights gained from our initial survey, we conducted qualitative focus group interviews with 12 diverse groups (n=51). Across both social and personal dimensions, key themes emerged, including challenges with cross-cultural social skills development, the desire for personalized job placement, the importance of employability-focused course offerings, appreciation for personalization in relationships with members of ecosystems, the value of diverse activities, and the significance of interactive community engagement.

We revealed the dual struggle between ideals and reality faced by international students, which can be succinctly summarized as the dichotomy between *I should* and *I would rather*. This duality reflects their inner conflicts between a rational, *I should*, realizing the importance of fast integration into a new professional reality, and the inner, *I would*, need to slow down the process and integrate through trust-based settings.

At the Personal level, participants exhibited a strong inclination towards self-development and accomplishment, epitomizing their *I should* aspect. This reflects a recognition of the necessity to proactively cultivate personal skills, encompassing self-management, and advancement, to succeed in a new setting. Conversely, in their *I would* mindset, a significant number prefer seeking comfort and stability, gravitating towards established habits and lifestyles. especially when faced with the challenges posed by new languages and cultures, which can impede taking bold initiatives on their path to personal growth.

The findings on the Social level reveal a similar duality. Respondents understand the importance of establishing new social networks and integrating into local communities on the *I should* level, recognizing that expanding their social circle and understanding new cultures is crucial for comprehensive adaptation and success. However, on the *I would* level, they prefer to interact with people from the same cultural background, avoiding cultural conflicts and communication barriers.

Reflections at the Professional level mirror this duality. Participants acknowledge the importance of continuous learning and career development on the *I should* dimension, understanding that sustaining competitiveness in a globalized work environment requires constant skill enhancement and network expansion. Nevertheless, many exhibit the *I would* disposition when faced with the uncertainties and pressures of new work environments, preferring to stick to their acquired skills and familiar work patterns rather than venture into exploring new fields or accepting challenges.

In the Emotional domain, respondents emphasized the importance of emotional support and mental health, which is their *I should* aspect – they realize that maintaining mental health and emotional stability is vital for overall well-being in a foreign land. On the *I would* spectrum, despite this awareness, many still tend to be introverted and self-contained when facing stress and loneliness, avoiding seeking help or participating in activities and communities that might offer emotional support.

These findings reveal the inner conflicts and challenges international students face in adapting to new environments, especially the struggle between the *I should* and *I would* aspects. While they recognize the importance of positive adaptation and development, the fear within and dependence on comfort zones often hinder their growth in these areas.

5. Conclusion and Implications

Throughout this paper, we have investigated how the Center for Global Talents can become a comprehensive career ecosystem, empowering newcomers through tailored support across personal, social, professional, and emotional dimensions. Our research, employing a sequential mixed-methods approach, underscores the essential elements of community building—

diversification, customization, and belonging. We discovered that international graduate students seek empowerment through diverse, tailored experiences. These aspects resonate with the motion of the future of work (McKinsey, 2023). The BE-EDGE method (Ivy, 2019) resonates with these needs, offering a step-by-step developmental framework. This approach encompasses personal goal elucidation, social and professional trust-building, and emotional readiness for the job market (Table 1). The study's critical revelation lies in the *'I should*' versus '*I would*' dichotomy, as students navigate their transitions to global talent. Table 1 illustrates how students' *I do* experiential learning activities of direct investments in employability must be framed with the expected *I should* workshops and seminars and inner *I would rather* T-groups, small circles, and peer support.

Table 1. Center of Global Talents Activity Map. Source: By Authors (2024).

	"E": Personal (Step 1: 1-2 months)	**"D": Social (Step 2: 3-4 months)**	**"G": Professional (Step 3: 3-4 months)**	**"E": Emotional (Step 4: 1 month)**
I Should	- Career goals. Job market trends & expectations - Leadership skills - Personal branding - Course selection	- Social competencies - Social opportunities - Culture Agility sessions - Networking events	- Skill-building workshops, Case Interviews, problem-solving, design thinking - Network with industry experts, and entrepreneurs	- Community Engagement - Desire for Personalization
I Do "BE"	- Personal Positional Strategy - Assessment Market entry strategic plan	- BCC: Becoming Case Consultant - learning about local contexts	- MYCC: Making My "Diversity" Consulting Case - working with a client	- BE-EDGE "Impact" Consult-a-thon - Pitch to the employers
I Would Rather	- Be true to myself - Avoid external push and humiliation - Sarong my frustration and fear with those in a similar situation	- Relationship with alike people - Small group interactions - Comfort zone (online or same culture)	- I just want to focus on job hunting, instead of socializing - I wish capitalizing on my own skill set	- I want to make an impact with people and feel empowered - I want to be proud of the brand of this center

The proposed Center for Global Talents framework has theoretical and practical implications and needs further testing. To test the framework's conceptual validity, we plan to conduct further research through case studies and surveys of the Center's participants and their choices.

To test the framework's practical implications, we plan to launch a pilot at Northeastern University in Boston, USA. The pilot will allow us to refine our methodologies and curriculum designs within a supportive educational environment, laying the groundwork for further program expansion. Initial funding for the CGT will be sourced from university and city resources, grants focused on educational innovation and workforce development, and partnerships with industry stakeholders committed to developing a diverse and skilled workforce. We will set effectiveness measures and collect data to evaluate the validity of the methodology and proposed activities. This will provide data for the project's scalability across universities and cities and establish dimensions for the project's contextualization to adapt to evolving educational and market demands, ensuring it remains effective in developing global talent.

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What's in it for us? Boosting social inclusion through international students' mobilities into higher institutions in the GCC

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Abstract

This study investigates social inclusion as the catalyst in promoting international student mobilities across diverse countries who opt to study in the Gulf Cooperation Council (GCC). Against this backdrop, the study highlights the importance of social inclusion as a language-learning mechanism relevant for Arabic and non-Arabic speakers within formal educational contexts. This study seeks to highlight in themes: (1) the influx of international students as the GCC positions itself as a hub for diversity and opportunities and (2) the salient factors that influence the preferences of international university students to study in the GCC. The study relies on different Higher Education Councils' (HECs) open data to decipher the inclusiveness of international students as a win-win mechanism for social inclusion, language exchange, and possible career opportunities. The findings seem to shed light on the importance of building cooperative interculturality, inclusivity, and opportunities among diverse GCC HEIs stakeholders.

Keywords: *Social inclusion, international students' mobilities, Higher Education Institutions (HEIs), GCC region, University students.*

1. Introduction

Global Higher Education Institutions (HEIs) acknowledge the influx of international students into developed and Western countries as a hub for more opportunities and quality education (Akanwa, 2015; Tight, 2022). Moreover, other countries are opening up and welcoming other international students who may not have the privilege of securing admissions or getting international opportunities. Within this context, this study investigates social inclusion as the catalyst in promoting international students' mobilities across diverse countries who opt to study in the Gulf Cooperation Council (GCC) countries (Umar, & Rahman, 2023). It was established on May 25, 1981, in Abu Dhabi, United Arab Emirates, and comprises member

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countries from Bahrain, Oman, Saudi, Kuwait, Qatar, and the UAE (Arab News, 2020; Mosly, 2022). Figure 1 represents the demographic population profile of the GCC countries.

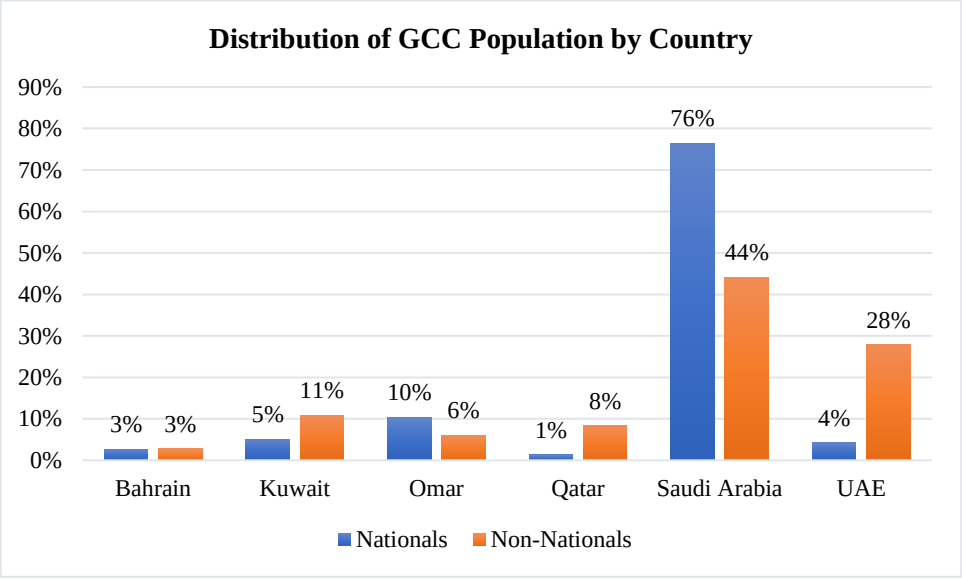


Figure 1: 1The population by Country in the GCC

The GCC region over the years has positioned itself as a potential hub for higher education for students from within the member states, Arab countries, and other non-Arab countries due to their geographical location, political stability, friendly culture, peace co-existence, and hospitality (Bahgat, 1999; Fida, et.al. 2017). As Dubai (UAE) positions itself as the economic hub of the region (Gulf Today, 2023), it has expanded the number of foreign universities or campuses that have moved from Western countries to the country. It is worth noting that other GCC countries have their share of the robust wave of foreigners or expatriates coming into their countries not just for work or investment, but for education for studying abroad or exchange programmes (Alhalwaki & Hamdan, 2019; Nekhili et al, 2019). Hence, the study dives into higher education within the GCC, tracing the statistical number of international students. Also, noting the prospects for international students who choose to study in the region and the impact of their presence on the institutions they represent in terms of the cultural, social, and language inclusion that occur within this context. The study highlights the importance of social inclusion as a language-learning mechanism relevant for Arabic and non-Arabic speakers within formal educational contexts.

[1] The data presents the most recent available data from the different GCC countries.

1.1 Higher Education Councils in the GCC

The joint educational process which later became HEC was established in 1975 through the Arab Bureau of Education for the Gulf States (GCC Archives). It began before the establishment of the GCC which was still under the supervision of the Ministers of Education from the six representative countries. The joint educational action held in March 1985, made resolutions with a specific focus that is relevant to this research, "Equal treatment to the GCC students at the general education stages same as the students of the State where schooling is provided" (GCC Archives). This implies that there should be equality among all GCC nationals and other host students in terms of admission and conduct. This factor is relevant to understanding students' mobility as it provides the enabling platform for social inclusion within the higher education context not just primarily for GCC students but for other non-GCC students. In other words, the equal treatment of students within the GCC indicates the acceptance of other GCC students without preference or bias but on an even level playing ground. Over the years, the HEC according to the Cooperation Council for The Arab States of the Gulf, has introduced new resolutions to cater to student social activities such as organizing camps, theatre festivals, competitions for vocational skills, sporting events, and most significantly, external visits to France in 2014 (GCC Archives).

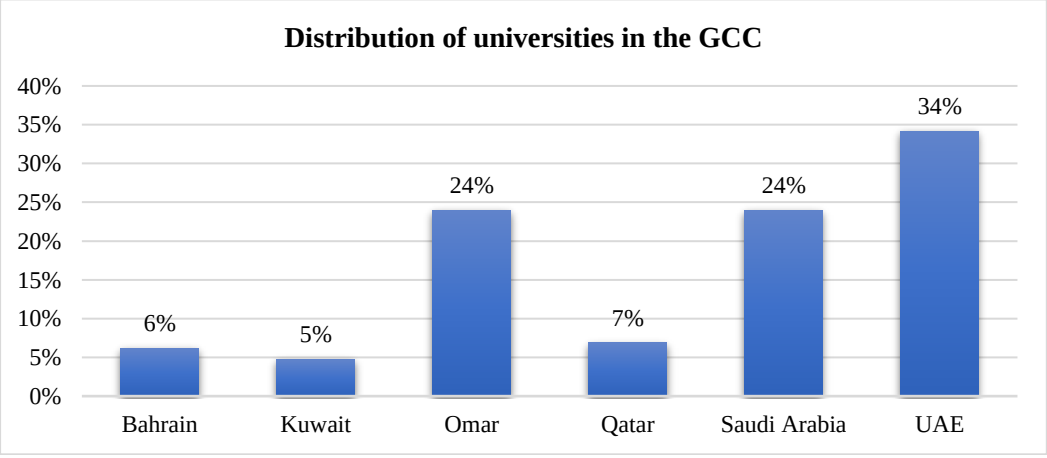


Figure 2: Distribution of HEIs in the GCC. GCC Secretariat General Information Center-Statistical Department, Education in GCC Countries, (2020): https://dp.marsa.gccstat.org/statistical-domain/education

2. Literature: Social Inclusion

Social Inclusion (SI) according to O'Donnell et al. (2019, 3) has gained global recognition across many spheres as noted by international organisations such as World Bank reports which assert that "confronting the need for social inclusion will prove vital if we are to meet our goal of building shared prosperity for all people." In other words, social inclusion relates to

accepting people irrespective of where they come from, how they speak, or their accents within a particular workplace environment. According to Piller & Takahashi (2011, 372), SI represents a feeling of belonging, community involvement, and empowerment. Additionally, Yates (2011) confirms that SI reflects a sense of affiliation, acceptance, and the right to be recognized and respected. It goes beyond the set of rules of regulations governing the institution, but the general acceptance of people irrespective of their backgrounds, social status, educational attainment, culture, religion, or other societal stereotypes. Thus, this study seeks to highlight conspicuous policies wherein the different HECs in the GCC Member States promote SI among international students whether as GCC nationals or non-GCC nationals, who choose to travel to study in a particular Member State. In addition, social is reflected in language exchange as the joint educational work held in March 1986 states that "Arabization of higher education and enhancing the GCC trends towards integration and the joint students activities and meetings" (GCC Archives). In other words, since the common and official language is Arabic, there should be a common acceptance of Arabic in communication spaces where students are more comfortable using a language other than English. Howbeit, over the years, most private universities in the GCC have incorporated the use of English as the English as Medium of Education (EME) rather than English as a Medium of Instruction (EMI). This direction has also increased the choice of study designations of non-Arabic students as they consider language inclusion a paramount factor when considering their preferred GCC country.

3. Methods

The study quantitatively relies on the statistics from open data access on the various GCC HEC websites as reference points and was textually analysed. Also, the study noted instances wherein certain periods were not published, clearly stating the data's unavailability in the public domain. This poses one of the study's limitations due to inaccessible data from the concerned government's portal.

4. Findings and Discussions: Social Inclusion in the GCC

It is worth noting that as Mosly, (2022, 6) affirms that "all six GCC states provide excellent opportunities for further development in education...growth drivers are the GCC states' funding and financial commitments to improving their education sectors." Similarly, Nekhili et al. (2019, 116) assert that member states of the GCC share a regional vision to make the Arab Gulf a hub for a world-class education." The section provides data on the educational system for local and international students across the GCC in various HEIs over the years and future visionary goals based on available data in chronological order of Member States. The data represents the number of universities across the GCC with UAE topping the list at 34%

and Kuwait with the lowest at 5%. This is reflected in the position of UAE more significantly Dubai as the choice destination for many international students largely due to its economy, social and language-inclusive, and knowledge-based reputation (Gulf Today, 2023; Huang, 2013; Shukla, 2020).

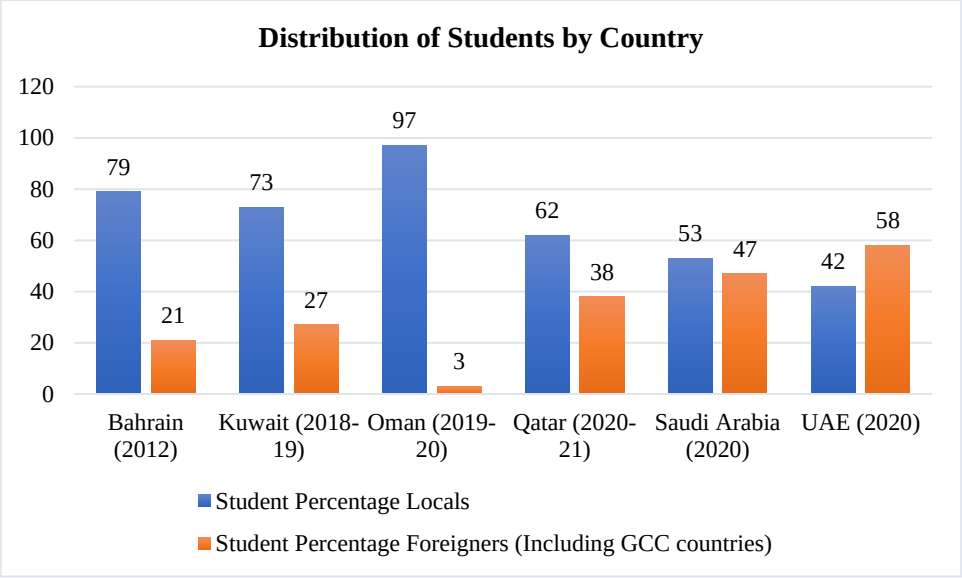


Figure 3: [2]***Distribution of Students by Country in HEIs in GCC***

The distribution of students by country shows Omani students comprise significantly 97% of all students than non-Omanis 3% in HEIs. Other GCC countries with more students in HEIs are Bahrainis 79% > non-Bahrainis and Kuwaitis 73% > non-Kuwaitis. While Qatari Students are 62% > 38% non-Qataris and Saudis are slightly 53% > 47% non-Saudis. On the contrary, the UAE tops the list of the highest number of non-Emirati students at 58% > 42% of Emiratis.

4.1. Impact of GCC Economic Visions towards International Students' Mobilities

This study highlights the impact of the GCC Economic Visions as an integrated platform wherein international students can consider themselves inclusive to the region rather than just for education without social integration. Thus, this aids in reinventing the students' experiences. Against the backdrop, the summaries of the collected GCC Economic Visions through the improvement of the educational system are; ***(1) Bahrain –*** According to Mosly (2022: 5) states that Bahrain Economic Vision 2030 aims to "support and develop talented

[2] The data presents the most recent available data from the different GCC countries.

youths throughout the course of their education" (The Economic Vision 2030 for Bahrain). Bahrain attracts students from most Arab countries including Iraq, UAE, Qatar, Lebanon, Syria, and Jordan as well as other non-Arab countries like the Philippines, India, and Pakistan (Higher Education Council Annual Report 2012; Oxford Business Group, 2015). Bahrain anticipates that over the years will become the study choice destination for most international students due to some noticeable factors. Firstly, the HEC continuously strives for excellence, quality, and international recognition for all students. Secondly, Bahrain is well-positioned for travel around the Gulf. Lastly, the country offers a good lifestyle for overseas students looking for diversity and opportunity (Higher Education Council Annual Report 2012; Nekhili et al., 2019). ***(2) Kuwait* –** Kuwait's Vision 2035 aims to improve its education system through a quality higher education programme (GFH, 2020; Mosly, 2022; Oxford Business Group 2016). ***(3) Qatar* –** Qatar National Vision 2030 aims to build a modern world-class educational system that provides students with an exceptional education that is comparable to what is offered globally. ***(4) Oman* –** Oman Vision 2040 aims to improve its education system through a quality educational system with shared partnerships for private and government entities ***(5) Saudi Arabia* –** Saudi Vision 2030 aims to improve equality in education, fundamental learning outcomes, the global ranking of educational institutions, and ensure the alignment of educational outputs with labour market needs. And ***(6) United Arab Emirates (UAE) –*** In collaboration with Dubai Plan 2021 and Abu Dhabi Economic Vision 2030, aim to improve the quality of education through improved course curriculum and facilities (GFH, 2020; Mosly, 2022).

5. Conclusion and Recommendations

The study concludes that social inclusion is a major catalyst in promoting international students' mobilities across diverse countries who opt to study in the Gulf Cooperation Council (GCC). Since the GCC seems to become the choice destination for the labour force, this could be leveraged to boost the influx of international students. Thus, one can appreciate the collective GCC economic visions in inventing international students' experiences as they have made concrete steps to absorb most of the graduates into the economic labour force (Nekhili et al., 2019). Further studies could be carried out to give an accurate representation of these international students in the GCC labour workforce.

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Teaching Gender in Engineering: Path-creation for Gender-Sensitive Innovation

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Abstract

Neglecting characteristics and requirements of women resulted in a number of products that were less safe for females than for men, including airbags, safety belts, and medical personal protective equipment. Efforts to develop gender-inclusive products need to go beyond aesthetic design features and require engineers to reflect consequences of technical product development that targets properties of male bodies only. Rather than a single course on applied ethics and gender issues, we demonstrate how a more inclusive perspective for reflecting how to define application profiles can be implemented in several courses in engineering education programmes. We present how to build on standard concepts and tools in product and service development, drawing attention to the requirements of females to enable gender-sensitive innovation including an adequate pricing strategy. While integrating inclusive innovation or gender-sensitive innovation in the learning outcomes of modules may results in stronger integration in a curriculum, there are also benefits in implementing an gender-perspective immediately.

Keywords: *Engineering education; gender equality, gender-sensitive innovation; gender-sensitive pricing; product development; UNSDG.*

1. Introduction

Research in gender studies has shown that neglecting women[1] with their characteristics and requirements in innovation may result in products and services that discriminate them (Marçal,

[1] Throughout this content, the terms 'woman' and 'female' are used in an inclusive manner to encompass all individuals whose bodies and needs align with characteristics and requirements that are distinguishable to 'male' bodies. We recognize and respect the diversity of gender identities, and our use of these terms is not intended to exclude or marginalize any person based on their gender identity or expression. The use of these terms is intended to be inclusive rather than exclusive. If you have specific concerns or questions regarding the language used, please feel free to reach

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2022). The examples range from airbags and safety belts in cars, medical devices, personal protective equipment, to athletic shoes. Some of these products even caused physical harm to women, which are roughly fifty percent of our society. Moreover, improving the products to accommodate characteristics of women afterwards requires additional innovation resources. Accordingly, it can be also framed as an economic and sustainability problem, when engineers and designers neglect crucial requirements of their product design in the first place, and have to invest additional resources to improve it afterwards.

We do claim that including a gender-perspective in product development may result in more robust, equitable, and safer innovation and contributes to gender equality (UNSDG 5). Consequently, to create awareness amongst engineers, the importance of gender-sensitive application profiles should be taught in higher education curricula. Instead of an extra course on gender-sensitive innovation, it can be implemented in several modules that involve product development, without having to change the learning objectives and go through official administrative changes of the courses. However, implementing gender-sensitive and inclusive innovation in the learning objectives may encompass that it depends not on individual instructors, whether students learn to reflect on this.

In the following, we present a brief introduction to the issue of gender-sensitive innovation in the theoretical background. Then a case study illustrates how it is implemented in an engineering module. The discussion section provides some advantages and disadvantages of this approach in comparison to implementing gender-sensitivity in the learning objectives.

2. Theoretical Background

Thinking through gender-sensitive innovation, it is helpful to distinguish aesthetic requirements from technical features. Looking merely at aesthetics, our world is full of products and services targeting women to increase their appeal, and in some instances justify a higher price. However, an athlete training shoe in pink or pastel colors does not mean necessarily that the sole is designed to absorb and cushion a female runner. Hence, in this section we present a brief introduction to gender-sensitive innovation and gender marketing, to illustrate the differences.

2.1. Gender-sensitive innovation

While products and services are design with aesthetic features targeting women, they are not necessarily developed to specifics of female requirements. Issues associated with product development that neglects requirements specific to women can impact their health and safety. Airbags and safety belts initially have been tested and certified with dummies simulating the

out, as we are committed to fostering an environment that values and acknowledges the rich spectrum of human experiences.

properties of male-bodies (Linder & Svedberg, 2019). Accordingly, this led to airbags deploying with excessive force for smaller and lighter individuals, including women. The forceful deployment of airbags caused injuries, such as bruises and abrasions but also more severe outcomes, such as broken bones and internal injuries. Early designs of seat belts were not optimized for pregnant women. The positioning and tightness of the lap belt could result in discomfort or even harm to the fetus in the event of a collision. Consequently, pregnant women were at risk of injury due to the improper fit of seat belts, and in some cases, they chose not to wear seat belts at all, further increasing the risk of injury in the event of a crash (Linder et al., 2018). Personal protective equipment is also a product field that discriminates women. Although female workers achieved some attention for this topic, e.g. through work unions and some of the businesses providing personal protective equipment improved their products (e.g. Johnson and Johnson Foundation, 2021), a recent report amongst Canadian women shows that about 58% of women are still complain about wrong fit and even 28% do not wear equipment because of discomfort and ill fit (Gowan Consulting, 2023). These results emphasize the health risk for women when personal protective equipment such as safety harnesses, protective shoes and overalls, are still designed for men with "scale-down" versions for women that lack proper fit.

This technology gap is attributed amongst other reasons to the fewer proportion of women that work in research and development, and in higher managerial positions, deciding on innovation (Rüst, 2020). This claim is substantiated by findings, that the focus on women increases with increase in female workforce. A recent study amongst European businesses found that women in management boards correlate positively to inclusive innovation that target the needs of people who live in poverty (del Mar Fuentes-Fuentes et al., 2023) – with the majority of them being female as the wealth distribution amongst people who live in poverty effects women more than men (Nieuwenhuis et al., 2018).

2.2. The female beauty tax as part of gender marketing

Browsing the offers at online shops, drug stores, shopping malls or inner city districts in Germany, the country seams to offer more products and services to women than to men. Hence, this richness may distract from the issue that we require gender-sensitive innovation.

Marketing strategists discovered gender as a source of additional income and invented gender-based pricing, targeting women with higher prices, often for products and services that are associated to their beauty such as cosmetics, clothing, haircuts, and dry-cleaning of clothes. This price markup is also referred to as the "female beauty tax", "hidden tax", "gender tax" and "pink tax" (Duesterhaus et a., 2011; Liston-Heyes & Neokleous, 2000; Shenbagavalli et al., 2023). For example, hair loss fighting foam on the U.S. market was 40% more expensive for women, despite the same active ingredients and volume, also clothing alteration as a service of retail stores are offered in some areas for free to men as part of the sales package, while women have to pay for this (Jacobsen, 2018, 243). This gender tax is discriminatory, as the cumulative costs

of products and services add up (Duesterhaus et al., 2011). Especially when considering the gender pay-gap and wealth disparities (Meriküll et al. 2021), the amount of money that women have to spent for equivalent products and services appears double unfair.

3. Examples of Introducing Gender-Sensitive Innovation in Engineering Education

Offering individual courses on gender studies often results in self-selection of students, who are already interested in the subject. Consequently, in order contribute to gender equality, study programs should aim to introduce gender-sensitive innovation tools in the standard curricula. The following case study on how we teach it in an engineering study program (B. Sc. and M. Sc.) may provide inspiration for implementing it at low threshold, without having to go through formal adjustments of learning objectives and skills. Our course evaluation has shown that by introducing a gender perspective on requirements and pricing, students become more sensitized to gender equity issues and that it increases their motivation to participate. Tey may spread their knowledge at their future workplaces contributing to gender-sensitive innovation.

3.1 Innovation tools that facilitate gender –specific requirements

The following two suggestions can be implemented in any engineering modules that cover e.g., product development, quality control, standards and testing, material selection, even basic math such as statistics and physics to sensibilise students for technology gender gaps:

In a first step, reflecting market-pull and technology-push mechanisms in innovation, students may comprehend that even with inventions that are based on new technologies – a successful market diffusion is only possible when it meets market requirements. We use smart-textile applications as example and analyze why some are successful and others fail. Then, introducing examples such as personal protective equipment and test dummies for vehicles, we discuss health risks when innovation is not fit for purpose.

We usually use two sessions to reflect on innovation and market diffusion, as well as gender-sensitive innovation to overcome gender technology gaps in the beginning of a product development project module that runs over three months. The students – depending on the complexity of the development – may work in groups or sub-groups to then define a need and develop a suitable product that addresses this need. In general, all groups – but at minimum two groups – are eager to experiment and contribute to solutions that address needs that would improve the life of women. We found tools from design thinking, such as defining a persona and a user journey map are especially helpful to analyze the requirements. This includes researching the daily lives and specifics of women. To list a few that came up during the courses, this includes menstrual cycles, pregnancy and meno pause, temperature differences in limbs, and the higher share of care-work (encompassing e.g., caring for children, parents, and any sick

family member, cleaning, cooking, grocery shopping), higher vulnerability when moving after sunset or on their own during cities and the country side, including using public transport, and in many instances a higher pressure and/or desire for beauty encompassing clothing, recovery, cosmetics, leisure sports, and healthy diets.

To provide a few examples, the product development resulted in a round-shaped shelter tent for refugee camps as a recreational space for women, considering also the psychological effects of colors and shapes and the insulation effects of different materials. Another development was a single-person tent integrated in a backpack that was designed for average German female body shape and requirements to go hiking. A coat was developed with distance measuring sensors in the back, that is connected to a vibration mechanism in the sleeve and a switch in the sleeve that allows to turn on flashing LEDs in the back to signal more distance to passengers who walk up too close and do not respect the comfort zone of the wearer.

With a first market research on what is available, what can they built on, we derive already at gender differences that are acknowledged in products, but also at gender marketing. This leads to the next example: gender-sensitive pricing.

3.2 Market research to land at gender-sensitive pricing instead of gender pricing

Innovating encompasses building on what is already available. Accordingly, students perform a market research of a given textile product including materials, special features, and pricing. Then as a second step, the students are invited to look "out of the box" at other products that relate to the application field and features, services, marketing, and in particular pricing strategies. They usually work in teams, report their findings, and discuss them in class. Analyzing pricing strategies with engineering students broadens their perception that prices are (or should) be cost-based, to cover manufacturing, development, marketing and logistics. It is a common practice in many sectors that pricing strategies are based on what costumers are willing to pay, instead of a cost-based calculation considering the efforts and required resources (Meehan et al., 2012). Discussing with students that in a portfolio, not all offerings may be cost-effective but some offers are compensated with higher margins of others, and what potential customer segments are able to pay or willing to pay opens the door to reflecting business ethics and what specific customer segments should pay. Accordingly, considering that women in general own, and in particular accumulate less wealth during their work life (Kukk et al., 2023), pricing strategies should be part of gender-sensitive innovation. Hence – this often leads to the discussion whether gender-sensitive pricing in terms of women who as a group own and earn less get special discounts or have to pay less, is fair or discriminating. Here, the teacher may refer to national constitutional laws and consumer protection acts that prohibit discrimination.

Depending on the academic age of the students and their experience with discussions, it can be helpful to propose a role-play with predetermined opinions. Divided into smaller groups, they

get sorted into proponents who defend or opponents who object gender pricing. Both proponents and opponent get ten minutes to prepare their arguments. Afterwards they suggest a pricing strategy and discuss it with their counterpart. This way, they do not need to have an opinion yet, may enhance their skills to reflect opinions and emphasize with other views.

In the courses, we defined gender-sensitive pricing strategies as recognizing and addressing economic disparities between genders, acknowledging that women, on average, may earn and own less than their male counterparts. By offering lower prices for products and services targeting women, businesses can contribute to bridging the economic gap and ensuring accessibility. This approach reflects a commitment to business ethics in terms of social responsibility, recognizing that affordability is a key factor in enabling equal access to goods and services. These strategies emphasize fairness and inclusivity by considering the economic realities faced by women.

On the other hand, female and male students in Germany do not experience significant difference in wealth and income yet. They may find pricing strategies unfair, that facilitate women having to pay less. The aim of the teacher should not be to drive them to pricing strategies that discriminate men, but rather to facilitate the discussion and reflection. Creating the awareness may empower them in their future work life to discuss with the business units fairer pricing strategies.

4. Brief Discussion and Outlook: Introducing a Gender Equality Focus in Standard Engineering Curricula

Although there is a positive trend in incorporating characteristics of women in application profiles of products, as they are considered to be an important market, and as more and more women enter jobs in the field of science, technology, engineering and mathematics (STEM), this trend is rather slow. According to a recent report of the World Economic Forum, women still remain underrepresented in the STEM workforce with globally about 29% in comparison to almost half across other occupations (World Economic Forum, 2023). Accordingly, introducing a gender focus in engineering courses that e.g. considers comfort and fit for females but also aspects related to women's health, such as menstruation, pregnancy, and menopause, may improve the situation especially for health-critical products and services.

Offering individual courses on gender studies often results in self-selection of students, who are already interested in the subject. Consequently, in order contribute to gender equality, study programs should aim to introduce gender-sensitive innovation tools in the standard curricula. Whereas these ideas can be implemented immediately, without having to formally change the learning objectives and skills of a module, the following overview points out specific advantages of implementing gender-sensitive innovation formally in the study program:

Table 1. Advantages of formal and informal implementation of gender-sensitive innovation in engineering study programs

Formal implementation through adjustments of learning outcomes	Informal implementation in existing modules
Can take a year or longer, depending on the required boards that review the changes	Can be implemented immediately
independent of instructors	Depends on willingness of instructor
Visibility that UNSDG-5 is implemented in curicula	Low entrance barrier to start also at education institutions where gender-issues are still viewed with reservation
Inspiration for other engineering programmes at the institution and at other education institutions	

This teaching approach is based on the assumption that engineering students who got sensibilised for the technology gender gap may engage in their future work life to improve innovations in a gender-sensitive way, including pricing strategies. However, some studies on gender issues show, that it can also lead to a defensive stance, also from female engineering students, as they do not want to associate themselves with victims. Accordingly, the effects and how to balance the issue should be monitored carefully.

This case study reflected on how to implement a focus on female issues in engineering. While the ideas can be implemented instantly in different modules, there are benefits of addressing gender-sensitive innovation as part of learning objectives and skills. Amongst others, as part of the curriculum the topic becomes independent of instructures and universities may demonstrate to potential students and their future employees, that they do take the UNSDGs seriously, addressing social sustainability and gender equality.

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Bridging the Gap: Developing Entrepreneurial Competences in Engineering Studies

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Abstract

This study aims to address the challenge of integrating entrepreneurial competences development into the traditional engineering curriculum to enhance job creation prospects. A course design intersecting project management and entrepreneurship, employing challenge-based learning, is proposed. Leveraging experiential learning principles, the design aims to foster entrepreneurial competences among engineering students. A pilot test of the course in a Spanish university Project Management program reveals, through a series of assessment tools and statistical analyses, significant enhancement in students' entrepreneurial competences post-course, with minimal gender variations except for heightened autonomy perception among women. This research pioneers the integration of engineering and entrepreneurship, demonstrating how such pedagogical approaches can enrich students' professional and personal development while preserving engineering program knowledge.

Keywords: *Higher education; challenge-based learning; entrepreneurial competences; project management.*

1. Introduction

Interest in entrepreneurship education has experienced significant growth, driven by societal demands for a workforce capable of fostering innovation and contributing to economic and social progress (Pettersen *et al.*, 2019). Consequently, there is a recognized need to provide entrepreneurship training within higher education institutions to meet these expectations mandate (Reis *et al.*, 2021).

Scholarly literature widely acknowledges the importance of incorporating entrepreneurship education into university curricula to better prepare students for the dynamic demands of the professional world (Akhmetshin *et al.*, 2019; Bejinaru, 2018). While traditional

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entrepreneurship education focused on venture creation, it has evolved to encompass a broader range of skills, behaviors, and attitudes essential for overall effectiveness in diverse contexts (Watson and McGowan, 2019). As a result, there has been a proliferation of modules and courses aimed at cultivating entrepreneurial mindsets across various disciplines beyond business and management (Zappe *et al.*, 2023).

Engineering plays a crucial role in wealth creation and innovation, with many groundbreaking companies being led by engineers. Transitioning from conventional engineering to engineering entrepreneurship is deemed essential given the changing landscape of professional demands. Future engineers must possess not only technical competences but also professional skills to address complex challenges effectively (Zappe *et al.*, 2023). However, the integration of entrepreneurship within the engineering curriculum poses challenges attributed to the inflexible nature of syllabi. In instances of such rigidity, the introduction of diverse activities aimed at fostering the acquisition of entrepreneurial competences is strongly advocated.

Various studies have explored different teaching methodologies aimed at nurturing entrepreneurial competences among students, with a particular focus on engineering education. For instance, Bellotti *et al.* (2014) and Mayer *et al.* (2014) have investigated the effectiveness of serious games and game-based principles in cultivating entrepreneurial mindsets and competences. Similarly, Gorlewicz and Jayaram (2020) proposed entrepreneurial minded learning, emphasizing active learning through challenge-based approaches to address real-world problems. Barba-Sánchez and Atienza-Sahuquillo (2018) and Soares *et al.* (2013) among others, underscored the significance of practical experiences, like workshops and competitions, in acquainting students with entrepreneurial processes, and Karim (2016) proposed the use of different teaching methods such as case studies, guest lectures, internships, networking opportunities, business competitions, or entrepreneurial projects. The findings of these works collectively suggest that a combination of diverse methodologies, exposure to real-world challenges, and interdisciplinary collaboration are crucial for effectively fostering entrepreneurial competences among engineering students.

Rooted in this context, the present study reports the experience of a Project Management course within a Master's Degree program that aims at fostering entrepreneurial competences among engineering students. Through various exercises aligned with real-world scenarios, the course integrates entrepreneurial thinking into traditional engineering education. This work is based on a more extensive research recently published by the authors (citation omitted to preserve anonymity).

2. Course description

2.1. Context

Based on challenge-based learning, a course was designed and implemented in a Project Management course for 56 students (18 (32%) female) in the Master's Degree in Management and Operations in Barcelona (Spain). All students had a background in engineering.

2.2. Task

Students in the course selected project topics mirroring real-world scenarios where professionals engage outside the office for ideas and opportunities. Following Bayuo *et al.* (2020), the curriculum aims to empower students as social innovators by aligning projects with UN Sustainable Development Goals (UNESCO, 2017), emphasizing tangible impacts on Barcelona, and securing external partners. This reflects a modern approach to entrepreneurship education, blending theory with practical methods. Projects constituted 85% of the course grade, and were evaluated through in-class activities, weekly progress reports, posters, final reports, and oral presentations. Individual contributions were assessed via self-evaluation, peer evaluation, and professor observation, acknowledging varying levels of motivation and commitment within groups. The remaining percentage of the overall grade considered an individual case study (10%) and the participation in a workshop (5%).

2.3. Course structure

The course initiation involved presenting the project assignment, followed by the strategic formation of student groups. Building upon Yang *et al.*'s (2022) insight that mere grouping does not guarantee optimal learning outcomes, emphasis was placed on structuring groups based on diverse criteria, including entrepreneurial competences and gender, among others. To assess entrepreneurial competences, and in line with prior research evaluating entrepreneurial competences among students (e.g., Horng *et al.*, 2021; Ishiguro, 2015), the General measure of Enterprising Tendency test (Caird, 2013) (www.get2test.net) was administered, which evaluates dimensions such as achievement, autonomy, creativity, risk-taking, and locus of control. Given that this test does not have right or wrong answers, but rather measures the extent to which each dimension is possessed, taking the test twice in a short interval, as done in other studies, was not considered to introduce bias into the results. Instructors utilized this information for group formation, paving the way for teams to identify project needs and stakeholders, employing lean and agile methodologies, and utilizing various tools to map progress.

The instructional approach encompassed a blend of theoretical and practical elements, including readings, simulations, exercises, and case studies. Striving for a balanced qualitative

and analytically oriented approach, the course aimed to equip students with fundamental project management knowledge. Additionally, by incorporating diverse quantitative methods and tools for data interpretation, students were expected to develop the skills necessary for constructing a robust business plan in the future.

3. Results

The evaluation of the teaching experience encompasses a thorough analysis of the course's effectiveness and utility, employing various methodologies to gauge its impact on students' entrepreneurial competences, academic performance, and satisfaction. Central to this assessment is the examination of changes in students' self-perception of their entrepreneurial competences, facilitated through pre- and post-course evaluations using the Get2Test tool. Results indicate a discernible improvement in overall competence scores after completing the course (the average score pre-course was 66.48% and 69.13% when finisling it), albeit with a noteworthy discrepancy observed in the dimension of autonomy, where students' perceptions lag behind other competences (45.57% pre-course and 48.82% post-coure, far behind the second dimension with the lowest level of perception, namely creativity, with 64.82% pre-course and 66.04% post-course). This finding underscores the pedagogical imperative of fostering autonomy, as espoused by the self-determination theory (Deci and Ryan, 2013), to adequately prepare students for the exigencies of professional life. Despite this disparity, the overall enhancement in entrepreneurial competences attests to the efficacy of the instructional strategies employed.

Statistical analyses, including paired t-tests and gender-based examinations, offer nuanced insights into students' competence development. Particularly noteworthy is the differential response observed among female students, who exhibited a more pronounced increase in autonomy (60.63%) compared to their male counterparts (21.93%).

Furthermore, the investigation into the correlation between perceived competence improvement and academic performance yields intriguing but inconclusive findings. While there is an inverse relationship between self-perception and grades , the statistical significance of this association remains ambiguous. This underscores the need for further inquiry to elucidate the intricate interplay between self-perception, competence development, and academic achievement.

Additionally, students' satisfaction with the course is evaluated through a comprehensive survey, revealing a high degree of contentment with the course organization (average score of 4.16 in a scale from 1-lowest to 5-highest) and effectiveness of learning activities (average score: 3.61). This underscores the pivotal role of clear instructions and engaging pedagogical methodologies in facilitating effective student learning.

Moreover, the collaborative ethos cultivated within the course emerges as a significant contributor to student satisfaction, fostering an environment conducive to idea-sharing and effective teamwork. This collaborative approach aligns with contemporary educational paradigms that prioritize cooperative learning and peer interaction as catalysts for enhanced learning outcomes. Overall, the comprehensive assessment of the teaching experience underscores the course's success in fostering students' entrepreneurial competences, albeit with areas for improvement, such as addressing disparities in autonomy development and further investigating the intricate relationship between competence enhancement and academic performance. These insights provide valuable guidance for refining course design and pedagogy to better meet the evolving needs of students in entrepreneurial education.

4. Conclusions

The study proposes a course design tailored to engineering education to bolster entrepreneurial competences among students. Emphasizing the fusion of engineering and entrepreneurship within university-level curricula, the integration of active learning strategies is advocated to enrich the learning experience. By aligning the objectives of project management courses with the development of entrepreneurial competences, the study seeks to exploit synergies between these disciplines, offering a pragmatic approach without the need for a separate course dedicated solely to entrepreneurship.

The effectiveness of the proposed course was tested through a pilot implementation at a Spanish university, yielding promising preliminary findings. Notably, the course demonstrated improvements in entrepreneurial competences among students, with gender differences being negligible except for heightened levels of autonomy reported by female students. This finding underscores the potential of project-based learning courses to mitigate gender disparities in perceived autonomy, aligning with prior research indicating the positive impact of entrepreneurship education on self-efficacy among women (Wilson *et al.*, 2009).

Furthermore, the study underscores the high level of student satisfaction engendered by the course, aligning with prior research emphasizing the transformative potential of challenging and enriching educational experiences (Karim *et al.*, 2020). Authentic learning experiences, characterized by real-life projects, are found to enhance student satisfaction and motivation while fostering skill development. However, the study acknowledges certain limitations, including the need for a larger and more diverse sample size for generalizability, as well as the exploration of alternative metrics to measure entrepreneurial attitude and individual participation assessment methods. All these aspects should be explored in future research. Nonetheless, the replicability and adaptability of the course design offer promising avenues for future research and educational practice, urging universities to embrace innovative pedagogical approaches to better prepare students for dynamic professional landscapes.

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The current educational atmosphere regarding Graphic Engineering courses in university degrees

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Abstract

Subjects regarding graphic content are essential in engineering and architectural degrees; however, a significant lack of updated teaching methodologies are still commonplace among them. Although some assumptions can be made relating the possible causes of this mishap, truth is that no clear answer can be stated. Aiming to gather all relevant information that may bring light into real causes that led to such situation, 250 educators have been surveyed to collect first-hand perspectives on the real needs of these type of subjects. Results show that new bespoke teaching platforms to deal with graphic contents are being demanded by lecturers, especially in the case of technical drawings. Furthermore, educators preferred the use of free software that also allows autonomous learning and the implementation of innovative methodologies.

Keywords: *graphic engineering; e-learning platforms; remote learning; university degrees.*

1. Introduction

New pedagogical perspectives aim to avoid the traditional method of teaching methods where a lecturer expose theoretical contents during the whole session with no active student enrollment. In this sense, new methodologies tend to place students in the center of the teaching-learning process, as in the case of flipped classrooms (Toriz, 2019), gamification (Da Rocha Seixas et al., 2016; Gómez-Jáuregui et al., 2017), or problem-based learning (Hsieh & Knight, 2008).

In the case of engineering courses, all these methodologies have been successfully implemented and combined with new technological resources as the use of specific software or novel online learning platforms where undergraduates can progress at their own pace. Altogether has transformed the class from a space to share theoretical knowledge into a space to also improve

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social (Calderón1 et al., 2018) and professional skills (de Campos et al., 2020; Lauana et al., 2022).

Related to graphic engineering subjects, such as Graphic Engineering or Industrial Drawings, novel methodologies have been successfully implemented, but there still is a significant lack of bespoke online platforms or customized teaching software to address the necessities of each lecturer. Hence, there is a significant tendency to continue using antiquated teaching techniques. Nevertheless, it worths noting that sometimes the own lecturers delay new updates implementation due to a lack of confidence in the promised results (Martí-Parreño et al., 2016)

To better comprehend the real and current demands that must be overcome in graphic engineering classes, 250 lecturers from different European universities have been surveyed to analyse: the profile of students enrolled in graphic subjects, the characteristics of their class groups and the methodologies that they use; taking special consideration on their relationship with e-learning platforms.

2. Methodology

Questions implemented in the survey must cover the whole spectrum of fields that influence the current teaching experience. For this reason, they were tailored to address issues related to the average teaching method used, state of the art about the relation between online learning platforms and professors and future needs and possible suggestions to improve current teaching methods. Most of the questions were closed-ended, although open-ended ones were possible to the latter group.

To reach the largest number of professionals related to the teaching of graphic contents, a survey formed by 11 questions was implemented on an online platform. All data was collected using anonymous responses to guarantee its neutral treatment. Instead of employing a commercial survey platform, a bespoke webpage was specifically created to host the survey. Subsequently, its link was sent to European universities, asking them to additionally spread it among their professors. Additionally, several accounts and posts were employed to disseminate the survey through social platforms. All questions are shown in Table 1.

Furthermore, it is worth highlighting here that questions were written in Portuguese, Spanish, Frenc, English, Latvian, Lithuanian and Slovenian to reach the maximum possible audience after reducing possible language barriers.

Table 1. Questions and possible answers employed in the survey.

Question number	Question Text
1	How do you evaluate students' math pre-knowledge?
2	In your opinion, does your subject have enough academic hours?
3	How many learners are there in the group during your classes?
4	How much time do you spend checking one drawing exercise (min)?
5	What CAD software is used for teaching Technical Drawing fundamentals?
6	What kind of representations of teaching materials do you use?
7	Do you use any educational platform for online learning in your subject?
8	The educational platform you use...
9	In case you are using web platforms in your teaching process, where do you find biggest shortcomings of web educational platforms?
10	What are the possible future needs that should be analysed to improve student learning of Drawing?
11	What other suggestions that were not presented in the questions can you propose to the project development (teaching methodology, time spent on learning this subject, etc.)?

3. Results and discussion

The survey allowed to reach the perception of up to 250 professors related to subjects with a major graphic engineering component. Most of them (60.0%) agree on the fact that the average student has an adequate starting level to face the subject at a university degree. However, there is also a significant percentage of educators (29.2%) who consider that undergraduates have low level previous knowledge; almost tripling professors related to students with a strong background (10.8%). In this sense, it can be assured that most students enroll in graphic engineering courses at university with an adequate previous level. Nevertheless, 48.7% professors still demand more time to cover all the different modules forming a certain course, thereby highlighting the necessity of optimize teaching and evaluating tools. Addressing the adequacy of a given number of contents to a particulate schedule cannot be performed without also considering the number of students per group. It is obvious that the same course contents explained to larger learner groups may involve greater periods of time to ensure that all pupils understand most relevant aspects. To avoid this potentially biased conclusions, professors were asked to indicate the average number of learners on their groups. Figure 1 shows that most common scenario is classes with over 30 students working simultaneously. Therefore, improvements aimed to boost self-learning work by the students or tailored tracking progress by professors are encouraged. These last proposals would also be convenient to increase self-paced work by students; there overcoming the need of extra course hours demanded by 58.0% of surveyed educators.

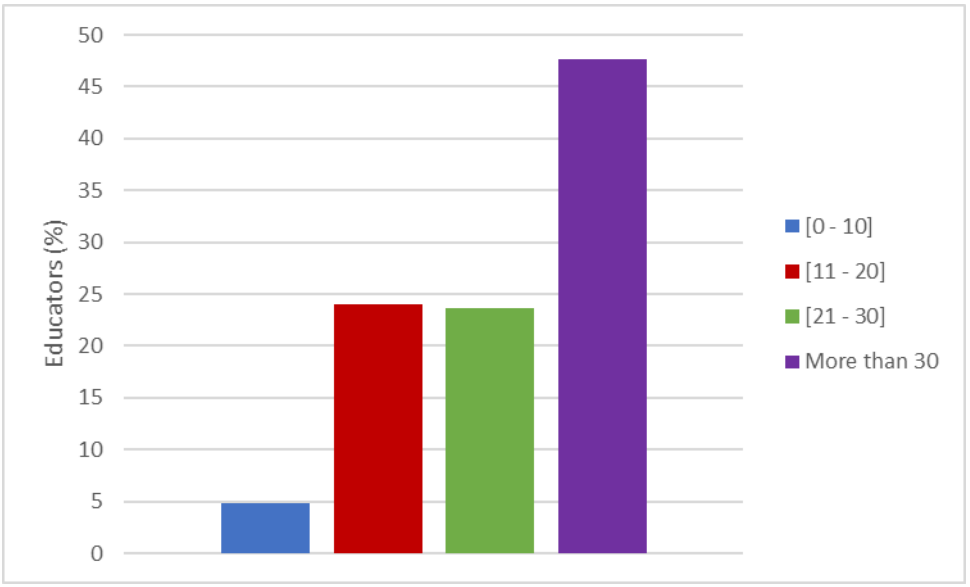


Figure 1. Number of learners on each session.

Increasing self-paced work by students may be seen as a positive aspect to be implemented. However, the correction time of each exercise may take an average of five to ten minutes for most educators, whereas only 23.6% are able to check them in less than five minutes (Figure 2). It worths mentioning that this average time was estimated regarding different activities in various groups of students; hence, it must be considered only for general considerations, as the kind of assessment may strongly influence its value. As long as the self-paced work by students involves the supervision of professors at some point, it will lead to a significant work overload which is not clear that could be handle by instructors; especially if there is no automated system or software to support the correction.

Another relevant obstacle to overcome when updating teaching methodology in graphic engineering subjects is that most professors (55.6%) rely on manual drawing techniques during their courses; hence, limiting the use of computer aided drawing (CAD) software to practical or laboratory sessions. In this sense, it is worth noting that those educators using CAD software may not translate it in the use of automatized correcting tools; so, it could be a source of delay anyways. In this sense, and based on the answers gathered on question 11, most lecturers highlight the absence of platforms focused on dealing with graphical contents, assuring that significant inconvenience arise when trying to adapt existing ones to generate or interact with graphical content. Furthermore, even in those rare occasions when it can be achieved for the simplicity of the contents or exercises, there is no possibility of self-assessment work by students, especially if an automated evaluation is desired.

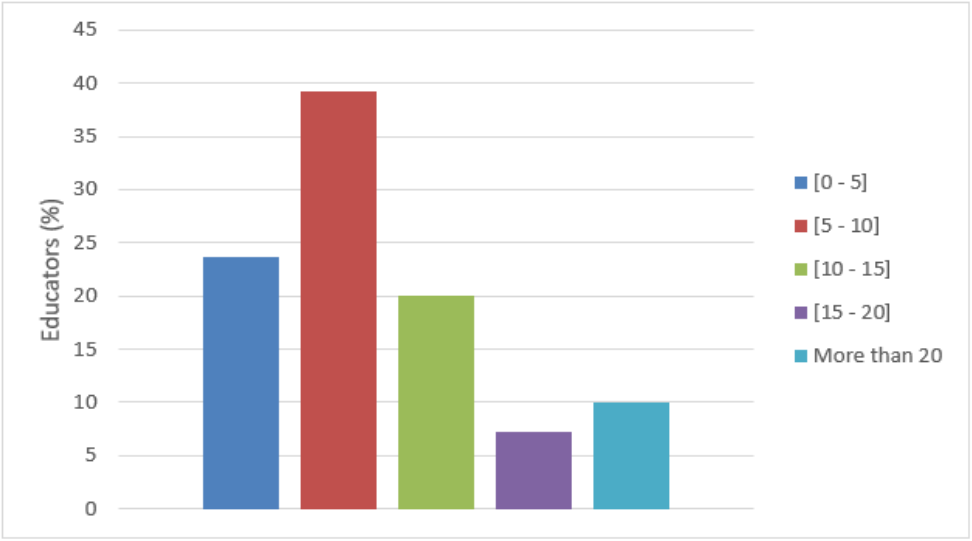


Figure 2. Average time employed on the correction of particular exercise by educators.

Figure 3 states that lecturers use online platforms to mainly share content, performed theoretical tests or communicate with their students. Only 5.2% already use them to prepare and solve exercises similar to those carried out face-to-face in the classroom or to allow students to have a form of unattended learning (8.4%). Furthermore, up to 43% feel that the platform is too time-consuming, which can be explained by the lack of platforms for teachers to customize and personalize the content shown to their students. This factor may also explain the lack of engagement of teachers in this field with digital platforms.

Although new bespoke online platforms to deal with graphical content would be welcome, use of technological resources is already a standard in teaching methodologies. As shown in Figure 4, PowerPoint presentations are the main option by lecturers to share contents with their students. Furthermore, there new resources related to virtual and augmented reality are progressively being used to update teaching methodologies. Even if combined they represent a modest 4.9% of the overall cases, their bond possibilities with 3D models (21.1%) and videos (18.7%) encourage to think on a promising future for them.

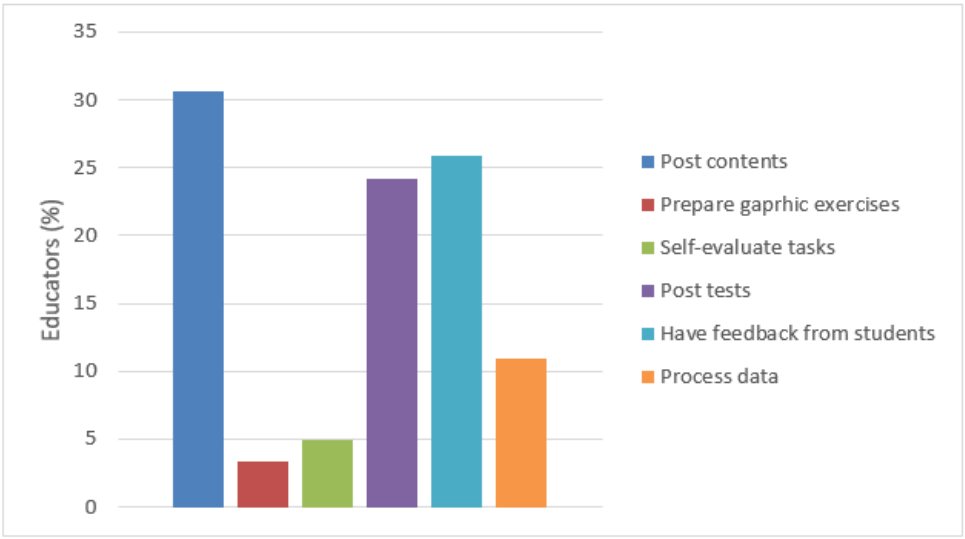


Figure 3. Use of e-learning platforms made by lecturers during graphic engineering courses.

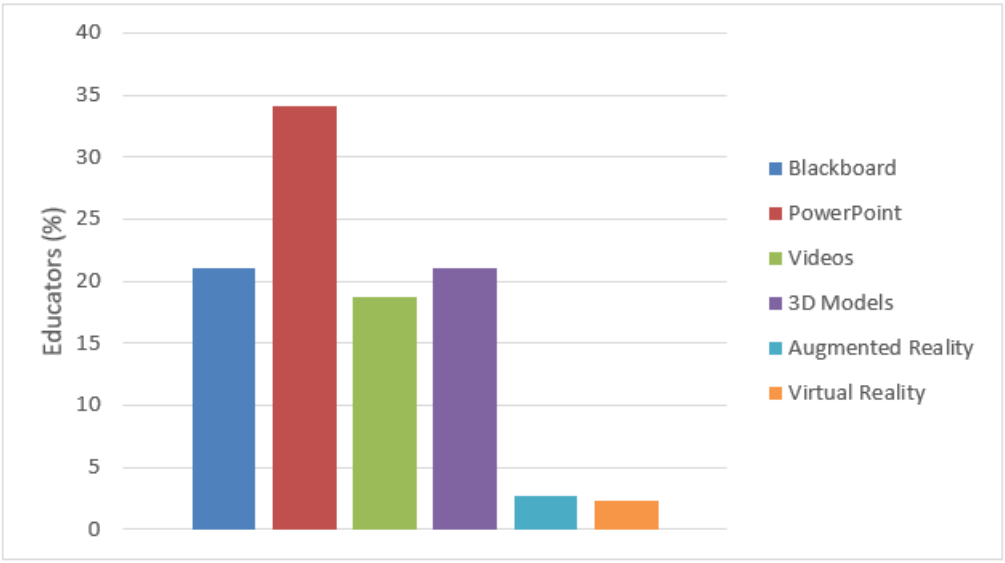


Figure 4. Resources used by lecturers during graphic engineering courses.

4. Conclusions

Graphic engineering courses have successfully introduced up to date methodologies regarding educators' opinions. Adequate background knowledge level of most students has facilitated this phenomenon; however, professors demand bespoke e-learning platforms specialized in graphic content that not only allow to share content, but also enables self-pace learning of students and automatic corrections.

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Learning and Motivation Impact of Collaborative Questioning Sessions in Construction and Building Engineering Educational Environments

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Abstract

This manuscript offers an in-depth examination of an innovative active learning methodology introduced within the Master's Degree program in Advanced Construction Engineering at the Universitat Politècnica de Catalunya. This pedagogical initiative centered around structured competitive engagements among student teams, where each group devised and presented multiple-choice questions to their peers. The primary objectives of this study are to delineate the implementation process comprehensively, appraise the efficacy of this approach, and scrutinize its influence on student learning and motivation. The evaluation encompassed experiences and surveys. The findings yield valuable insights into the potential of Collaborative Questioning Battles to cultivate highly competitive dynamics, thereby augmenting comprehension, retention of concepts, and overall engagement, thus fostering a conducive learning environment.

Keywords: *Active Learning; Collaborative Questioning Sessions; Questioning Battles; Construction Engineering Programs.*

1. Introduction

Traditional pedagogical approaches often rely on passive learning, where students act as recipients of information rather than active contributors to their own understanding. These traditional teaching methods may not sufficiently address today's educational issues, such as motivation, as they often prioritize passive learning over active engagement (Schwerdt & Wuppermann, 2011 and Nurutdinova et al., 2016). In this context, the multifaceted benefits of active learning (Freeman et al., 2014) present an intriguing opportunity to address these prevalent challenges, fostering deeper comprehension, critical thinking, and engagement among students. In this regard, this manuscript delves into the implementation and assessment of

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Collaborative Questioning Battles Sessions within the context of a subject of the Master's Degree in Advanced Construction Engineering program at the Universitat Politècnica de Catalunya, where basic structural design and seismic resistance of buildings are taught. The battles involved teams presenting face-to-face multiple-choice questions to their peers, encouraging a dynamic and engaging learning environment. Rooted in the principles of Constructivism (Dewey, 1986; Bonwell & Eison, 1991; Anthony, 1996 and Cooperstein & Kocevar-Weidinger, 2004), Game-Based, Experimental, and Collaborative Learning (Van Staalduinen & De Freitas, 2011; Plass et al., 2015; Qian & Clark, 2016; Bakan & Bakan, 2018; Petrunich-Rutherford et al., 2019 and Zainuddin et al., 2020), this activity seeks to create a dynamic learning environment that transcends the confines of conventional teaching methods.

The aim of this manuscript is to contribute to the ongoing discourse on effective pedagogical strategies by presenting a detailed account of this Team-Based Questioning Battles active learning experience, its execution, and its impact on students. By drawing upon our practical involvement and survey results, we furnish evidence-based perspectives on the efficacy of this approach. Moreover, the potential to enhance learning outcomes and motivation in the field of construction and building engineering is highlighted.

2. Materials and methods

To investigate the effectiveness and usefulness of a Collaborative Questioning Battles (so called Collaborative Questioning Sessions) implemented, this paper employs a mixed-methods approach, combining the experience of the author together with a detailed survey and interviews; thus, bringing a deep understanding of practical nuances.

2.1. Collaborative Questioning Sessions description

To foster active learning in a Master's Degree program at the Universitat Politècnica de Catalunya, an innovative pedagogical approach was implemented involving competitive battles in a collaborative questions session. Teams of 3-4 students created challenging multiple-choice questions to reinforce understanding of fundamental course concepts. Battles were conducted face-to-face with each team presenting their questions to opponents within a time constraint of 20 minutes. Rounds were repeated with teams facing different rivals to ensure fair competition. Scores were tallied to determine the winner. This format encouraged thorough subject review, active collaboration, and communication skills development. Post-battle, correct answers were discussed with the entire class to facilitate knowledge-sharing. This approach provided a dynamic learning experience, enhancing both technical understanding and teamwork skills among students.

2.2. Survey Design

2.2.1 Participants

The survey aimed to collect quantitative data from students enrolled in Building Engineering, a compulsory course in the Master's Degree in Advanced Construction Engineering program at Universitat Politècnica de Catalunya. 55 students participated. The study captured a diverse student body, with class sizes ranging from 25 to 30, promoting interactive learning. Participants hailed from varied academic backgrounds, including architecture, civil engineering, and building engineering. Culturally, the majority were Spanish speakers, representing Spain, Chile, Mexico, Peru, Uruguay, Brazil, Colombia, and Ecuador. Moreover, Chinese and French students' participation in the course enriched its cultural perspective, providing valuable insights into the impact of diverse backgrounds on the activity.

2.2.2 Questions

The study was carried out after the Building Engineering course, aiming to gauge participants' views on the impact of Questioning Battles on their learning experience and overall effectiveness. This timing was chosen to assess students' attitudes towards this approach compared to traditional teaching methods used previously in the course. The survey, meticulously crafted, comprised four sections: (1) Previous Engagement with Active Learning or Team-Based Questioning Battles; (2) Effects on Learning and Motivation; (3) Study Patterns and Performance; and (4) Preferences and Enjoyment. Participants responded to a total of twelve questions, with this manuscript focusing solely on presenting findings related to the impact on learning and motivation.

- Q_A- On a scale of very low to very high, how would you describe the level of competitiveness and difficulty of questions during the team-based battles?
- Q_B- On a scale of very low to very high, how would you rate the impact of the activity on enhancing your understanding and retention of the subject concepts?
- Q_C- On a scale of very low to very high, how would you rate the impact of the activity on improved team building skills?
- Q_D- On a scale of very low to very high, how would you rate the impact of the activity on improved communication skills?
- Q_E- On a scale of very low to very high, how would you rate the impact of questioning battles on your overall motivation to learn?

3. Results and discussion

A certain level of competitiveness is essential in educational activities of this nature to cultivate an environment that encourages student engagement, facilitates effective learning, and ultimately improves overall educational outcomes. Insights gleaned from the results of inquiries

into the competitiveness and question difficulty levels during battles (QA) offer valuable perspectives on student perceptions.

The data reveals that a significant majority of respondents, comprising 69.1%, categorized the competitiveness level as "High" (49.1%) or "Very High" (20.0%), indicating a considerable degree of challenge and competitiveness. This indicates that a substantial number of participants found the questions both stimulating and demanding, thereby achieving a competitive atmosphere during the battles. Following closely, 30.9% of participants described the competitiveness level as "Medium", indicating a perceived moderate level of challenge. This suggests a range of experiences among students, with a notable portion finding the questions moderately challenging. Importantly, no respondents indicated that the competitiveness level was "Low" or "Very Low". This absence suggests that the activity effectively creates a dynamic and stimulating learning environment where the level of challenge aligns with the diverse preferences and capabilities of the participants.

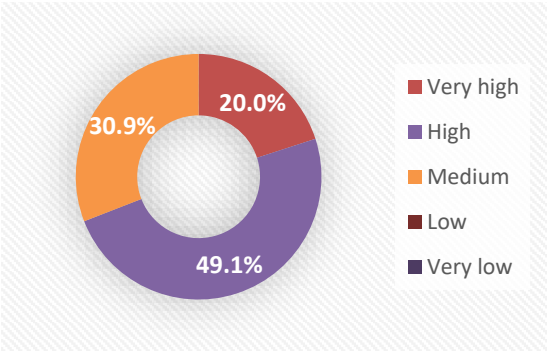


Figure 1. Students' perception of the level of competitiveness and difficulty of questions (QA)

The question related to the assessment of the activity impact on enhancing understanding and retention of subject concepts (QB) reveals a highly positive response from the participants (see Fig. 2). A substantial majority (72.7%) rated the impact as "Very high", highlighting a significant and effective influence on their comprehension and retention of the subject matter. Furthermore, 27.3% rated the impact as "High", reinforcing the overall positive trend. Remarkably, no respondents selected "Medium", "Low" or "Very low", indicating a unanimous consensus among participants that the activity had a substantial positive effect on their understanding and retention of the subject concepts. This clearly favorable response suggests that the activity successfully achieved the intended educational goals and was perceived as highly beneficial by the majority of participants.

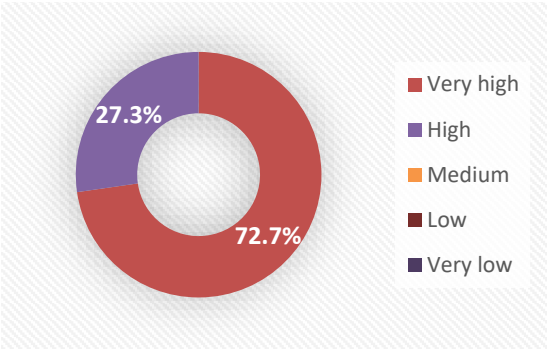


Figure 2. Student's perception of how the activity help them in the understanding and retention of subject concepts (QB)

The examination aimed at gauging the effect of the activity on enhancing team-building skills (QC) demonstrates a promising trend, as depicted in Figure 3. A considerable proportion of participants, comprising 91.0% of respondents, appraised the impact as either "Very high" (45.5%) or "High" (45.5%), signaling a significant positive influence on team-building skills. Conversely, a minor percentage of students (9.1%) evaluated the impact as "Medium". Moreover, the absence of responses in the "Low" and "Very low" categories underscores that the majority of participants encountered a substantial improvement in their team-building skills. The prevalent high and very high ratings for the impact of the activity on QC underscore its effectiveness in fostering collaborative abilities and dynamics within the teams.

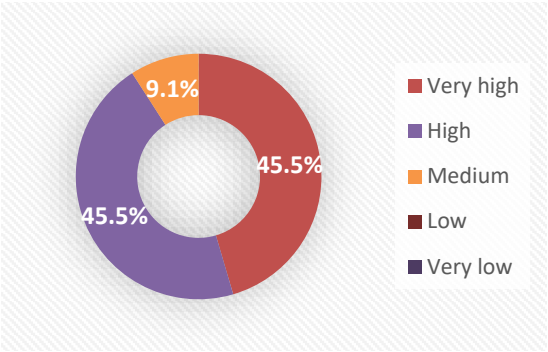


Figure 3. Students' perception of how the activity improved their team-building skills (QC)

The results of the question regarding the impact of the activity on improved communication skills (QD) reveal a generally positive perception among the participants. However, these results also highlight that the activity has not been perceived as overwhelmingly positive compared to the team-building aspect (QC). A majority of respondents perceived the efficacy of the activity in enhancing communication skills as either "Very high" (54.5%) or "High" (25.5%). While a

smaller proportion rated the impact as "Medium" (18.2%) and "Low" (1.8%); none rated it as "Very low." (see Fig. 4)

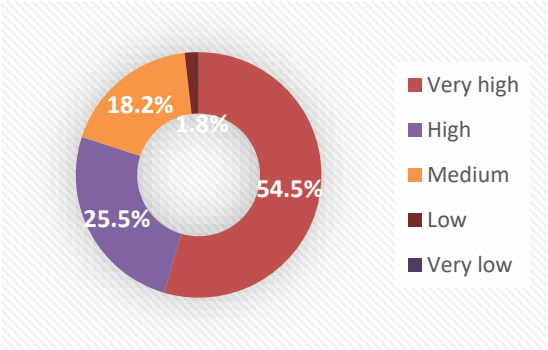


Figure 4. Students' perception of how the activity improved their communication skills (QD)

The results of the question that evaluated the impact of team-based questioning battles on overall motivation to learn (QE) revealed a notably positive trend (Fig. 5). A significant majority of respondents (69.1%) rated the impact as "Very high" and 29.1% assessed the impact as "High", emphasizing a strong positive influence on their motivation. Only a small percentage (1.8%) rated the impact as "Medium" indicating that the majority of respondents perceived a significant boost in motivation.

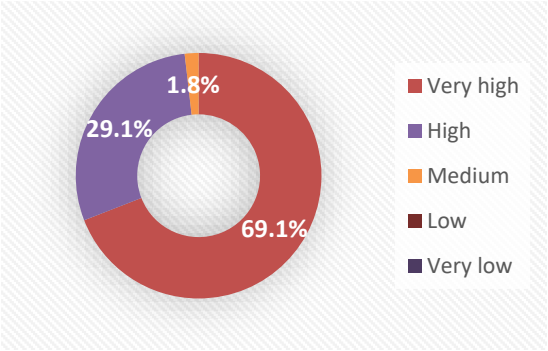


Figure 5. Students' perception of how the activity improved their overall motivation to learn (QE)

In summary, the analysis of the learning and motivation impact section presents a thorough and positive evaluation of team-based questioning battles as an educational tool. Students generated a competitive environment by formulating high-quality and challenging questions, such circumstance, together with the activity dynamics, contributed to heightened motivation to learn. This underscores the effectiveness of the activity in establishing a stimulating and engaging learning atmosphere. Furthermore, the activity was positively perceived as a tool for enhancing communication skills, but specially in improving teamwork.

Taking into account this feedback, it's crucial to highlight that while the proposed method is engaging and offers educational value, the activity is rather time-intensive. With consideration to class size, completing all rounds may consume up to three hours for a moderate-sized group. Repeating it frequently throughout the course could impede the timely progression of curriculum delivery and might diminish its novelty, potentially making the activity less stimulating or predictable. Drawing from our own experiences, we suggest integrating this activity either as a concluding session for the course or within a designated block of time.

4. Conclusion

This research offers valuable insights into the influence of Team-Based Questioning Battles on diverse aspects of learning and motivation. Unlike conventional educational approaches, the Battled method consistently garners recognition from participants for its positive impact on engagement, comprehension, information retention, team-building abilities, and overall enthusiasm for learning. Participants uniformly view the activity as highly competitive, fostering a dynamic atmosphere conducive to active learning and facilitating a comprehensive educational experience.

An important suggestion emerging from this study entails incorporating select battle questions into final assessments, presenting a potential pathway for the activity to contribute to formal evaluations and academic recognition. To maximize its benefits while ensuring the timely coverage of curriculum content, the study proposes a strategic integration approach, such as incorporating it as a concluding session for the course or within specific thematic blocks.

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BIM evolution of architectural teaching

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Abstract

The contribution refers to an experience of integrating IT (information technologies) within the single-disciplinary course of design of construction systems of the second year of the degree course in Architecture of Pescara (IT). The experimentation was conducted in order to verify the potential and limits of the use of BIM (Building Information Modeling) within the architect's training course. On the basis of the results achieved, it was possible to note various advantages brought by the use of these technologies, such as to give rise to some reflections on the scenarios of transformation of traditional teaching methods. Transformations necessary to intercept the educational potential offered by new multimedia project and communication tools, and to meet the ever-increasing demand of the construction and infrastructure european market, especially the public one, strongly oriented towards the digitalisation of processes.

Keywords: *Information technologies; Building information modeling; architectural teaching; building sistems design; digital skills.*

1. Introduction

The digital transition represents one of the main challenges that facing the economic and social system, in terms of simplification and automation of organizational processes, and in terms of information sharing and knowledge dissemination. The progressive integration of computerized data processing tools within traditional analog procedures, requires in addition to in-depth knowledge of the available software, a progressive and careful rethinking of methodologies and processes of analysis and control of results, necessary to ensure the consistency of outcomes respect to objectives. This makes it necessary to implement a comprehensive rethinking of programmatic, design, production and training approaches, so as to build a professional and operational scenario in which traditional skills are complemented by new professional figures, capable of driving and orienting the integration of new technologies. This need is particularly urgent in the construction sector, which over the past decades it was particularly affected by

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instances of change, toward greater and more efficient evolution in terms of digitalization, industrialization and sustainability of design and production processes.

2. Background

A concrete demonstration of this situation, is the strong push implemented by most member states of the European Union toward progressive digitalization of the sector (European Construction Sector Observatory, 2021). Push based on the three pillars consisting of the digital data acquisition (Internet of things, 3D scanning), the automating processes (use of robots, 3D printing and drones), the Digital information and analisys (BIM-Building Information Modelling, Digital Twins, Virtual and Augmented reality, Artificial Intelligence).The latter one, urges all project disciplines in the AEC (Architecture, Engeenering, Construction) sector to review their methodological and operational approaches, in light of ongoing technological innovation (Paris, 2023) based on policies initiated by national governments, and aimed at integrating BIM-oriented requirements within public procurement (Bolpagni, 2013; Popov et al, 2021). Policies culminated with the adoption of EU Directive 2014/24/EU, Article 22 of which states "For public works and design contests, Member States may require the use of specific electronic tools, such as Building Information Modelling.". A need also reiterated by the Strategic Research & Innovation Agenda 2021-2027, promoted by the European Construction, built environment and energy efficient building Technology Platform (ECTP), which identifies the deployment of digital technologies as the medium-term cross-cutting objective to be pursued (2030 agenda), in order to support policies for energy, ecological, sustainable and inclusive transition of built environment (ECTP, 2019).

Studies conducted at European level confirm that among of the causes of delay of Information Tecnoligies (IT) diffusion, emerges the lack of professionals trained in the use of technologies, especially in the early stages of design, where the use of digital tools could reduce project production time by 50%.

Studies also emphasize the need to change the current design approaches of professionals, in particular of architects, so as to conceive the entire project in a digital, informed and integrated manner (Salgado, 2022). The new experties required by digital transition concerns, in addition to knowledge of IT tools, the ability to coordinate technical skills that converging in digital BIM model (architecture, engineering, energy, sustainability and environment, manufacturing, economics and managent), as well as the management of digital information flows, validation and data security (European Commission, 2019). Studies also highlight the lack of this type of teaching within university courses (Charef et al., 2019), as well as some obstacles and methodological needs for the application of BIM.



Figure 1. Cross cutting dimension of the Digitalisation with other three objectives . Source:(ECTP, 2019)

2.1. Obstacles

In architecture degree programs, in particular, the use of BIM as early as the first years of the course is seen as potentially negative for students, because it could limit their creativity and take a long time to learn the tools instead of focusing on the project development (Almutiri, 2020). Two aspects in apparent contrast to the traditional conception of teaching, based on the pedagogical value of the design-lab, a place of communication and critical reflection between student and teacher, where students conceptualize their projects and visually represent the answer to the problem. (Green & Bonollo, 2003). However, at the same time surveys show that the students spend more than 65% of their time in the elaboration of traditional 2D method drawings. They starts drawing plans and only after these drawing elevations, sections and 3D views, limiting their three-dimensional perception of project (Almutiri, 2020). Moreover students use simple lines to represent building components (eg: windows, doors, walls) without including detailed information, such as the type of glass or the thermal properties of materials. Traditional method has also additional limitations related to the dependence on drawing skills, the difficulties of moving from conceptual diagram to a detailed design, the necessity to modify all 2D drawings (plans, elevations, sections) every time that will be introduced design changes, the high costs of printing and phisical models production (Salama, 2005; Ostwald & Williams, 2008). All operations that can be performed from the early design stages in the BIM environment (eg. Revit, Archicad, etc.), an interactive, information-rich and implementable methodology.

2.2. Operational approaches

The experiences reported by various universities gives some useful operational indications for understanding the approaches to be taken, in order to achieve a proper implementation of BIM methodology. The first relevant finding is the lack of effectiveness attributed to the teaching of digital technologies carried out in a stand-alone form, as teaching modules in which BIM is considered an autonomous technical tool respect to the " ... treatment of the other topics of disciplinary knowledge ... " (Anderrson, 2013; Sanpaio, 2018). More effective appears the implemetation of a progressive approach to the knowledge of IT for the project, considered as an interdisciplinary subject. An approach that can be start by a training, oriented to the use of tools, and then moving onto their use in disciplinary teaching experiences. Some authors also highlight the importance of articulating the teachings in theoretical seminars and application labs so as to "Mimic the working environment and conditions of real project construction, in order to promote students' ability to analyze and solve problems." (Agirbas, 2020). It is also worth highlighting the aspects of innovation introduced by these teaching methods, which tend to combine specific disciplinary teaching with assisted digital one and with a practice design-lab (Xu, 2018). A teaching model structured according to a multi-year sequence, that starts from the knowledge of 2D graphic tools, passes through solid volumetric modeling to arrive at the construction of an detailed BIM model, which is gradually enriched with new information, according to the logic of the LOD (level of Definition) and LOI (level of Information) introduced by the international standard ISO 19650/2019 and Italian UNI 11337/2007 and followings. A potentiality inherent of digital technologies, due of the possibility of managing all informations in a single virtual environment (the 3D-BIM model), of use this for the prefiguration of functional and spatial incompatibilities (architectural, structural, plant enginnering), of simulating the building's performance (visual, energetic, material, environmental), the construction costs and the facility management activities.

2.3. Feedback

The opinion of the students involved in the experiments is interesting. More than half highlighted the usefulness of BIM as a tool to facilitate the process of understanding and knowing construction systems. Approximately two thirds also noted better operational efficiency, productivity and respect for available times compared to the use of 2D traditional graphic techniques, thanks to the possibility of building the technical elements, and related functional layers, through the use of the parametric libraries and/or of the 3D-objects, developed by the manufacturing companies. Also teachers involved in the training based on BIM confirmed that its implementation helped the students to improve the information contents of their project, their level of knowledge, efficiency and communication, also allowing them to relate the project to the climatic context , to the structural and energy choices, to the materials and products used, in terms of performance and perceptive effects. In addition teachers said that

the teaching methodology adopted has reduced the gap between the disciplinary and digital courses, producing an effect of simultaneous knowledge learning (Agirbas, 2020; Almutiri, 2020).

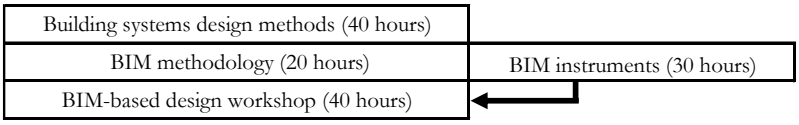
3. Application experiences

The framework of knowledge and operational indications provided by the experiences reported above, has allowed the development of a training proposal oriented towards the integration of information technology within the architecture technology courses of the five-year degree course in architecture in Pescara (IT). This integration concerned the introduction of a BIM-oriented course in the compulsory design of construction systems course in the second year (20 hours out of 100) and the creation of a BIM advanced design course among the disciplines of choice in the fifth year (60 hours). It should be pointed out that in this contribution, for the sake of brevity, the description of the activities carried out in relation to the second-year integrated course only will be developed below. The main objective of the second year integrated course is to accelerate the introduction to the use of a digital 3D approach in the understanding and development of construction solutions from the early years of training, so as to facilitate the overcoming of the limits represented by the complexity of the two-dimensional representation of architecture as much as possible.

3.1. Material and methods

From a methodological point of view, the didactic organisation of the course was divided into an initial 40-hour single-discipline theoretical module, aimed at acquiring knowledge related to the design of building systems. A second module of 20 hours was included to provide basic knowledge of the regulatory framework and related procedural approaches of the BIM methodology. A third module of 40 hours covered the development of BIM-based design workshop executions. At the same time, an additional 30-hour tutoring module was made available to the students, oriented towards the knowledge of BIM tools, in order to enable them to acquire, through the development of elementary case studies, an approach useful for the subsequent development of the BIM-based design workshop.

Table 1. Articulation of teaching modules



In particular, in the third teaching module, students were asked to design the construction solutions of a single-family house, defining its structural typology, the overall dimensions of the plant equipment, the stratigraphy of the envelope elements and the performance of the

constituent materials. BIM Revit© and/or Archicad© software was used for the development of activities related to the tutoring training module and the workshop. Furthermore, for the parametric design of construction solutions and the technical information of materials and products, in addition to the use of the libraries contained in the two software packages, reference was made to BIM Object databases (www.bimobject.com, www.bim.archiproducts.com, www.bim.cic.hk, www.bimcomponents.com) as well as manufacturers' data sheets. Finally, in order to facilitate the adoption of the new design approach in a digitally informed environment, the construction details of architectural works on the Detail Inspiration platform (https://inspiration.detail.de/projekte.html) were drawn upon.

3.2. Results and Discussion

The experimentation conducted, allowed us to validate what was stated by the studies developed by the other authors mentioned above. It also consented to appreciate how the parallel development of methodological and technical-applicative knowledge (tutoring), allowed students to accelerate learning processes and develop a fair degree of autonomy in the management of digital projects, finding particular benefit in the use of three-dimensional objects for the construction of technical elements. Benefits able to carry out an immediate interference and collision check of individual elements (e.g. beams and columns) directly in the 3D environment, thanks to its spatial visualisation. In this sense, the use of the object libraries, already catalogued by building sub-systems (structures, closures, partitions, installations) allowed them to become immediately familiar with the various types of products used in construction, and with their geometric and performance characteristics, which are shown in the information sheets associated with the individual BIM objects. Even the determination of the functional layers and materials to be used for the construction of the envelope (walls, roofs, etc.) has been made more intuitive by the possibility of combining the layers by subsequent addition into a single multi-material object (e.g. the wall), simply by selecting them from the library. All this while working within the same BIM model, without having to produce the complex quantity of written-graphic drawings required in the traditional 2D method (plan, section, exploded and axonometric views, details, technical data sheets), and thus being able to concentrate more on the design choices rather than on the drafting/editing/continuous updating of drawings..

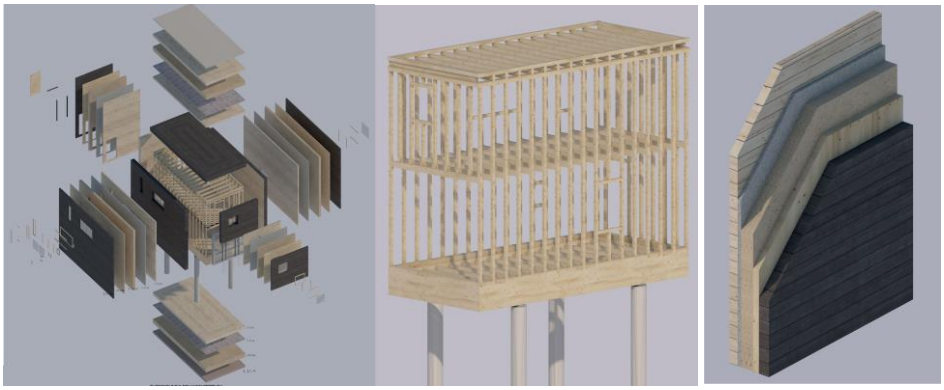


Figure 2. Some results of the design exercitations

4. Conclusions

The results obtained, although limited to the field of investigation of building systems design, highlighted the usefulness and unreliability of the use of IT in the building sector and also challenged traditional methods of project communication, which are too static to be able to render contemporary information complexity. They did, however, provide useful pointers for the development of the subsequent training courses in the fifth year (BIM advanced design course) in which approaches oriented towards structural, energy and environmental simulation and their disciplinary connections will be applied, or alternatively, to the temporal planning of interventions (4D), cost estimation (5D), management and facility management in the building life cycle (6D) and sustainability (7D).

Author Contributions

Conceptualization, AB; methodology, AB; formal analysis, AB and EDG; investigation, AB and EDG; writing-original draft preparation, AB; writing-review and editing, AB; visualization, AB and EDG; supervision, AB. All authors have read and agreed to the published version of the manuscript.

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Innovative Engineering: Developing Laser Manufacturing and Optical Detection Systems

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Abstract

The Master's Degree in Industrial Engineering at Escuela Técnica Superior de Ingenieros Industriales, Universidad Politécnica de Madrid (ETSII-UPM) integrates a series of compulsory subjects known as INGENIA (ENGINEERING). These subjects aim to cultivate students' ability to design and construct systems and products that address societal needs, emphasizing a project-based learning approach. The Laser Manufacturing and Optical Detection Systems INGENIA topic, introduced in the 2017-18 academic year, focuses on applying theoretical knowledge in optics, electromagnetism, and mechanical engineering to practical scenarios. Students work in teams to develop and implement innovative laser manufacturing or optical detection systems. Beginning with proposal development and culminating in system fabrication and testing, students engage in hands-on learning experiences guided by faculty. This paper outlines the methodology and outcomes of the Laser Manufacturing and Optical Detection Systems topic, highlighting its role in bridging theoretical knowledge with real-world engineering applications.

Keywords: *Laser Technology; Optics; Industrial Engineering; CDIO.*

1. Introduction

The curriculum of the Master's Degree in Industrial Engineering (MII) of the Escuela Técnica Superior de Ingenieros Industriales, Universidad Politécnica de Madrid (ETSII-UPM) incorporates a type of compulsory subjects that have been generically called INGENIA (ENGINEERING). The basic guiding principle of these subjects is to develop in the student the

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ability to design and build systems and products that solve the needs of society. It could be said, in a simple way, that these subjects are based on the engineering student doing engineering.

This initiative, approved by the Spanish Agency for Accreditation (ANECA) and the Accreditation Board for Engineering and Technology (ABET), gathers the learning competencies of this level of expertise by combining the project-based learning strategy with the learn-by-doing focus (Hernández Bayo et al., 2014).

These types of subjects have an important international reference within the CDIO initiative, which has been promoted by MIT in the United States and by Chalmers University and other Swedish universities in Europe (Kjersdam et al., 1994; Crawley et al., 2017). The acronym CDIO refers to the starting point of this initiative, according to which engineers should be able to Conceive, Design, Implement, and Operate engineering systems in modern team-based work environments (CDIO, 2023).

To achieve these objectives, students must master a complex and changing body of technical knowledge. Young engineers must also possess a broad set of personal skills that will enable them to successfully work in companies and organizations. To achieve this, CDIO member institutions advocate the incorporation into their curricula of learning experiences that lead to the development of the required personal and interpersonal skills in students, while developing their ability to conceive, design, implement, and operate products or systems, see ABET 2023. The INGENIA courses of the Master's Degree in Industrial Engineering have a conception that is very much in line with the CDIO approach (Mtz. Muneta et al., 2020).

The principle that defines the INGENIA courses is that they are based on the student's approach to the realization of a project, system, or product in the field of engineering, taking into account a series of restrictions or requirements previously defined and working and taking into account situations similar to those that may occur in a real professional environment.

These are, therefore, subjects in which the realization of projects or developments within the field of engineering is addressed from the first phase of conception and design to the final phase of implementation and operation. Depending on the complexity of the proposal, some courses may decide to limit the activity to the design phase or to reserve implementation only for the best designs.

This type of approach should facilitate the transition from theory, taught in other subjects of the curriculum, to practice. On the other hand, it is based on posing open-ended problems that deal with complex situations in which there is no single predetermined correct answer.

It is made up of different topics, although each year new topics are proposed, and some disappear or change their scope, and new ones are added. The following topics were offered in the 2022/23 academic year: Industrial Applications of Acoustic Engineering, Computer-aided Engineering, Development and management of industrial construction projects, Design of intelligent systems

with robots and AGV, Bioengineering Design, Design and Simulation of a Pressurized Water Nuclear Reactor, Circular Engineering, Engineering an electrical system, Automotive engineering. Design, manufacturing, testing, and demonstration of a vehicle for Formula SAE competition, Systems Engineering, The School of the Future - Smart ETSII, Motor-Gen: Design and manufacture of a thermal engine, Machine project, Traditional forging manufacturing, and Laser manufacturing and optical detection systems.

The present contribution is aimed at the last of these topics: Laser Manufacturing and Optical Detection Systems which was started in the 2017-18 course.

This topic is oriented to enhance the practical application of knowledge acquired throughout the degree, especially concerning topics of Optics, Electromagnetism, and Mechanical Engineering, using a project-based learning approach. Students will work in teams living the complete process of development of the machine/system proposed and designed by themselves, not only from the technical point of view, but also from the economic one, addressing all its phases, from the choice of the process (and its study in bibliography), the conceptual design of the machine/system with its specifications booklet, the integration and manufacture of the same, and its final test to verify compliance with the specifications initially raised.

2. Materials and methods

In order to start this course, there is an initial outlay to acquire equipment (from calls for equipment and from the department's own funds), but the material is reused every year (except for consumables, electronic components, plywood, paint, etc.) and the annual cost is less than €500. The course also uses calls for teaching equipment and the existing infrastructure at the university (mainly the UPM Laser Centre).

The Laser Manufacturing and Optical Detection Systems INGENIA topic aims to provide students with a systematic methodology for the development of these systems.

Students will have a first phase of training to complement the training received in the Degree, they will be introduced to the operation of lasers with a reminder of Optics and Modern Physics, and they will be introduced to the different Types of Lasers and Laser Systems (laser together with the beam and part delivery system) available in the industry and a brief introduction to the physics of Laser-Matter Interaction. This training allows them to take a course on "Laser Safety Training" which enables them to work with lasers in the laboratory. Finally, they are introduced to Industrial Applications of Lasers and Optical Characterization Techniques to provide them with ideas and examples on which to base their system.

At the end of the first month of fundamental classes, students will be grouped into teams of 2-3 members, each tasked with developing a proposal for an innovation. During this phase, they

will receive limited guidance from professors, encouraging creativity in identifying the innovation's purpose rather than focusing solely on technical details.

Following this, presentations will be conducted, and students will vote on the best ideas, which will proceed to the next phase. The feasibility of selected ideas will be analyzed by the faculty, and students whose ideas are not chosen may join other teams. Subsequently, students, divided into groups of 5-7 individuals, will work collaboratively on the laser fabrication or optical detection process proposed in the previous phase, developing a complete system for the intended process.

Drawing inspiration from literature, including patents and designs of similar machines, students will design cost-effective, simplified versions of the proposed machines while adhering to their specifications.

Once the desired laser process/optical device is selected, students will proceed to work on its design. They will be guided through a series of steps, including understanding the process, determining the necessary laser/lighting source, defining the beam handling system or movement system if necessary, designing the optical path, and establishing safety elements.

Following the conceptual design, students will present their designs, specifications, and estimated costs. The faculty will then suggest simplifying the systems for scale models, ensuring they retain key features while reducing costs and risks.

After simplification, students will proceed to fabricate the system, which involves designing the scaled system, selecting components, integrating and assembling the system, and conducting tests to validate its performance and adherence to specifications.

Upon obtaining the demonstrator, students will present it to their peers along with specifications, validation test results, and the final system cost.

The final grade consists of two parts: Team grade (80%) – obtained from different tests and presentations given to assess the progress of the teams and from the assessment linked to the final project and Individual grade (20%) - based on individual performance in the development of the system and peer evaluations to assess how individuals perform within the teams.

Since the beginning of this subject, no student has failed it (except in cases of abandonment for reasons unrelated to the subject) and most of the groups have achieved an excellent result.

3. Projects completed along this INGENIA years

Since the beginning of *this* Ingenia, several ideas have been brought to fruition. Far from building a fully industrial system, the idea behind the INGENIA goal is to develop project-related skills - such as strengthening teamwork or improving project presentations - as well as some engineering skills - planning and developing a design and implementation project.

These student-led projects fall into three main categories related to the focus: External Problem Solving, Process Implementation, and System Development. Two projects in each category were selected from the different years of this INGENIA.

3.1. External Problem Solving

These projects focus on finding a solution to an external problem, usually proposed by the students because they are aware of it. The main difficulty is in finding a solution, and the focus is not on obtaining the best process parameters or developing a final system. Two projects have been selected to illustrate this category:

LaserDry (2017-2018) was a two-stage station for studying laser drying in the automotive paint process. As the automotive industry moves to water-based paints, the drying process must use large ovens that consume a lot of energy. The proposed solution was to use local drying with lasers. The system is a combination of paint spray and laser heating. Electronic control allows the part to be moved from the painting stage to the laser curing stage. This project was designed for 2D top patterns in a first approach.

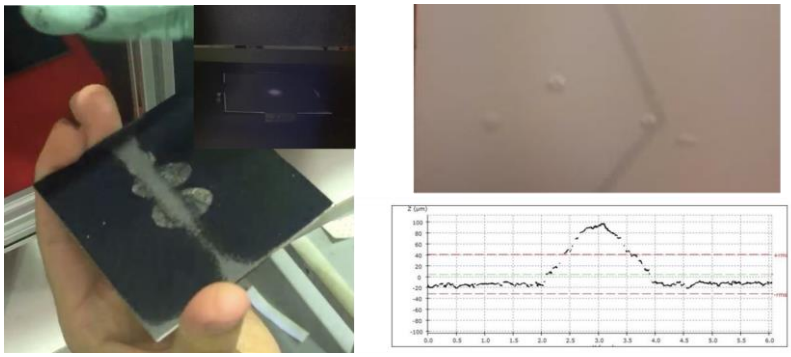


Figure 1. Left. LaserDry (2017-2018 course) shows that the laser-treated area has dried the paint. Right. Braisser (2019-20) example of Braille dots created by the laser.

The Braisser (2019-20) team focused on finding a solution to write Braille to help teachers with students suffering from visual problems to be able to generate study material without the need for an external organization (in the case of Spain, this was done by ONCE). The project worked on finding a material and a laser process that would allow the generation of a 3D dot (with the specifications of the Braille system). The chosen solution was a foaming process: the interaction of a laser beam with a material (typically a polymer) can cause it to inflate in the shape of a small bubble - can be used to write in the Braille system, taking advantage of the flexibility that a laser beam gives.

3.2. Process Implementation Projects

These projects focus on extending the capabilities of existing equipment to meet the needs of a specific application, usually requiring some adaptation and incorporation of new elements. The main difficulty is in finding the process parameters and there is less focus on system development. Two projects have been selected to illustrate this category:

LaserJeans (2018-2019) project is an alternative to traditional denim distressing processes commonly used in the apparel manufacturing industry. Currently, the predominant method used worldwide to achieve this distressing effect is sandblasting, which is associated with significant water consumption and a notable risk of silicosis. However, a Spanish company has introduced the innovative approach of using lasers for this purpose. This project achieved the desired distressing effect on denim fabric using a 5W CW IR laser (a very cheap laser with specifications worse than those used in the industry), see Fig 2 left.

The Laserust (2021-22) team worked on laser rust removal, which is a superior alternative to manual and chemical cleaning methods. Laser cleaning produces minimal airborne dust, which can be easily removed with an exhaust system, minimizing cleanup time and maintenance. In addition, the process eliminates the need to replace cleaned items, promoting reusability. Utilizing fiber laser pulses ensures minimal energy consumption, contributing to environmental sustainability by replacing chemical-intensive methods and reducing material waste and energy consumption, see Fig 2 right.



Figure 2. Left. LaserJeans (2018-2019) example of laser drawing on denim fabric. Right. Laserust (2021-22) example of laser rust removal showing their logo.

3.3. System Development Projects

System development projects focus on the industrial implementation of a technology, either at full scale or scaled down as a prototype. The main difficulty is the design and implementation of a working system, as the process parameters are already known or not very time-consuming. Two projects have been selected to illustrate this category:

BraccioBeam (2017-2018 course) (fig.3 left) resembles the processes in the automotive industry involving a robotic arm for 3D parts processing. In this approach, the students built a scaled workstation for laser engraving –which is, in brief, a downscaled process for cutting and welding–. The pattern was predefined in CAD software. The project not only involved the laser system but also the safety parts surrounding the laser equipment, such as the enclosure, an electronic interlock, an optical window to oversee the process… Though the electronic control was not smooth, it was enough to engrave patterns onto sensitive materials.

A permanent laser marking system was designed for the project Movilaser (2019-20), but they were not able to finish it due to COVID-19. The final design and construction were done the following year by the Laserange team (2020-21) (fig.3 right). Traditionally, laser engraving machines are heavy and difficult to transport. Through this idea, a nanosecond fiber laser was mounted on an aluminum profile structure to build a desktop engraving machine. Its size and weight have been specifically optimized to have a portable machine that can be used as a demonstrator in the industrial fairs done in ETSII-UPM. The machine is fully functional, including a laser and a scanner, a safety enclosure, and some aesthetic elements such as LED lighting strips. It is used by new teams to develop processes and to upgrade the system (safety elements, cameras, ...).

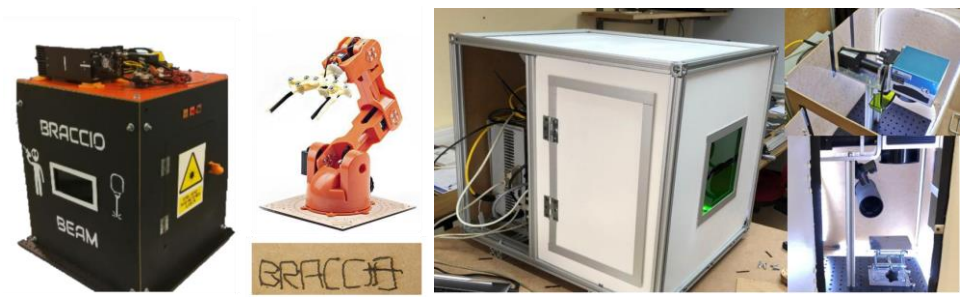


Figure 3. Left. BraccioBeam (2017-2018 course) laser with a robotic arm for 3D parts processing Right. Movilaser (2019-20) and LASERANGE(2020-2)1 laser engraving machine.

4. Conclusions

In conclusion, while the Industrial Engineering curriculum at ETSII-UPM covers a broad spectrum of industry-related science and knowledge, the intricate details of technologies such as laser technology cannot be fully expounded due to constraints in curriculum planning. Despite this, laser technology plays a significant role in industry, with only a fraction of its potential being addressed within the curriculum.

The formation of interdisciplinary groups comprising engineering students from various specialties offers a broader perspective when tackling complex problems. This approach encourages students to identify challenges and devise innovative solutions, thereby honing the skills demanded by the industry.

Engaging in hands-on, learn-by-doing subjects provides invaluable opportunities for students to navigate the professional process of product or service development, while also delving into topics not typically covered in the standard curriculum.

The Laser Fabrication and Optical Detection Systems INGENIA course enriches the educational journey of engineering students by immersing them in optics, electrical and electronic design, programming, business acumen, and communication skills within a collaborative learning environment. Furthermore, the students also acquire indirect competence in laser technology. Feedback from course evaluations consistently reflects high levels of student satisfaction across all these years.

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Making the invisible visible: Augmented Reality and Distributed Optic Fiber in educational Structural Engineering labs

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Abstract

In the present work a framework for the implantation of Augmented Reality in educational labs within the structural engineering field is presented. In order to close the existing gap between theory and practice in engineering courses, lab activities have been always an important media. However, due to the associated costs, both in time and economic resources, particularly in structural engineering where the test elements are big, the use of such labs is declining. Therefore, new approaches that enable the maximisation of the use of such resources while enhance the student's learning are paramount. In this regard, new technologies such as Augmented Reality, combined with top-notch sensing technology, applied in such lab activities are devised as a key step in that direction.

Keywords: *Educational labs; Augmented Reality; Enhanced learning; Structural Engineering*

1. Introduction

Structural engineering is the branch of engineering that takes care of the design and analysis of a large part of society's civil infrastructure such as roads, tunnels, bridges, dams, harbour piers, etc. Consequently, one of the main objectives of structural engineering courses in higher education is to provide students with the necessary knowledge and tools to be able to design and analyse different types of structures.

However, one of the persisting problems that have been identified in the assessment activities within structural engineering courses is that most students are unable to repeat a certain task or exercise as soon as minor changes are introduced in the assignment. This is indicative that students fail to grasp the physical meaning behind the equations and tend to memorize procedures without understanding the concepts, meaning they might succeed in passing an exam

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but fail in reaching the intended learning outcomes. Given that the theory and fundamentals in structural engineering have remained nearly unchanged for the last 150 years, the current problem cannot be attributed to the content of the subject. In trying to identify possible ways in which the learning process of the students could be improved, two main aspects have been considered: the media and the method.

Regarding the media (PowerPoint presentations or books), in the past, it had been hypothesized that did not play any significant role in the student's achievements and media were considered mere channels to carry information, see e.g. (Clark, 1983). Conversely, subsequent investigations postulated that the media influence the learning process of some students (Kozma, 1991). Today, there seems to be a general agreement that certain media, or combinations of them, can be more effective than others depending on the type of content to be communicated (Bates, 2015).

Additionally, as recently pointed out in an opinion article published in a Swedish online news website (Nandorf, 2017), one of the causes of the high number of dropouts in engineering compared to other subjects is that the content of the courses does not match the students' expectations. This situation could be partly due to the large amount of math courses that students need to go through during the first year, but it may also be attributed to a missing link between theory and real-world applications in more subject specific basic courses.

In this regard, educational lab activities are presented as a good solution to close this gap between theory and reality (Breunig, 2017; Gadola & Chindamo, 2019; O'Brien et al., 2021; Regev et al., 2008). However, due to large costs associated to lab within structural engineering courses, both in terms of economic resources and time, where the testing specimens are typically large, e.g. structural components such as beams or walls of several meters, a common trend has been to either eliminate them from course syllabus or replacing them by other activities such as Finite Element Modelling (FEM), which are typically more cost effective. In an effort to promote and recognising the added value of such occasions in order to help the students to meet the different learning outcomes of the course syllabus, the department of Architecture and Civil Engineering, and particularly the division of Structural Engineering, has made important efforts to introduce more lab activities in their courses and develop them to strengthen the outcomes and benefits of such activities in the students' learning. However still one of the biggest problems related to testing in the lab is how to enhance the students' learning, hence, how to maximise the ratio effort (economic and time) to benefit, or in other words enhance the students' learning deepening in the learning outcomes covered by the activity.

On top of that, an obvious limitation of a lab testing activities, is that it can be difficult to connect the background theory with what is happening in the element now of the lab occurs. An obvious reason that explains that is that typically the naked eye observations are quite limited. If that is true that they provide a different perspective form the observed phenomena, to couple the

observation with the background theory or even with the internal response of the element, is not straight forward, what needs some level of abstraction and understanding about the topic.

Therefore, in this manuscript it is presented an implementation of a series of new enabling technologies that reduces such limitation and hence significantly enhances the outcome of the lab activity. In this regard two set of technologies are implemented; first the use of Distributed Optic Fiber Sensors (DOFS) that allows for a thorough description of the strain distribution inside the beam and second the use of Augmented Reality (AR), which combined to the DOFS data allows for making the invisible visible, enabling a different perspective of the test.

2. Theory and method

2.1. Sensing technology

As previously mentioned, one of the main problems of the current lab activities in education is the complexity to link the internal response of the structural element with visual observations. By implementing a distributed network of sensors to collect and transfer data regarding the real-time state of the structure, it is possible to know more of the structure response. In this regard, DOFS, based on Rayleigh scattering, is devised as good alternative for the activity purpose; systems using this technology can deliver unprecedented spatial resolutions, reaching down to the sub-millimetric scale, and thereby offering new possibilities for the development of damage detection and condition assessment.

2.2. Real-time web-based condition monitoring

A promising approach to obtain a deeper insight into the behaviour and condition of our element is the use of the so-called “digital twins”. A digital twin is a virtual replica of a physical asset that combines numerical modelling and updated sensor data to simulate and visualize the behaviour of its physical counterpart in real-time. In this study, our own concept of digital twin is developed, tailored to the educational lab activity needs. The concept relies on DOFS for the collection of data, cloud computing, and a web-based application as the user interface for the retrieval and visualization of results. The developed framework delivers the information in a clear and straightforward manner in near-real time, which is valuable for the students to better meet the learning outcomes. The system’s architecture devised in the present work can be divided into three main modules: Monitoring Module, Analysis Module, and Interface Module.

The Monitoring Module comprises the elements required to acquire measurements of physical properties of the structure, namely the sensors and the interrogator, as well as the devices used to enable remote access to the data, i.e., a gateway or router and a server. All the elements in the Monitoring Module must be physically placed at the location of the structure being monitored.

The Analysis Module includes a computer with specifically developed algorithms used to pre-process, analyse and post-process the sensor data received from the Monitoring Module. Thereafter, both the pre-processed and post-processed results are transferred and stored in a database from where data can be served to an external client on demand.

The Interface Module includes the elements that enable users to access and interact with the digital twin. In this study, a web application has been developed using different open-source frameworks and libraries to implement the front-end and back-end. The system's architecture showing the interconnection between the three modules and its components is schematically depicted in Fig. 1.

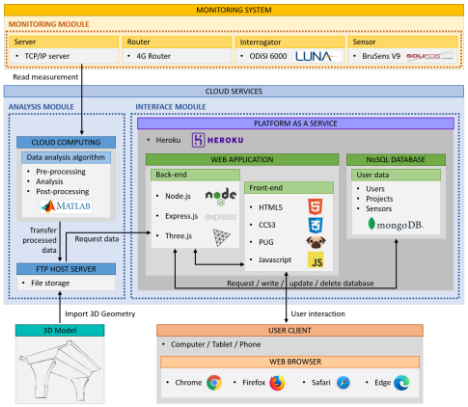


Figure 1. Schematic representation of the web-based asset management system's architecture.

2.3. Data analysis and visualization

A case study of a reinforced concrete beam subjected to flexural loading similar to the elements used in the structural engineering lab at Chalmers University of Technology is described to show the applicability of the presented system.

2.3.1. Beam geometry, loading and sensor deployment.

In Fig. 2, the geometry, test-setup and sensor deployment are carefully depicted for the reinforced concrete beam used in this case study. Further Digital Image Correlation was used as a reference system to validate the proposed methodology.

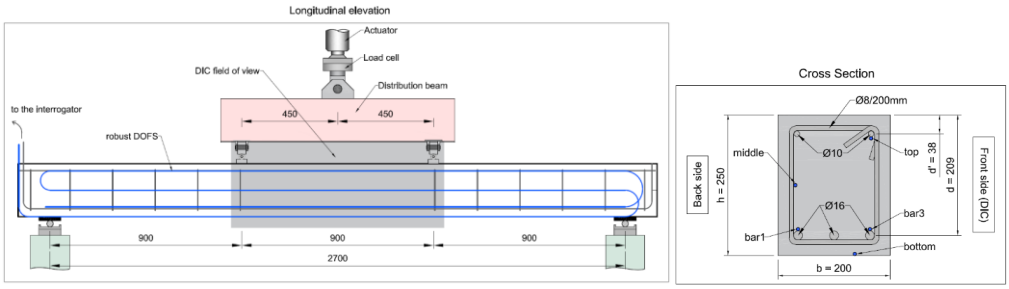


Figure 2. Geometry, loading setup and DOFS installation configuration for the RC beam specimen.

2.3.2. Analysis of sensor data

In most cases, raw sensor data do not provide useful information that can be directly interpreted. Therefore, the collected data must be processed and analysed to increase data value. For this concept, based on Euler-Bernoulli beam theory, the curvature distribution of a beam can be obtained by deriving two times the deflection with respect to the spatial coordinate along the beam axis. Consequently, a method has been implemented to back-calculate the beam deflections by integrating the curvatures twice, obtained from the strains measured by DOFS, and applying the right boundary conditions, i.e., zero deflection at the supports.

Further, it has been previously shown that the existence of cracks is evidenced in the strain measurements of DOFS embedded in concrete by the presence of strain concentration peaks, as illustrated in Fig. 3, and compared to the DIC measurements. The gradual merging of the strain peaks is likely due to the progressive deterioration of the steel-concrete bond with increasing load. This observation suggests that crack detection should be performed as a recurrent process taking the load history into account.

Subsequent to crack detection, the estimation of the crack width is addressed. A method proposed by the authors in (Berrocal et al., 2021), which is based on the mechanical models included in current structural design codes, is used in this study. The proposed method can be effectively used to estimate the crack width of individual cracks provided those are correctly identified and isolated by the DOFS.

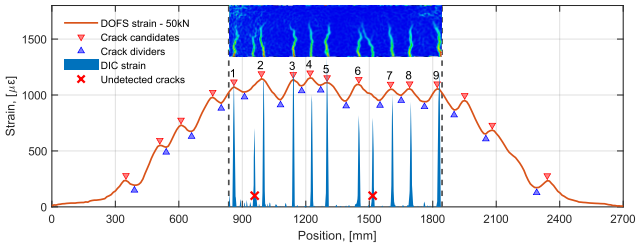


Figure 3. Determination of crack location based on DOFS.

2.3.3. Data post-processing for improved visualization

For this method to be useful to the students and the data to be of practical use, the analysed data must be conveyed in a clear and accessible way. One of the most straightforward and intuitive ways to present this type of data is through contour plots. The development of such contour plots requires that DOFS measurements are available in at least two levels, or in this case heights of the beam, where the greater number of levels will produce more accurate contour plots. In this case three different contour plots were considered relevant for the comprehensive behaviour of the beam behaviour: 1) strain distribution along the beam, 2) deflection distribution along the beam and 3) crack distribution and propagation. The first two can more or less be obtained directly from the DOFS measurements, i.e. assuming Bernoulli Theory as previously described, both strains and deflections can be computed as a linear interpolation in the direction of the beam height for each longitudinal coordinate. The later requires transforming the strain profiles into crack profiles, which hold the relevant information about all the cracks, i.e., their position and width. This is achieved through "crack functions" the value of which is zero everywhere except in the vicinity of the cracks, where they present a peak of value equal the width of each crack. Further information about this procedure can be found in (Berrocal et al. 2021).

The crack contour plot obtained after completing the entire post-processing of the cracks is shown in Fig. 4. As observed, the result of the described procedure provides a quick and straightforward way to read critical information about the cracking condition of RC elements.

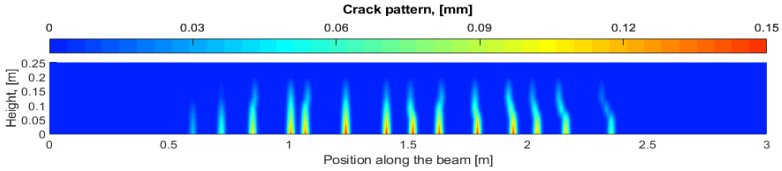


Figure 4. Visualization of crack width and position in the beam

2.4. Augmented Reality

In recent years the interest in Augment Reality (AR) for different applications has significantly increased, mainly driven by new hardware, such as Microsoft Hololens, as well as availability of feature-rich AR frameworks for mobile phones and tablets, such as ARKit (Apple) and ARCore (Google). Additional recent efforts have devoted to bring AR to the web through a new web-based AR framework called WebXR, which opens for the possibility to support a wide range of devices with a single source code.

Therefore, a web-based solution based on WebXR was chosen in this application for the AR-tool. In order to render the plots, the web-rendering framework Three.js was implemented. An important challenge when using AR and data visualization overlayed is the alignment between real element with its virtual representation in order to present and augment accurately the sensor

data. In this particular case, the WebXR framework utilises three aspects that allows the tool to locate the user/camera in the space and therefore identify objects for further interaction.

Anchors. Modern AR systems use a technique called simultaneous localization and mapping (SLAM) to construct an internal 3D representation of the environment. Instead of a fixed position in space, anchors provide virtual positions in relation to physical locations. That is, relation between physical and virtual object are prioritized before absolute positions in space.

Image and marker tracking. WebXR provides functionality to track images or more typically "markers", like a QR code. During the session, WebXR will identify the previously stored images and provide information when detected such as position and orientation.

Alignment. Placement and alignment of virtual objects can be done in several different ways. A common approach to proceed with the alignment is to control where a virtual object should be placed by using a "marker"/image. The WebXR session will then detect and track this image and report a position in 3D-space where a virtual object should be positioned and rendered.

3. Results and discussion

In order to simplify the 3D plotting in the real-word space, a marker-based solution was chosen. As illustrated in Fig. 5(a), this approach requires two markers to be placed equally apart from the edges of the beam, so that a mid-point between the markers identifies the origin of the global coordinate system. Theoretically a single marker would also work well, in practice it would be more sensitive to any tilting of the images and therefore two markers were preferred due to the length of the specimen. Hence, once the two markers are identified, the virtual beam can be positioned at the real-world origin. So, in order to align the virtual and physical beam, the user only needs to make sure that the mobile device detects the two markers, as seen in Fig. 6. Upon detecting the images, two anchors are created internally, and the virtual beam is aligned to the real one, hence a wireframe 3D model of the beam is displayed, see Fig 6(right).

A user interface was specifically developed in order to be able to plot the relevant data. WebXR was chosen as framework for the AR interface as it allows the use of conventional Hypertext Markup Language (HTML) and Cascading Style Sheets (CSS) to define and style a web interface and then renders all the graphics as an overlay to the AR interface. As illustrated in Fig. 5(b), the simplified interface makes is possible to display strains, cracks, or deflections using a contour plot overlay with max and min values presented. In addition, it is possible to select a specific timestamp using a slider in order to retrieve time-history data. Using this interface, it is then possible to walk around freely and inspect any part of the beam at the same time as strains, cracks, or deflections can be visualized for specific load levels.

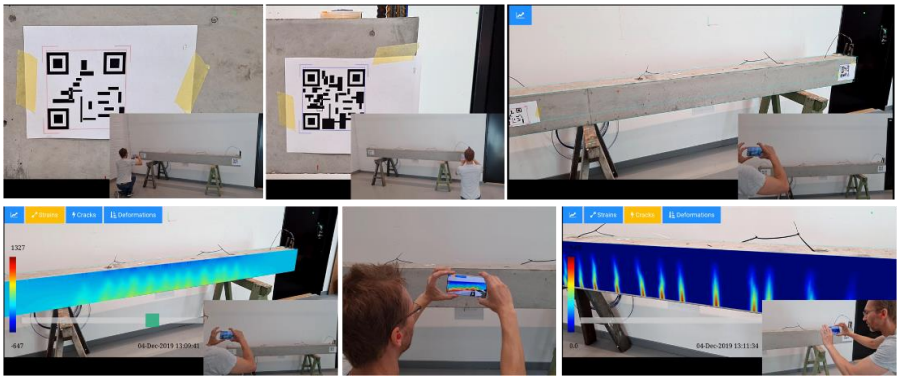


Figure 5. (a) Procedure to align the real and virtual beams in the AR tool using two markers. (b) The AR Tool interface (https://youtu.be/y8yFHzpmzI8)

4. Conclusions

This work explored the possibility to enhance traditional educational lab activities with novel enabling technologies to increase the student's learning of structural engineering courses. The following conclusions can be made:

- The incorporation of AR in educational lab activities opens for a vast number of possibilities in order to convey better the different learning outcomes, to establish stronger links theory/reality and in summary to maximize investments (both time and economic).
- In the current iteration of the tool, deflections, strains, and crack development are quasi real-time visualized and overlayed on the beam through AR. This already allows to show aspects of the structure behavior that were not possible to see else. However, the possibilities to show more detailed aspects such the sectional behavior of critical cross-sections, in combination with the material response together with the actual beam are huge.
- Even though that the activity has only been conducted once and no direct assessment comparing the lab with and without the AR implementation is carried out, the students showed appreciation and a better understanding with on-site questions about the different observations.

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Small Space - Low Budget. Designing an Innovation Lab for Lecturers in Higher Education

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Abstract
Driven by the rapid pace of social and technological changes, innovation plays an increasing role in the higher education system. This requires an ongoing and permanent commitment and engagement of the academic community. Against this backdrop, bringing communities together and providing space that fosters creativity and collaboration in universities can play a key role in promoting innovation in higher education. A Centre for Teaching and Learning at a German university has set up an innovation lab for the innovation of courses, study programmes, and exams. It is designed for collaboration, presentation, visualising ideas, and producing media content. Issues of restricted space and budget were solved by a creative use of resources. This case-study describes the theoretical considerations, as well as the initial phase of planning from strategic intention to physical embodiment. The experiences in implementing an innovation lab are reflected. In addition, first user impressions and lessons learnt are reported.

Keywords: *space; innovation lab; communities of practice; higher education*.

1. Introduction

Innovation is inherent to the higher education system. Driven by social and technological developments, current best practices in teaching and learning at universities have been evolving over decades. What is new is the pace of innovation cycles. Global issues, such as climate change or Artificial Intelligence are putting pressure on institutes and faculties to implement new curricula, teaching methods, and assessments.

University leaders and education policymakers are responding to this with a range of policies and programmes. Such fundings provide valuable impetus for innovation in higher education. To implement ideas that lead to sustainable innovation, however, it takes an ongoing and permanent commitment and engagement of the academic community. Nerantzi (2016) therefore uses the analogy of gardening where - like an ecosystem - innovation in teaching "is more likely

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to flourish when individuals with shared interests and complementary skills interact in effective and creative ways with each other and with their environment" (p. 64).

Against this backdrop, bringing communities together and providing space to foster creativity might play a key role for innovation in higher education (Nerantzi & Thomas, 2019). Indeed, in recent years academic developers have been convening, facilitating, and maintaining communities of practice (Nerantzi, 2016), and have supported them with helpful resources (Hawelka & Bachmaier, 2023). However, little attention has been paid so far to the need for adequate space that - like a greenhouse for ecosystems (Nerantzi, 2016) - supports communities in designing innovative and creative pedagogical concepts (Winks, Green & Dyer, 2019).

2. Space as catalyst for innovation

Spaces can serve as "organisational catalysts for innovation" (Schiuma & Santarsiero, 2023). That is why leading innovative companies have been successfully setting up innovation labs for years. Meanwhile, there is a large body of evidence that such innovation labs can foster collaboration, creativity, and thus enhance the efficiency of innovative processes (Moultrie et al., 2007; Schiuma & Santarsiero, 2023).

In a university context, however, only a few lighthouse projects (i.e. the Teaching Lab at the University of Delft) have assigned significance to such physical resources in order to foster innovative work among faculty. Of course, such architecturally sophisticated innovation labs based on industrial models are unaffordable for most public funded universities. However, as De Paoli and Ropo (2017) state, "creativity can flourish in different kinds of spaces with a variety of aesthetic features" (p. 164). What counts is the balancing between design and needs of the user.

3. Planning an innovation lab for faculty

At the University of Regensburg (Germany), we set up an innovation lab for faculty with very limited financial and physical resources. We had a fully-equipped videostudio (including several camcorders, microphones, a teleprompter, a lightboard and an interactive smartboard) and three fixed rooms at our disposal, ranging from 30 to 65 m² with a total of 156 m², as well as a budget of 50.000 Euros. The following paragraphs describe the initial phases of this process according to Osario et al. (2019), from strategic intention to physical embodiment.

3.1. Strategic intention and conceptual considerations

The innovation lab was initialised in 2023 by the University's executive board. It aims to support faculty with space (rooms, tangible and intangible infrastructure) for innovation of courses, study programmes, and exams.

Our conceptual considerations therefore started by identifying the different functions of spaces that support our strategic goals as well as (expected) users' needs. In a half-day workshop with the whole academic development team, we generated ideas on different functions and qualities the space should incorporate (Thoring, 2019). All ideas were collected, discussed, and prioritised. Table 1 summarises the results of this workshop.

Table 1. Identified function and qualities.

Function	Question	Quality
Process Enabler	What processes should be enabled?	Visualising ideas, recording and editing video and audio
Knowledge Processor	What sources of knowledge should be processed?	books, journals (best evidence) previous projects (good practice) shared knowledge (experience)
Social Dimension	What social activities should be supported?	collaboration, communication, teamwork, presenting ideas, feedback
Source of Stimulation	What atmosphere should be stimulated?	"thinking outside the box" "getting out of the silo"
Indicator of organisational culture	What organisational culture should this space indicate?	Innovative, nimble, supportive, empowering, dynamic

Based on the identified functions and qualities, the innovation lab was designed to encompass spaces (Thoring, 2019) for collaboration, for creation (making space), and for presentation. All spaces, including so-called intermission space (such as hallways that are not dedicated to a specific activity) should be designed to stimulate a creative atmosphere and indicate an innovative and empowering culture.

3.2. Physical embodiment

Space is not only functional, it is "a physical embodiment of their [people's] desired modes of working" (Moultire et al., 2007, p. 53). Layout, furniture, and infrastructure in every space suggest a perceptible or hidden affordance, they induce or even prompt specific actions or behaviours (Young & Cleveland, 2022). Furniture and design elements are not just decorative or functional in a basic sense; they actively contribute to making the activities more effective, efficient, or engaging (Thoring, 2019). Based on these findings, the whole academic development team spent one month on (asynchronously) pooling ideas on design elements that support the intended qualities and functions listed above (3.1). We allocated them to the appropriate space, and simultaneously assessed the functions they might serve.

Table 2. Example from the collection of different design elements (Thoring, 2019) and their function. See https://lehrblick.de/wp-content/uploads/2024/02/elements.pdf for the full collection.

Element	Description	Idea	Space | Function
Visible Tools	inspiration for potential processes	Makerbox Click and share	Making | Process enabler Presentation | Knowledge processor

4. Realisation

Drawing on this list, we equipped the innovation lab. Impressions of each space and selected design features are shown in the following sections.

4.1. Collaboration Space

One of the primary goals of our innovation space is to foster effective working as a team. For this reason, we have paid particular attention to the design of *collaboration space*. We selected layout and furniture to enhance and support communication (Figure 1a). Multi-functional furnishing allows our users to modify the arrangement in a way that suits their specific purposes and preferences (Figure 1b).



Figure 1. a) Table with ergonomic seat variations; b) flexible building blocks and portable sockets

Different design elements inspire the users to share information and resources. Elements with raw structure and plants in the collaborative space indicate an experimental atmosphere and encourage out-of-the-box thinking.

4.2. Making Space

Our *making space* is tailored to enable two key processes (see 3.2): visualising ideas and producing media content. An oversized, mobile whiteboard system and some visible tools encourage collaborative development of ideas and their visualisation (Figure 2).



Figure 2. Mobile room divider with writable surface; elevated seats enable better visual engagement and more active participation.

The videostudio offers maximum flexibility to realise a wide variety of videos: it includes self-supporting, light, collapsible panoramic background with seamless surface, including different covers (including chroma key, white, black) and portable LED steady lights with different lightformers instead of fixed equipment. In addition, a voice booth is dedicated to creating high-quality audio recordings, such as podcasts or dubbing slides.

4.3. Presentation Space

The *presentation space* is designed for mutually providing input, as well as giving and receiving feedback. Its character is closely that of a seminar room, yet it incorporates several nimble and empowering features. A wireless conference system replaces the commonly used projectors. That enables participants to easily share their screen content with others by simply connecting their laptop to a USB port. This feature allows for a seamless switch from being a listener to taking on the role of a presenter (Figure 3a). The monitor wall is on wheels and can therefore be easily turned. With just a few simple steps, the technology disappears and opens space for oral- or poster presentation (Figure 3b).

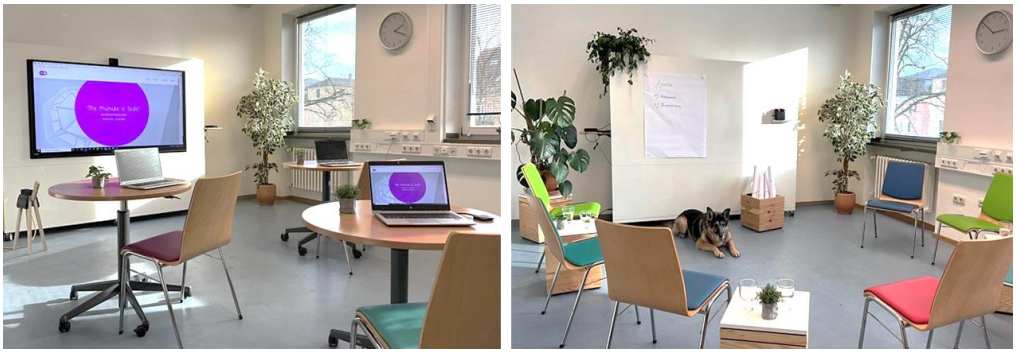


Figure 3a) setting with wireless conference system; b) technic-free setting with writable surfaces, utensils for poster presentation.

4.4. Intermission Space

Some of our *intermission areas* are seamlessly incorporated into the spatial concept to encourage spontaneous meetings, short coffee breaks, or for reflection on previous work (Figure 4). Various design elements in niches and on walls stimulate activities and provide inspiration. They indicate and bolster an innovative mindset and a dynamic mode of working.



Figure 4. A pop-up coffee bar serves as an anchor for casual meetings.

5. Reflection and lessons learnt

When setting up the innovation lab at our University we have been facing two main challenges: restricted space and a limited budget. To overcome the issue of limited space, we designed all

rooms as flexrooms. The consequent use of multifunctional and movable furniture enables us to easily transform a maker's space into a collaborative area, or a presentation space into a creative workshop.

The more significant challenge, however, was working on a low budget. We had to allocate the majority of our budget to technical equipment (i.e. the audio booth or a conference system) and flexible furniture (such as moveable room divider or flexible building blocks). Not only did these gadgets consume nearly 90% of our budget, but they also fell outside the scope of the standard furnishings provided by the University. This meant that it required extensive, time-consuming research to find suitable and affordable fittings.

For smaller furnishing items, there was only a little money left, so we had to do a lot of it ourselves: we built a room divider, for example, from pallets that came with the delivery of the whiteboards (Figure 1b), we transformed an old desk into a large table for collaborative work with the help of a wooden board (Figure 1a), and we collected plants that were being given away on eBay. Since no facility service was available for such tasks, a significant portion of the work had to be completed during our free time. This is only doable when a larger team fully supports the project and actively contributes to its realisation.

If we were to undertake a similar project again, we would dedicate at least half of a person's workload for three months solely to coordinating all deliveries and assisting with the construction. The usage numbers of the innovation lab, however, prove that the effort was worth it: from its opening in September 2023, to the end of January 2024, a total of 16 communities, ranging from groups of 3 to 18 people, have used the lab for iterative sessions lasting between half a day and 4 days. They have used it to enhance exams, redesign self-study phases for students, create online learning modules, or simply to produce short videos.

Given the brief operational period of our innovation lab, there is currently no evaluation data available. A systematic evaluation focusing on the usage process and innovation (Osario et al., 2019) is scheduled for this year and might lead to minor modifications. Direct and personal feedback from our users indicates that we have successfully created a space that effectively encourages collaborative and creative innovation in courses, study programs, and exams. The supportive and empowering design of the space helps faculty in breaking out of their traditional silo and in cultivating an innovative mindset. As one of our visitors remarked: it makes you feel like you're on holiday while you're working.

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Twitter as an instructional tool for critical thinking and creativity in Higher Education

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Abstract

The interest and use of Twitter (now X) as an instructional tool is perceived as an opportunity for learning processes related to critical thinking and creativity. This case study is based on the creation of a Twitter account for a course within the fourth year of the university degree in Audiovisual Communication at the Universitas Miguel Hernández (Spain).

The qualitative research, conducted over several years, validates the progression of each student year group from a passive role to a more engaged role, in which they found themselves involved in the creation of high quality audiovisual material and developed a critical concern over their own works. Furthermore, the managing of their own account on the social network contributed to improving learning outcomes in skills such as communicating complex theoretical ideas through digital tools, fostering innovative thinking and enhancing creativity.

Keywords: *Twitter; Critical thinking; Digital tools; Innovative thinking; Creativity; Qualitative analysis.*

1. Introduction

Technology and education are intricately linked, and the integration of technology in Higher Education Institutions (HEI) has been a topic of significant interest (Greenhow & Lewin, 2016). The social media platform known as Twitter –since July 2023 known as X—has gained significant attention among educators due to its potential to enhance students' development and facilitate learning since the early 2000s (García Montero et al., 2012). However, there is an ongoing debate about the effectiveness of incorporating social networks into higher education (Cheng et al., 2022; Woods et al., 2022).

The research literature suggests that Twitter had been used at High Education Institutions (HEI) for various purposes, though it has been mainly as a communication and networking tool

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(Cheong-Li & Tak-Ming Wong, 2021). Twitter provides a platform for students, educators, and experts to connect and engage in discussions beyond the classroom. It allows for open and real-time communication, enabling students to reach out to professors, mentors, and peers for assistance and to pose questions in an accessible way (Abella-García et al., 2019; Cazarez Valdiviezo et al., 2016; Gallardo-López & López-Noguero, 2020)

Twitter is being used in higher education degrees as a tool for active learning and student engagement (Akella, 2014). It allows for real-time communication, diverse interaction, and sharing of experiences and opinions and to think critically (Pollalis et al., 2018). Additionally, Twitter has the potential to encourage participation, engagement, reflective thinking, and collaborative learning in different educational settings (Sulisworo et al., 2018). Furthermore, the use of Twitter in education has been found to implement specific skills such as critical literacy in the classroom (Kunnath & Jackson, 2019), or to improve critical thinking skills in general (Gao et al., 2012).

2. Critical thinking

Critical thinking plays a significant role in higher education, as it helps students develop a more analytical and reflective approach to their learning and, thus, it has been extensively used in the classrooms across different courses and subjects (Puig et al., 2019). It enables students to question and evaluate information, arguments, and ideas, leading to a deeper understanding of the subject matter. Critical thinking is an important aspect of higher education that can be fostered through various means. One way to promote critical thinking in higher education is through the use of social networks like Twitter.

In the context of the research literature, the use of Twitter in educational settings has been found to contribute to the development of critical thinking skills among undergraduate students. Interacting with classmates and people outside the class through Twitter allows students to learn from different opinions and perspectives, which enables students to develop critical attitudes towards opinions that may differ from their own, and engage in debates, further enhancing their critical thinking skills.

Furthermore, Twitter plays also a significant role in the spread of disinformation and fake news, which can have negative consequences on society. Studies have shown that people often do not critically evaluate information on social media, leading to increased trust in fake news. Educational activities that encourage students to think critically about the truthfulness of news on social media can also be effective in developing their skills in investigating the reliability of stories(Kruijt et al., 2022; Pollalis et al., 2018).

Thus, the experience of using Twitter in an educational context has been shown to contribute to the heightening of the quality of learning and the teaching-learning process itself, as stated by

the students themselves (Abella-García et al., 2019, p. 7). It is important to note, however, that while Twitter can be a valuable educational tool, the effectiveness and appropriateness may vary depending on the context, subject matter, and specific teaching strategies employed.

In light of these considerations, in 2018 we incorporated into the course 'Cultural Mediations through the Arts' (*Mediaciones culturales en las artes*) an activity based on Twitter to enhance critical thinking skills among students and to contribute to a more engaging and interactive learning environment.

3. Method

3.1. Description of the activity

This course, which spans over a period of fifteen weeks, is situated within the initial semester of the fourth and final year of the university program in Audiovisual Communication at the Universitas Miguel Hernández in Spain. The course's curriculum revolves around two educational units, each encompassing various themes. These units focus on the *intricate processes of social and cultural meanings*, including the fundamental aspects of signifying practices, the exploration of social representations and cultural mediations, the examination of the sociocultural foundations of taste and aesthetics, as well as the study of cultural industries and their impact on society's fascination with spectacle. Additionally, the course delves into the *interplay between culture, politics, and society through the lens of visual arts*, offering an introduction to the world of arts and aesthetics, an exploration of the transformative power of drawings and the use of color in portraying social realities through paintings, and an analysis of how photography captures and frame social time.

Each student is anticipated to periodically publish a tweet in their personal Twitter account wherein they concisely summarize the material that was taught and deliberated upon in the lectures or assigned readings. In addition, they are required to complement their thoughts with an image. This image can either be their own creation of any format (such as a gif, videoclip, photograph, drawing, or painting) (fig. 1) or a meme derived from a distinguished work of art (fig. 2). It is imperative that the image is digitally signed by the student, adhering to the guidelines established in artº70 of the Royal Decree 24/2001, which pertains to the utilization of memes (Sp. *pastiche*). Furthermore, the tweet must include the hashtag *#mediacionesculturales* and mention the Twitter account of the course *@umh3600*. The most exemplary tweets are retweeted from this account. After the publication of the tweet, the student converts a screenshot into a Pdf file and proceeds to upload it onto the university campus website, which operates on the Moodle platform.



Figure 1. «My teacher explains Plato's cave whilst at home online, and I identify with it».



Figure 2. «We should learnt that our social networks profiles only depict a representation of ourselves, not our true selves».

In 2021 the teachers expanded the possibilities of Twitter as a tool to enhance critical thinking. Exploring the Moodle workshop module we realized that it was a powerful peer assessment activity and, hence, we decided to include a written commentary of two classmates' tweets.

The process is simple. Once the students have submitted their pdf files, these files are subsequently distributed among their peers for evaluation. The distribution process is partially anonymous. While the commentator is aware of the authors of the two tweets being analyzed as their names or usernames are displayed, the commentator's identity remains undisclosed to the author. The final grade for the assignment is determined by a combination of the posted tweet (80%) and the *crítica* (20%). This combination of both tasks, the creation of the tweet and the critique, enables the instructors to assess the students' performance, to contemplate their learning achivements and the comprehension of the course material, as well as to enhance their critical thinking abilities.

The workshop tool's interface permits the inclusion of a grading scale on designated questions at the beginning to guide peers in their assessments, as well as a mandatory open text field that serves as the most enriching component.

The students freely comment on the first two tweets, without using an itemized or bullet point scheme. However, starting from the third tweet, the teacher provides a grading scale and specifies the comments using an itemized format and a guide on how to form a critique in five paragraphs within the designated text field.

4. Results

The qualitative analysis of the tweets posted by students since 2018 consistently demonstrates their proficency to comprehend the course materials, effectively convey intricate theoretical concepts in a fresh way, and to communicate it to the public (fig. 1 & 2 above or 3 & 4 below).



Figure 3. - Do you have power or authority? | - Surname! | «…and who on earth gave this one the surname?»



Figure 4. Where does the art lie? Where it is exhibited or in the work itself? | Your home's toilet | Museum

In addition, the qualitative analysis and discourse comparison of the open text field of the initial tweets and the final tweets, it becomes clear that the concept of critical thinking is essentially narrowed down to criticizing actions and relying solely on students' personal opinions and viewpoints. The criticisms revolve around the self with phrases like '*I believe*', '*in my view*' or '*I am in favour*', with little attention to the tweet itself or the intended original message. However, in the final tweets the critiques are focused on the actual content of the posted tweets:

Example of a first tweet

«I don't understand the correlation between the tweet and the image, since the tweet names Wittgenstein and his work and reflects on it, but then, in the image, he puts a kind of meme where he names Antonio [the teacher] and his questions, which if it weren't for the context that I have attended to class, I wouldn't understand what the image is all about. And that's the problem, it's decontextualised.

I am in favour of the idea that if in a tweet we talk about and name x elements, the illustrative image cannot have elements that are external to it. Because rather than illustrating, it confuses. Beyond that, the question posed seems interesting to me, although I don't know to what extent the questions are going to show reality more than the words themselves, knowing that the questions are formed by the same words that delimit reality, but it opens up a very interesting debate about how reality is shaped and whether there really is a single reality that is the same for everyone».

Example of a final tweet

«This tweet tries to explain the importance of social networks in today's society of spectacle, where platforms have become the nerve centre of information and communication. The author uses a very important topic such as the use of platforms as a means of communication and how we have no guarantee that what we are being sold is a reality or not, and how the society of the spectacle is concretised in the principles of advertising, in the commercialisation of objects.

The author constructs a well-written tweet but, in spite of this, he doesn't present the idea clearly, as it is diffuse and not very coherent, because he presents an idea that is transformed throughout the tweet, which means that the reader does not fully understand what he is trying to get at with it.

However, the image he uses is quite clear in explaining this contrast between reality and what is published on social networks, this fictitious 'reality' that we create for ourselves on different platforms, to sell ourselves, turning us into a social product to fit into this society of spectacle.

In short, the question posed does not quite clarify the idea, but the execution of the image that accompanies it does reflect the intention of the idea that the author had for this tweet (as he does not quite develop it) and I encourage the author to reflect on the possible ways of writing what he does manage to represent in the image».

Independently that the commented tweets are not included in this paper for space limitations, it is clear that the discourse and structure of the critiques differ completely one from each other.

To conclude the course, in the final tweet the students are instructed to highlight those elements of the course that had the greatest influence on them. Despite being aware of their final grade, the majority of them exhibit a positive mindset towards the course. Moreover, the utmost significance for our initial intention of utilizing Twitter as a means to improve critical thinking is that they possess a keen awareness of the enhancement of their critical abilities (fig. 5 & 6).

5. Conclusions

Both this case-study and the existing body of research indicate that Twitter can have positive effects on learning outcomes and foster critical thinking. However, it is important to note that further empirical evidence is required to substantiate these assertions.

Teachers can also interpret tweets as signs of the difficulties that students face while studying. Also, since students typically incorporate instructors as characters in their memes or mention them in their texts, these tweets provide valuable feedback for educators to assess their own effectiveness in the classroom and allow a valuable opportunity to gain insight into their own performance. The tweets also provide the teacher with a repertoire of examples for use in the classroom in the successive courses. A very nice resource to modulate the dreadful consequences of the unavoidable generation gap that incessantly increases over the years.



Figure 5. «Everything we have learned throughout the course helps us to see the world in a clearer way and with more developed critical thinking. It's like when you take your first photograph and then learn to use the camera for real».



Figure 6. «If you don't attend #mediacionesculturales how can you say you understand the world you live in if you haven't learned about signification, habitus or the society of the spectacle? How can you say you like art if you don't know what levels of interpretation are?»
| We do not know what we are getting into | Antonio teaching 'Mediaciones culturales'

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Comparing Students' Perception of Higher Education's Digitalization – A Longitudinal Study

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Abstract

This study aims to compare students' perceptions of the digitalization of higher education over time. We hypothesize that the perception will become more positive throughout a study program because of more exposure over time. We applied a 31-item questionnaire in a longitudinal study setting to measure the change in perception. Results indicate data protection, teaching quality, collaboration between students, and training for the digital learning platform as major areas of change in perception. Interestingly, students do not perceive a change in their study success. We conclude that data protection especially needs attention from Higher Education Institutions. Trust, which students experience in the physical space, needs to be transferred to the digital space.

Keywords: *Higher Education; Digitalization; Enablers; Barriers; Longitudinal Study*.

1. Introduction

Digital tools have transformed HEI teaching and learning (Castro, 2019). Student aid, administration, knowledge transmission, and assessment are increasingly computerized. Digital infrastructure improves learning methods, educational resource accessibility, and communication and collaboration. Higher education institutions (HEIs) face technology implementation issues. However, HEIs have struggled to digitalize due to stakeholders' varying needs (Reid, 2014). As digitalization grows in education, adoption has become a major concern, especially after the emergency remote teaching during the COVID-19 pandemic.

Students spend significant time on their studies at their Higher Education Institutions (HEI). Thus, they are heavily affected by changes in their HEI, such as digitalization. In our study, we aim to answer the following research question: To what extent do the students' perceptions of the digitalization of their HEI change during their studies?

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To answer the above research question, we conducted a longitudinal study in which we surveyed the students' perceptions at two points in time. Our work contributes to research on enablers and barriers to digitalization. A lot of barriers will first be perceived when there is an absence of enablers, such as problems with the internet connection. Thus, barriers to the dearth of digital accomplishments are defined "as those few things that can hinder or stop the successful implementation" (Vogelsang, Liere-Netheler, et al., 2019, p. 4938). Generally, longitudinal studies are harder to conduct than cross-sectional studies (Li & Tucker, 2014). Thus, our study also contributes to an understanding of changes in perceptions over time. We hypothesize that the students' perceptions of their HEI's digitalization will be more positive with more experience. Thus, our study relates to studies by Venkatesh et al. (2012), in which experience moderates a user's behavioral intention and actual use behavior of an information system.

The study's theoretical foundation follows. After, we introduce the research approach and then analyze and discuss the results. Our study finishes with its implications and limitations.

2. Digitalization of Higher Education Institutions

Digital technologies help instructors improve learning resources and assess learning objectives (Vogelsang, Droit, et al., 2019). Additionally, digital approaches speed up services in HEI. Therefore, digital technologies have different effects. Student success becomes more transparent and portable between HEIs. This convergence may also boost process efficiency. Higher Education Institutions (HEIs) must prioritize efficiency and competitiveness due to increased competition (Adler & Harzing, 2017). The extensive availability of digital resources may challenge academics and administrators (Proserpio & Gioia, 2007).

Digital asset use in higher education is diverse. The past pandemic forced HEIs to use these resources (Mittal et al., 2021), which might have negatively affected students. Still, the enforced experience might have moderated the intention to use digital teaching and learning (Narayan & Naidu, 2024).

Many studies have examined learning environments (Lapitan et al., 2021), students' individual learning achievements (Janson et al., 2014), or achievements of educational systems (Ouajdouni et al., 2021). Tejedor, Cervi, Pérez-Escoda, Tusa, and Parola (2021) advise designing didactic learning aspects in addition to Gregory and Lodge's (2015) drivers and impediments. Several studies considered organizational anchoring and adoption (Porter & Graham, 2016). Interestingly, HEIs made few operational adjustments during the pandemic (Miller, 2021). HEIs usually resist change, which makes integrating digital technology into their organizations difficult (Al-Senaidi et al., 2009). Students experience digitization like customers. They are highly picky about HEIs' digitalization due to their digital upbringing (Crittenden et al., 2019). Also, digitization will affect their future careers (Friga et al., 2003).

3. Method

We used a 31-item questionnaire to examine students' perceptions of digitalization. The questionnaire sought students' perspectives on the digitization of higher education institutions. The items address nine digitalization barriers and 22 enablers. Participants rated items on a five-point Likert scale from "I completely disagree" (1) to "I strongly agree" (5) (Brink et al., 2020).

The longitudinal data was collected in a Bachelor's degree program in Media Technology at Malmö University, Sweden. The first data collection occurred during the second semester in April 2022 within the Digital Marketing (DM) course. The second data collection was conducted during the fifth semester in December 2023 within the course Introduction to Business in the Media Industry (AIM). The main author of this study is an active lecturer in this program. Thus, students were directly asked to participate in the study. Both courses have a workload of 15 ECTS and use a variety of physical and digital components such as lectures, workshops, seminars, and office hours. Coursework included individual and group projects, exams, and case studies. Students should master broad assessment and validation skills. Between the two measurement points, students studied courses on Process Management, Web Production, Organization & Leadership, and/or Electives.

The sample yielded 28 surveys completed at both measurement points, representing a response rate of roughly 40% of the whole batch of students. Most of these longitudinal participants were females (23 out of 28). The average age at the second measurement point was 23.7 years. We used descriptive statistics to analyze and calculate the differences between the measurement points (DM-AIM). We also used the MWU (Mann-Whitney U) test to compare the measurement points. The MWU test compares two sample medians to determine if they differ significantly. Its effect size quantifies the amount of differences (Pallant, 2005).

This longitudinal data was collected within a broader research project, in which roughly 400 students were surveyed (Draxler-Weber et al., 2022). Several analyses were conducted on the broader data set. Thus, even if this specific sample is small, we conclude our study's adequate validity and reliability.

4. Results

The results are represented in Table 1. We do not disclose the results of all 31 items. In 13 items, the Mean difference ($\bar{x}$ of DM - AIM) is greater than 0.2 or -0.2. Thus, we focused on these relatively high differences in Table 1. The column Statements in keywords represent the item in a short form. An item was formulated as an enabler (e) of digitalization or a barrier (b).

Table 1. Mean Values, Standard Deviation, and MWU test.

Statements in keywords	DM		AIM		DM - AIM		MWU test	
	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s	Sig.	R
1: digital courses offer added value (e)	2.82	1.25	3.21	1.07	-0.39	0.18	0.20	0.24
2: same quality teaching with less staff (e)	3.46	1.04	2.93	1.12	0.53	-0.08	0.09	0.32
3: worsened exchange between teachers and students (b)	4.00	1.18	3.61	1.20	0.39	-0.02	0.16	0.26
4: worsened collaboration between students (b)	4.14	1.08	3.61	1.29	0.53	-0.21	0.08	0.33
5: trust university's data handling (e)	4.25	1.04	4.04	0.92	0.21	0.12	0.20	0.24
6: teachers' access to personal data does not change usage of DLP (e)	4.36	0.73	4.07	0.81	0.29	-0.08	0.18	0.25
7: integration of additional information into content (e)	3.64	0.73	3.29	0.90	0.35	-0.17	0.17	0.26
8: adequate data protection (e)	4.11	0.88	3.39	1.10	0.72	-0.23	0.01	0.47
9: lecturers have sufficient IT skills (e)	3.32	1.28	3.00	1.19	0.32	0.09	0.34	0.18
10: DLP uses all technical possibilities (e)	3.18	1.22	2.86	1.11	0.32	0.11	0.39	0.16
11: freedom to decide upon digital learning materials (e)	3.32	0.98	3.11	1.03	0.21	-0.05	0.46	0.14
12: sufficient training for DLP usage (e)	2.54	1.35	3.07	1.27	-0.53	0.07	0.13	0.28
13: university's internal processes digitized (e)	3.86	1.01	3.64	0.91	0.22	0.10	0.31	0.19

Source: Cf. (Brink et al., 2020) for exact wordings of the items

With items 2, 4, 8, and 12, the changes in the Means are greater than 0.5 ($\bar{x}$ of DM - AIM), which indicates half a value on the Likert scale. The changes of the Means in items 2, 4, and 8 show a more negative perception at the second data measurement. Item 12 (Sufficient Training for the Digital Learning Platform (DLP) Usage) indicates an increasing positive perception. Items 4 and 8 show the biggest change in the Standard Deviation, indicating that students agree less on the second data measurement.

Item 1 is an enabler perceived better in the second data collection, indicating that students see a higher added value in digital courses. The other enablers are perceived as worse during the second data collection. Interestingly, the two barriers (items 3 and 4) were perceived less as a problem the second time.

The Mann-Whitney U test shows one significant result with item 8, which indicates that the perceptions of the two data measurements are different from each other. With the other items, we cannot confirm this hypothesis. In general, the effect size of the difference is small (around/under 0.3). With item 8, the effect size of the difference is medium.

Among the items that did not make it into Table 1 because of their small difference in the $\bar{x}$ of DM – AIM is the perception of digitalization as a harm to students' learning success. Interestingly, $\bar{x}$ is 0,07, which indicates that students' perceptions did not change with more exposure to digitalization. The Means are around the Median of the Likert scale, with 3.36 and 3.29, respectively.

5. Discussion

Our results show that adequate data protection (item 8) is paramount. The data collected by DLPs gives room for learning analytics, with a potential range of guiding students to surveilling them (Cormack, 2016). Thus, data collection becomes an issue of transparency and trust. Digitalization in HEI requires trust in infrastructure and safe platforms. Additionally, digitally competent professionals are needed to boost teaching, learning, research, and governance (Shrivastava & Shrivastava, 2022). Especially with the rise of AI, students might feel the need for even harsher data protection and limited data usage. Trust is an important educational factor and is often discussed in student-teacher relationships (Curzon-Hobson, 2002). Further, it includes different aspects such as trust in the educational setting, trust in educational governance, and generalized trust (Niedlich et al., 2021). Thus, there is a need to transfer the concept of trust from the physical classroom into online settings, e.g., by being transparent about how learning analytics will be governed in the educational setting.

Other studies found that students agreed with the high quality and effectiveness of online programs from a moderate (Tshering & Tshering, 2022) to a major degree (Abbas et al., 2022). Our results partly confirm this. In the first data collection, students were moderately persuaded that same-quality teaching with less staff (item 2) is possible (Mean of 3.46). Still, the value dropped over time (Mean of 2.93). Thus, HEIs need to implement processes to maintain quality while following the need to be more effective. Teaching quality is related to learning success (Paul et al., 2020). Even if students in our study perceive a decline in teaching quality with less staff, they do not perceive a change in their study success. This might be due to the Swedish higher education system fostering independent learning by offering broad and holistic courses.

Students perceive working with online group work as stressful. Major obstacles include concerns about scheduling, grading, group membership selection, and lack of interaction or feedback from some group members (Forman & Miller, 2023). In our study, students perceive worsened collaboration between students (item 4) as a smaller problem at the second measurement. In our courses, students could decide to work online and/or physically. We assume students chose the latter or a combination to solve group work.

Students in our study feel, over time, better prepared to use the DLP. We have not noticed an offer of additional training for the students other than practical day-to-day work with the DLP.

Thus, we relate this to our hypothesis from the introduction, which is that more experience influences the use behavior of an IT system (Venkatesh et al., 2012).

6. Conclusion & Limitations

Our longitudinal study on students' perception of the digitalization of their HEI pinpoints the need for reliable data protection measures, further indicating the need for an elevated level of transparency and trust. HEIs need to focus on quality teaching, even if digital teaching processes might offer higher efficiency. However, collaboration problems seem to improve. Still, there is a need to support the exchange with peers.

Our study was conducted during and after the COVID-19 pandemic with a small sample size, which might have biased and limited our results. Even if Sweden had a rather non-restrictive approach, much of teaching had to be changed to emergency remote teaching through enforced digitalization. The WHO declared the end of the pandemic in May 2023 (Wise, 2023). Thus, the pandemic might have influenced our first data collection in 2022. Even if many courses mixed physical and online elements even after the WHO declaration, the situation might be perceived as less stressful and more normal during the second data collection in December 2023. Still, further studies should collect more longitudinal data under normal circumstances. Also, we hypothesized about the students' actual use behavior. Further studies could connect data about use behavior from the DLP to the data of the items.

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Diversity in Teamwork and Its Implications in O&SCM: A Dive into Students' Perspectives

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Abstract

Universities are crucial in preparing students for diverse team dynamics, with the understanding that the impact of diversity can vary across settings. This study delves into Operations and Supply Chain Management (O&SCM), an area where the importance of diverse team management has recently increased but is underexplored. The aim is to comprehend how O&SCM students perceive diversity and its consequences for teamwork. The investigation focuses on the MSc Supply Chain Management program at the University of Groningen, with specific insights on the Process Improvement and Change course, involving (diverse) teamwork. Findings reveal a multifaceted view of diversity, emphasizing dimensions like educational background, nationality and cultural differences, while also less-explored aspects like goal diversity. This study supports the dual effect of diversity on O&SCM teamwork, aligning with existing literature, but also unveiling new aspects like the influence of varying grade aspirations on team dynamics. It questions student-identified countermeasures, considering industry trends.

Keywords: *Diversity; Student teamwork; Inclusive Learning Environment*

1. Introduction

Teamwork has been essential in Operations and Supply Chain Management (O&SCM), functioning at both intra- and inter-organizational levels, such as cross-functional teams within companies and buyer-supplier collaborations externally. Recently, there has been a growing emphasis on *diversity in teamwork*. Internally, organizational resilience, especially during unprecedented challenges like the COVID-19 pandemic, has underscored the importance of enhanced interdepartmental cooperation (Sawyerr & Harrison, 2020). This cooperation is characterized by the participation of individuals with varied educational backgrounds, necessitating a balance of social competencies along with technical skills. In another example, the drive towards sustainability has fostered collaborations across a diverse array of suppliers,

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encompassing various national cultures (Gimenez & Tachizawa, 2012). Consequently, it has become essential for O&SCM managers to be able to effectively manage diversity. Universities play a crucial role in preparing students with an adequate understanding of diversity and in developing competencies in managing diverse teams in this field.

The literature on diversity demonstrates its multifaceted nature, which can encompass a broad range of characteristics such as age, gender, ethnicity, abilities, and experiences, among others (Baker & Clark, 2010; DiStefano & Maznevski, 2000; Meric et al., 2015, Popov et al., 2012). Moreover, when characterizing teams, there is evidence of the double-edged nature of diversity; while it fosters benefits such as enhanced creativity and problem-solving capabilities (Baker & Clark, 2010), it also presents challenges like miscommunication or biases (Popov et al., 2012).

In higher education, educators frequently face resistance when forming diverse teams in their class, with many students prefering homogeneous groups (Kanika et al., 2023), despite the potential benefits of diversity. In the O&SCM field, this resistance is partly due to a general underestimation of soft skills in favor of more technical knowledge and competencies (Boscari et al., 2016), which are considered central to this field. Therefore, educators play a key role in cultivate an inclusive learning atmosphere in their class and in promoting a deep understanding of diversity that reflects what students will encounter in their professional lives. At the same time, educators must possess a deep understanding of their students' needs, which often vary significantly across disciplines and contexts (DiStefano & Maznevski, 2000). This understanding is crucial in designing interventions to maximize these benefits and overcome the challenges posed by diverse teamwork.

Base on the above, this study poses two interrelated research questions: *In an SCM context, what are the key diversity dimensions as perceived by students? In an SCM context, what are the key perceived consequences (i.e., benefits and challenges) of team diversity?*

2. Methodology

This study employs a qualitative design to investigate students' perspectives on diversity and its consequences, allowing for an in-depth exploration of the subject taking into account the specificities of the context under investigation (McCombes, 2023). The chosen case is the MSc Supply Chain Management (SCM) program at the University of Groningen, which features a diverse student cohort (e.g. Dutch students from various bachelor programs and international students). Furthermore, teamwork plays a crucial role in the program's learning approach. The MSc SCM is a one-year program that students can join at two different start dates, in September and February. The focus is on the academic year 2022-2023.

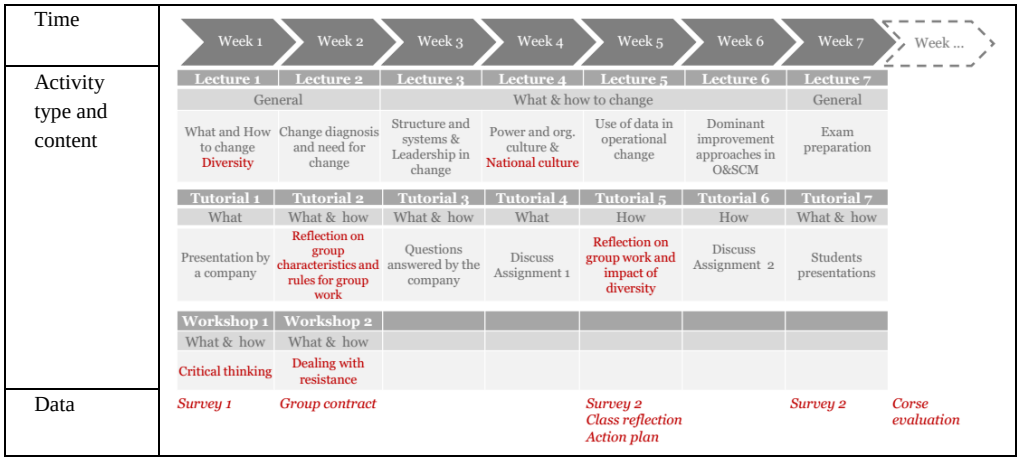
Of particular interest within this program is the 7-week compulsory course 'Process Improvement and Change' (PI&C), where students work in diverse teams to complete two group

assignments. The foundation for the group assignments is a real-life company problem, where students diagnose organizational issues related to O&SCM within a specific company's context and develop an improvement plan to address the issue. Educators use a method for team formation to create a heterogeneous mix of students, where they allocate group members based on specific chosen characteristics: biological sex, educational background, and time orientation. Furthermore, several initiatives are integrated into the course to foster an inclusive learning environment in the classroom and to promote a deep understanding of diversity that mirrors what students will encounter in their professional careers.

Data are collected in multiple ways by a team comprising both educators and students. First, as illustrated in Figure 1, in the course PI&C, data are primarily collected through three individual-level surveys: Survey 1 in week 1; Survey 2, in weeks 5 and 8, after the submission of each group assignment. Additional data submissions come from the teams of four individuals throughout the course (Collaboration agreements and Action plans). A sample of 106 students participated, divided in 26 groups. The distribution consisted of 35% female students and 65% male students. Of the participants, 73% had Dutch nationality, while 27% were international students.

Secondly, semi-structured interviews are conducted with a subset of 15 students (indicated as I 1 – I 15) who were enrolled in the MSc SCM program for the academic year 2022-2023. Students have been selected with the aim of providing diverse views, based on their country of origin, biological sex, and educational background. It is worth noting that, at the time of the interviews, some of these individuals had already begun their careers. These interviews provide an opportunity for these students to reflect deeply on their experiences in the course PI&C as well as the entire MSc SCM program, and are expected to yield further insights into team dynamics. Upon interviewees' consent, interviews were recorded and transcribed.

A systematic approach was employed to analyze the qualitative data collected. Initially, data were coded based on established diversity dimensions and consequences found in the literature, following a deductive approach (Yin, 2014). This deductive approach was supplemented with inductive analyses aimed at identifying any potential emerging variables from the data. Furthermore, the data analysis occurred at two levels: individual and team. For instance, we examined the consistency of views among members within the same team. To enhance the reliability of the process, multiple researchers were involved in data analysis.



Note: Main elements related to Diversity and Inclusion's intervention are in red

Figure 1. Diversity and Inclusion elements in the PIC course

3. Findings

3.1. Dimensions of diversity in O&SCM

In the MSc SCM program, students identified their *educational background* as a key dimension of diversity in team settings. In the PI&C course, they first encounter their teammates during the second tutorial of, where a collaboration agreement is formulated. Among various tasks, they are asked to pinpoint dimensions of diversity within their teams. The *educational background* emerged as the most frequently cited aspect, noted by 20 out of 26 teams. At the course's conclusion, students, reflecting on their seven-week experience, reaffirmed this view, with 63 out of 106 students highlighting *educational background* as a defining characteristic of their group's diversity. This finding aligns with data at program level, where *educational background* consistently emerged as a recurrent theme across interviews.

Nationality or cultural differences constituted another significant aspect. In the collaboration agreement, this dimension was prominent (mentioned by 17 out of 26 teams) and continued to be a focus in the final survey. For instance, one student (S4) stated, "I think nationality was the main difference" noting the impact of educational experiences from different countries on work approaches. Another student (S5) highlighted the influence of varied experiences and cultures on perspectives. Again, these views were consistent with insights gained from interviews.

The *period of enrollment* emerged as another notable aspect in the PI&C course (highlighted by 18 out of 26 teams). This dimension was perceived as reflecting the differences in knowledge and preparedness based on when students commenced their studies (September or February). A student (S7) noted, "people who started the master earlier had more knowledge than those who

has just started," highlighting varying readiness and expectations. *Diversity in goals* was a dimension primarily revealed through interviews. It manifested in the different grades students aspired to achieve in group assignments.

Finally, the data collected in the PI&C course revealed changing aspects of diversity over time. Initially unrecognized dimensions like *skills and personality traits* became more evident as the course progressed. For instance, a student (S9) described how various strengths within the team constituted another form of diversity, such as one member's creativity in poster design contrasting with another's theoretical expertise. Personal traits and approaches to teamwork, ranging from creative versus content-focused, outgoing versus introverted, or proactive versus reserved (as described by students S10, S11, and S12), further exemplified this diversity.

3.2. Key Consequences of diversity in O&SCM teamwork

In the MSc SCM program, students identified both positive and negative consequences of diversity in team settings. Concerning the *positive consequences*, students in the PI&C course recognized that diversity in knowledge and skills enriches team discussions and problem-solving, as noted by one student: "increases the quality of discussions" (S13), and another adding it allows for "multiple perspectives to be incorporated during problem-solving events" (S14). They also perceived the variety of educational backgrounds, skills, and personality traits as beneficial for collaboration, with a student commenting on how these diverse skills "more effective" in work distribution (S17). Diversity in perspectives and approaches was also seen to create a positive team atmosphere, with a student noting that "[diversity is] good for understanding the different working methods that are being used and can work" (S19). This was consistent with evidence at program level.

Interviews further revealed that working in diverse teams contributed to students' personal development, with interviewees noting increased patience and open-mindedness. The vast majority of interviewees believed that working in diverse teams at university was helpful in preparing them for their careers. One graduated expressed, "I think it definitely gave me a leg up in just feeling accustomed to my current workplace where there's a big mix between a cold Dutch group and internationals. So, I kind of fit in well. … But it's also allowed me to understand when I'm speaking to someone from India, and different cultural ways of approaching a problem. And similarly with more Western people from America. So, as I said, it's given me a leg up and made me more comfortable and confident in the office." (I 11).

On the negative side, students faced *communication challenges* due to language barriers, cultural differences, and personal traits. Miscommunication was a common issue, with one student mentioning, "nationality makes it easier to communicate in your language" (S21), and another linking it to language issues: "[it is] more difficult to express feelings or get your point across" (S22). Teams often overcame these challenges over time, as noted in interviews: "We

had to adjust to each other's ways of working, which were quite influenced by our cultural backgrounds" (I 7). *In-person interactions* were highlighted as effective in resolving conflicts and facilitating communication. It also helped the students to have a better understanding of the current feelings and emotions of other members while working simultaneously on the project. Talking about the advantages of in-person interaction, one interviewee noted: "People can actively contribute. If you meet someone, your interaction is different. Like, I think from a psychological standpoint, people don't have the opportunity to leave you unread, if you know what I mean. They're there, so you have to collaborate and participate." (I 4)

Goal diversity, particularly in terms of grade aspirations, also posed challenges. Disparities in grade aspirations among team members were described by interviewees as common and perceived to be reflected in *disparities in team members' effort*: "It is very difficult because of the different amounts of effort that people put into the project" (I 11). Variations in commitment levels created tension within teams. A strategy for some teams was to *discuss goals early* and find a compromise, though some believed those aiming higher should work more, as "having a very high grade as a goal is a personal decision and not all members should be forced to change their mindset for someone else." (I 11).

4. Conclusions

In today's world, the ability to work in diverse teams is fundamental to the success of many companies. Universities play a crucial role in preparing students for this diverse working environment. They have both the opportunity and the responsibility to cultivate an inclusive learning atmosphere that mirrors the diversity they will encounter in their professional lives. By integrating diversity into their curricula and fostering an environment where students from various backgrounds interact and collaborate, universities can enhance students' competencies in navigating and managing diversity.

Diversity is a complex concept that encompasses a wide range of characteristics, whose relevance varies depending on the context (DiStefano & Maznevski, 2000). This study focuses on O&SCM, an area that has received limited attention in past research. The findings indicate that students in O&SCM primarily perceive *educational background* and *nationality or cultural differences* as significant diversity dimensions. This aligns with the use of these criteria by educators to create diverse groups in the PI&C course, but are also consistent at the program level. While previous literature has predominantly focused on cultural dimensions in diversity (Baker & Clark, 2010; Popov et al., 2012), our study underscores the importance of educational background, which is also relevant in practical O&SCM contexts (Boscari et al., 2018).

Moreover, students recognize *enrollment time* as a source of diversity, a dimension often overlooked in higher education but deserving of further exploration. *Goal diversity*, primarily related to grade aspirations, is another dimension that has been underestimated in academic

settings but has received attention in practical workgroup literature. Contrastingly, *gender*, a commonly referenced diversity dimension (Ayega, 2018), is considered less relevant in O&SCM, despite its use by educators in forming groups and evidence of its relevance in the O&SCM field (Kumar & Paraskevas, 2018).

Finally, this study highlights an evolving understanding of diversity by students, with an increasing emphasis on *skill diversity and personality traits* over time, emphasizing the dynamic nature of teamwork and the various dimensions influencing teamwork in O&SCM.

Regarding the consequences of diversity on teamwork, this study reveals a double-edged effect, consistent with existing literature (Baker & Clark, 2010; Morrison-Smith & Ruiz, 2020). It acknowledges the *benefits* of diversity, such as richer perspectives, alongside challenges like communication issues. Furthermore, the findings shed light on *challenges* such as the impact of differing ambitions (grade aspirations), which can lead to tensions and varying effort levels among team members.

Students' proposed countermeasures to mitigate these *negative consequences* emphasize the value of *in-person interactions* for reducing miscommunication. However, in the context of globalized O&SCM, educators must consider developing students' capabilities for effective virtual buyer-supplier collaboration. *Early team discussions*, especially during the development of collaboration agreements, are recommended to address varying ambitions. Moreover, this study suggests broadening the perspective beyond immediate group assignments and focusing on *long-term employability*, emphasizing the development of interpersonal and communication skills essential for the professional world. Such an approach can provide students with a comprehensive understanding of the value of diversity in teamwork and its practical applications. These countermeasures provide a foundation for more effective diversity management in O&SCM, but warrant further in-depth analysis across multiple programs.

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Team Building that Prepares Students for Teamwork Competence

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Abstract

This paper describes an innovative two-step team building pedagogy applied in multiple management classes. We assessed whether such step-by-step engagement in two active and experiential learning exercises in consecutive class sessions can help students progress toward working competently in teams without instructor directives and advice. In the first step, we assigned students to classroom teams and engaged them in an escape room exercise (ERE) for 45 minutes. In the second step, we provided an agenda through which students worked collaboratively to form their Team Charter (TC) aimed at planning both process and project outcomes. At the end of each activity, students wrote individual reflection reports through which they expressed their learning about effective teamwork, need for change in behavior, and motivation to incorporate and further improve their teamwork competence. Qualitative analysis of students' reports revealed that: (a) the ERE serves to produce cognitive and emotional learning which motivates students to act more competently in teams, and (b) the TC activity provides opportunities to act on their learning, practice new behaviors and incorporate new behavioral intents when working on their team project. This research answers the call for team building through active learning techniques which can be implemented by college professors seeking to help their students' improve teamwork competence in a timely and time efficient manner.

Keywords: *team building, team effectiveness, classroom teams, collaboration, experiential learning, higher education.*

1. Introduction

Educators, scholars, and hiring managers agree that college students must graduate with knowledge and skills they can integrate into workplace teams (Petkova *et al.*, 2021). College instructors, particularly in business programs, have responded by assigning students to classroom teams, and requiring them to complete collaborative projects (Seow & Shankar,

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2018). The purpose is to foster a classroom environment inspired by notions of 'learning by doing.' While such practice is common, it is unhelpful. The literature widely criticizes this approach and contends that it leads students to view teamwork as a "requirement" rather than an opportunity for skill development and that the lack of guidance leaves them feeling confused, stressed and demotivated due to problems such as social loafing and lack of leadership (Aaron *et al.*, 2014; Petkova *et al.*, 2021). Therefore, scholars have called for more instructor interventions and provided advice – yet, employers continue to complain about fresh graduates lacking in teamwork competence (Morgan & Stewart, 2019).

A workplace team is likely to be successful when team members exhibit competence which comprises "the set of knowledge, skills, and attitudes required to work with others and carry out tasks and common goals" (Nadal *et al.*, 2015, p. 355). Teamwork competence refers to a nine-part construct (see Hebles *et al.*, 2022 for review). Members in competent teams: (a) jointly set goals and objectives, define mission, key milestones and resource requirements, (b) plan ahead, organize their contributions, and coordinate individual efforts, (c) engage in constructive conflict to trigger creativity and prevent groupthink, (d) proactively evaluate their team's performance gaps, and adjust when needed, (e) communicate in ways that produce a shared understanding of the situation and problems, (f) exhibit positive attitude towards teamwork and confidence in the team's ability to succeed, evident from enthusiastic participation and perseverance when faced with challenges, (g) monitor other team members' performance, create developmental feedback that improves contribution ad productivity, (h) support other members who need help, and (i) exhibit a learning orientation, remain vigilant, and initiate change in team members' attitudes and skills.

The literature is clear that higher education needs to do more to increase students' preparation for competent teamwork. However, the reliance on instruction that produces adherence rather than learning and commitment that fosters collaboration in classroom teams – seems ill-advised. Ways of producing learning without teamwork instruction deserves fresh attention. Therefore, we report the results of a two-step team building study that found: (a) an escape room exercise (ERE) we implemented in management classes produces cognitive and emotional learning through first-hand experience and reflection rather than instruction, and (b) a follow-up classroom exercise which produces evidence that students can translate their cognitive and emotional learning into behaviors and behavioral intents that signal the emergence of teamwork competencies.

2. How Team Building Helps and Where It Falls Short

Scholars advise instructors to go beyond simply assigning team projects and expecting teamwork competence will follow (Schartel-Dunn et al., 2021). Instead, many advise college professors to conduct *team building* which refers to providing instruction, guidelines, and

opportunities for interaction among members that result in improved communication and coordination of individual efforts and ultimately lead to successful team-produced outcomes (Kuznetsova et al, 2023). For instance, the literature suggests that instructors: (a) use lecture and class discussion at the start to highlight the benefits of teamwork, educate students on the stages of team development, and conflict resolution methods (Seow & Shankar, 2018), (b) encourage reflection and discussion on best and worst team experiences to serve as cautions and guide current classroom teamwork (Bacon et al., 1999), (c) assign student teams to produce a charter for defining rules of engagement to serve as guardrails for contributions and aid accountability (Hunsaker et al., 2011; Aaron et al., 2014), and (d) require mid-project formative and post-project summative peer feedback and evaluations (Jassawalla & Sashittal, 2017). The weakness in these suggestions is that they translate largely into instruction and guidelines given to students whereas the literature contends that if students know, it does not mean they can also do (see Ginting et al., 2020). When team building consists of passive learning strategies, it evokes at best cognitive awareness, and short-term adherence but not long-term teamwork competence (Huang et al, 2023; Hunsaker et al., 2011). The state of the art points to the need for designing active learning exercises and engaging students through them in early team building that produces cognitive, emotional, and behavioral learning about teamwork – *without any instruction* about "follow the rules."

3. An Innovative Two-Step Team Building Process to Instill Teamwork Competence

We incorporated team building at the beginning of the term with two classroom activities implemented in two consecutive 75-minute class sessions. The objective was to develop students' teamwork competence which they could practice throughout the term while working on their team project.

Step 1. Inspired by the principles and benefits of active learning (Huang et al., 2023), we utilized an escape room exercise (ERE) designed by a co-author. The purpose was to engage learners in interaction and guided reflection through which students generate their own cognitive and emotional learning about teamwork *without* instruction. We had 137 students working in 36 teams (3 to 5 members per team) and enrolled in eight classes over three semesters (6 undergraduate Organizational Behavior and 2 graduate Leadership in Organizations classes; 36% female, 64% male; 85% undergraduate, 15% graduate students). The participation was managed and monitored by two of the co-authors. To escape the room, student teams were required to complete seven consecutive puzzles, each one different from the others. For details of the ERE puzzles see https://bit.ly/InternOpDB

While each class received broad guidelines for participating in the ERE, no instruction about teamwork was provided. The engagement was competitive; all teams were challenged to escape

the room in 45 minutes. Only a few teams succeeded (7 out of 36 teams finished the challenge with only 4 out of 8 classes in which a team finished first and "won" the competition). Upon completion of the ERE, each student was asked to reflect upon and document their experience-based learning. Their written reports were content analyzed and provided evidence that participation in the ERE:

A. Led students to actively produce cognitive and emotional learning about how and why: (a) working on complex projects is better as a team than individually, i.e., individuals cannot achieve complex objectives alone nor by simply combining individually completed tasks, (b) defining a game plan as an initiating task can dramatically improve contribution, cooperation and coordination, (c) teams without leaders can meander off track, grow frustrated, and give up, and (d) teams afraid of constructive conflict can fall victim to groupthink. The triggering of negative emotionality from failure to escape the room transformed ways of thinking and frames of reference in ways that produce improved teamwork without instruction.

B. As a result of cognitive and emotional learning, students rapidly identified new behavioral intents related to: (a) communicating more openly and frequently with others to generate better solutions more efficiently, (b) developing a charter to guide contributions and serve as guardrails, (c) lead the team, and (d) initiate constructive conflict – also without any instruction about teamwork.

C. **Step 2**. In the next class, we added a second team building exercise to gather evidence of behavioral learning; i.e., did students do what they said they had learned in Step 1? A major theme in students' post-ERE reflection reports was their felt need for, and the strong intent to devise an initiating game plan to guide their team. Hence, in Step 2, we provided an agenda for each student team to produce a guiding team charter (TC). Based on the literature advocating for the TC (e.g. Aaron et al., 2014; Hunsaker et al, 2011), students completed the agenda by: (a) assigning roles to each member (leader, note-taker, manager, coach), (b) deriving ground rules in terms of 5 do's and 5 don'ts for future team meetings based on their learning from the ERE, (c) reviewing the team project expectations and developing consensus on the team's mission and milestones (interim tasks and deadlines) for successful and efficient project completion. For the next homework assignment, each student submitted a written report of the changes in their beliefs and attitudes about teamwork after the ERE, how those changes impacted their behavior during the charter-creation and led to behavioral intents noted in terms of specific items in their TC.

4. Students' Learning about Teamwork Competence

The 137 individual homework reports written by students at the end of the two-step team building process were content analyzed and served as a basis for our exploratory findings. This

process of two consecutive team building activities, each followed by reflection reports, produced evidence that students demonstrate the capacity to translate their cognitive and emotional learning into actions and make progress toward developing teamwork competencies. We summarize our key findings here which illustrate the linkages between: (a) five elements of teamwork competence aligned with students newly learned teamwork behavior in Step 2 (based on Hebles et al, 2022), (b) the changed beliefs and attitudes about effective teamwork due to experience in the ERE, (c) changed behavior and increased motivation for teamwork competence during the TC activity, and (d) representative quote from students' reports.

4.1. Planning and Coordination

This dimension of teamwork competence arose from the following changes: Students' old belief about teamwork was that it is best to dive into the project and divide tasks among team members to finish more efficiently. Based on the ERE, they formed a new conviction that the team is more efficient when members first draw a game plan for working together and achieving shared goals. As one student wrote: *"After the exercise, it became clear to me that in order to work effectively in teams, we need to set clear goals from the start and micro goals to accomplish said end goal. It will help everyone get on the same page and work progressively towards the answer."* As a result of this cognitive and emotional learning from Step 1 of team building, students expressed change in their own behavior and behavioral intents in Step 2 as follows: Conversation is more open and honest about distribution of work. Team members work enthusiastically on their TC. Behavioral intent was indicated in a new ground rule in the TC: Each member must complete tasks assigned to them and work equally.

4.2. Communication

This element of teamwork competence resulted from the following changes in students' beliefs, attitudes and behavior: Their old assumptions about working in teams consisted of working separately on their assigned task and communicating only when they complete it; expressing their idea or opinion only when they feel 100% sure it is right. After the ERE, they learned that the team works better when they freely and frequently discuss ideas, ask questions, express confusion, request help when unable to progress. A student remarked: *"Typically in groups I tend to do my individual part of the work and not discuss much with other members. I realized after doing this exercise that collaboration is a key aspect of group work. The groups that were the most connected, finished the fastest due to the different perspectives and ideas of different collaborators."* Another student added: *"I also learned that no communication within the group will lead to dead-ends, ultimately leading to low morale as a team, making them give up. Communication tremendously impacted our team charter for the better."* The resulting behavioral changes in Step 2 included notably more animated discussions with members sharing ideas and opinions more openly and honestly, raising questions and confusion quickly. Intent

for future expected behavior was encapsulated in the ground rule: Each member must make explicit what they have in mind, ask questions and clear up confusion immediately.

4.3. Performance Management

This aspect of working effectively in teams flowed from students articulating their recognition of the following: Old assumption that everyone knows how to work in teams, therefore there is no need for a leader. The ERE lead them to change this and gain a new appreciation for having a strong leader to ensure equitable contribution and engagement, keep the team on track - evident from the following student comment: *"Another change in my thinking was the (old) idea that no one had to speak up and take the role of a leader. In our group (in ERE) no one stepped up to be a leader and therefore we were moving at a slower pace. I have a new belief that one member needs to be the leader. Having one person step up and taking control is what will lead the team to achieve goals and keep progressing. (In the TC meeting) I stepped up as a leader during this task as I learned the importance of this in the earlier exercise."* Thus, the behavioral change in Step 2 included many students taking the team leader role immediately, working to avoid distractions, digressions, and ensure equitable contribution and engagement. The ground rule encapsulating intent for future behavior on this teamwork competency is: Team members will understand the multiple roles necessary for effective teamwork and take on the responsibilities and functions as needed.

4.4. Supportive Behavior

We identified this component of teamwork competence based on the following shifts in beliefs, attitudes and behavior students reported: Prior to the ERE, students believed that it is important to focus on their assigned task, not important to listen to others or help them. Their new conviction from their ERE experience is that listening has a key role in effective teamwork to ensure everyone is on the same page, build on each other's ideas and help each other to reach solutions efficiently. A student explained: *"Prior to this exercise, I did not truly consider the role that listening has in groupwork but this exercise made me realize the power of giving your full attention to someone when they are speaking. It not only speeds up all work processes but can lead to breakthroughs that may not have occurred without the thoughts and ideas of multiple people. Given that every member has a distinct perspective and thought process, it is vital that each member listen as well or as much as they speak in order for the group to reach peak efficiency."* As a result, in Step 2 students report that they often *listen* more, pay attention to others' ideas and views, ensure all voices are heard. The conviction was strong enough to include in a new ground rule for what was expected in future team meetings: Team members will listen actively, utilize different ideas and perspectives, provide their own to build better and quicker solutions.

4.5. Conflict Management

We find that students gain this insight best through their experiential learning and reflecting on changes needed in their prior beliefs about teamwork. Students admit that they previously believed that the team works best when members are like-minded and very agreeable. Based on their ERE experience, for many the disappointment of not winning or completing the series of puzzles, led to a new conviction: the team works best when members bring different ideas and opinions to the table, openly discuss, and respectfully disagree and question ideas when needed. A student admitted: *"Before this exercise (ERE), I found myself often trying to avoid any sort of conflict within a team setting. However, after this exercise I switched this opinion and believe constructive conflict is an important aspect to an effective team. It generated creativity in the problem-solving process, and allowed us to talk openly and respectfully through certain opinions and disagreements to come up with the best possible decision."* Therefore, in Step 2 of team building, many students report freely expressing difference of opinions, frequently challenging each other's views and welcoming others' suggestions for change. The new ground rule incorporated from this learning: Constructive conflict is necessary to avoid groupthink. Team members should not hesitate to question and challenge ideas, opinions, or decisions in the team.

5. Conclusion

We asked all participants, prior to their engagement in team building, about their previous experiences with teamwork. *All* reported prior experience working in teams, many reported extensive experience – 77% said they had previously worked in over 10 teams. However, based on the ERE in Step 1 of team building, it appears that previous team experience led to teamwork *incompetence*, e.g. dividing up tasks and working separately, whitholding ideas and diverse opinions, and giving up rather than admitting confusion or critiquing others' ideas. Our finding lends support to the notion that assigning students to teams without engaging them in early activities designed to improve their teamwork competence often leads to detrimental results. Our two-step team building could help avoid these problems. After Step 1, given that most teams did not complete all the puzzles in the ERE, participants reported a felt need to change their thinking and actions, set aside their social anxieties in favor of interacting with others who could help and support them in accomplishing shared goals. To instructors who continue to exhibit faith in the notion that simply assigning students to classroom teams and, at best lecturing them about best practices, can produce teamwork competencies, our study produces sobering evidence to the contrary. A careful engagement of students in exercises and activities designed to produce the important cognitive and emotional learning seems essential, followed by exercises that require students to translate their learning into actions. Future research could expand on our study with quantitative measures to confirm our findings as well as test the impact of this two-step team building on the longer term collaboration achieved by student teams

working throughout the term on their team project. A comparison could also be drawn between teams that experienced this two-step team building and those that did not, students' satisfaction levels after working in a classroom team with this two-step team building approach compared to teams that only apply the team charter activity. Finally, this two-step team building could be examined in classes in other disciplines since working in teams is an ability valued in various fields including health care and information systems.

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Effect of an authentic design thinking learning experience on collaboration, social problem-solving and satisfaction in physiotherapy and dietetics students

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Abstract

Aims: This study aimed to assess i) the effect of a design thinking learning experience in an authentic 'real world' environment on physiotherapy and dietetics students' skills in collaboration and social problem-solving and ii) their satisfaction with the learning experience.

Methods: A single group, quasi-experimental study with a pre- and post-test design involving 46 physiotherapy and dietetics students. Data were collected using self-administered anonymous questionnaires: the Interprofessional Collaborative Competency Attainment Scale-Revised, the Social Problem-Solving Inventory-Revised Short Form and a bespoke questionnaire exploring student satisfaction with the experience.

Results: Mean scores for collaboration were significantly higher following the learning experience. Social problem-solving skills did not change. Students reported satisfaction with engagement, support, and structure of the learning experience.

Conclusions: A design thinking approach can improve skills in interprofessional collaboration. Students reported satisfaction with the learning experience. The development and assessment of social problem-solving skills using a design thinking approach requires further research before definitive conclusions can be drawn on this topic.

Keywords: *Design thinking; interprofessional education; problem solving; dietetics; physiotherapy.*

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1. Introduction/Background

Healthcare professional (HCP) students need to acquire not only knowledge and skills in the basic and clinical sciences but, importantly, must simultaneously demonstrate the thinking processes required to resolve complex patient problems and navigate rapidly evolving environments (Baruch, 2017; McLaughlin et al, 2019). Learning to develop critical thinking, problem-solving, effective communication and collaborative practice skills are core to contemporary HCP curricula (Van de Grift & Kroeze, 2016: Cengiz et al, 2023) to enable the next generation of HCPs to deliver evidence-based, person-centred care.

There is a growing body of evidence that interprofessional collaboration (IPC) can enhance responsiveness to the needs of the service user to meet common interdisciplinary team goals and improve service user and healthcare systems outcomes (McLaney et al, 2022). The World Health Organisation (WHO) Framework for Action on Interprofessional Education and Collaborative Practice (2010), defines interprofessional education (IPE) as a strategic approach when "two or more professionals learn about, from and with each other during their education in the development of effective collaboration for future practice" (Gilbert et al, 2010. To date, achieving effective integration in HCP pre-registration programmes has been challenging, predominantly due to structural, curricular, financial, cultural, and organisational issues (Samarasekera et al, 2022; Frenk, 2022 et al).

Design Thinking (DT) provides an innovative approach to collaborative problem-solving that utilizes a user-driven process to design and deliver an impactful solution that meets the needs of the user (Ingram et al, 2022). The process supports the development of skills in critical thinking, problem-solving, collaboration and communication (Van de Grift et al, 2016) and is consistent with patient-centred care (Huang et al, 2021). Design thinking generally includes five steps, namely, "empathy", "define", "ideate", "prototype" and "test" and although described as a linear process, it is iterative when applied. The process requires team members to practice and communicate divergent and convergent thinking processes to collaboratively create and test the best fit solution to user problems (Beard et al, 2018). Most studies examining the implementation of DT methodology and processes in HCP curricula to date have been conducted in medical students' education and are limited (Van de Grift et al, 2016, Huang et al, 2021). To the best of our knowledge, the DT approach is yet to be applied in the education experience and curricula of physiotherapists and dietitians.

Healthy UCD is a health promotion initiative in University College Dublin (UCD) which endeavours to create a culture supportive of healthy lifestyle choices for the university community and raises awareness of individuals staff and student capacity to improve their own health status. It is aligned with national government strategy in Ireland and to the Irish Health Services (HSE) efforts to promote the WHO 'healthy campus' concept (HSE, 2023).

By engaging with, and in partnership with Healthy UCD, we created an authentic 'real world' experiential learning opportunity for physiotherapy and dietetics students, to create a health promotion campaign underpinned by a DT approach. This paper provides an overview of the process, presents our findings in relation to the effects of the learning experience on the students' perceived IPC and problem-solving skills, and explores their satisfaction with the learning experience.

2. Methodology

2.1 Study design, setting and participants

A quasi-experimental study with a pre-test: post-test design was conducted in UCD, Ireland from September to November 2023. All students involved in the development of a university-wide healthy eating active living campaign (23 MSc in Clinical Nutrition & Dietetics, 23 Professional MSc in Physiotherapy) were invited to participate. Both student groups had experience in interdisciplinary problem-based learning from previously taught modules; however, neither group had previous exposure to DT.

2.2 Procedure prior to intervention

Students' participation was voluntary. An information pack outlining the study purpose, aims, rationale, participation process and study data management was provided to each student via the university's virtual learning platform to enable informed decision-making for study participation. Students were provided with access to study questionnaires also via the virtual learning platform and consent was obtained prior to completion. All information collected was anonymous. Authors obtained permission to use study questionnaires. The study was approved by the Human Research Ethics Committee-Sciences in UCD (LS-C-23-162-Dervan Low Risk).

2.3 Measures

Data were collected using self-administered questionnaires.

2.3.1 Interprofessional collaboration assessment

The Interprofessional Collaborative Competency Attainment Scale-Revised (ICCAS-R) is a self-validated administered 21-item questionnaire; 20 questions measure six interprofessional skill dimensions namely communication, collaboration, roles and responsibilities, collaborative patient-family-centred care, conflict management/resolution and team functioning using a 5-point Likert scale (1 = poor to 5 = Excellent) (Archibald et al., 2014; Schmitz et al., 2017). Higher total scores represent higher IPC competency. An additional question asks students to compare their ability in IPC after the learning activities using a 5-point qualitative scale ranging

from much worse now to much better now. The tool was developed as a retrospectively administered pre-test: post-test tool in healthcare students and practicing clinicians to self-assess IPC competencies (Archibald, 2014).

2.3.2 Problem-Solving assessment

The Social Problem-Solving Inventory-Revised-Short Form (SPSI-R:SF) is a validated 25-item self-report questionnaire that assesses functional and dysfunctional characteristics to solving life problems D'Zurilla et al, 2002, Hawkins et al, 2009). It consists of five different scales which measure the five-dimension social problem-solving model (positive problem orientation (PPO; 5 items), negative problem orientation (NPO; 5 items), rational problem-solving (RPS; 5 items), impulsivity carelessness style (ICS: 5 items) and avoidant style (AS; 5 items) (D'Zurilla, 2002)). Each item is rated on a 5-point Likert scale ranging from 0 which represents "not at all true to me" to 4 which represents "extremely true of me". Totals are calculated for each subscale as well as for a cumulative score. Higher total scores are indicative of a higher level of social problem-solving skills. Higher scores on the PPO and RPS represent more adaptive problem-solving whereas higher scores on the NPO, ICS and AS are reflective of a more maladaptive approach to problem-solving.

2.3.3 Student satisfaction

Student satisfaction was assessed using a bespoke questionnaire rated on a 3-point Likert scale (agree, disagree, agree nor disagree). The students were asked whether they perceived changes in their skills in communication, collaboration, problem-solving and health promotion, and if the experience was engaging, offered sufficient support and had a good structure.

2.2 Intervention

Design thinking methodology and processes underpinned the learning experience, which required students to collaboratively create a user-centred health promoting campaign for the university community. The learning experience was completed over nine weeks and, from the outset, students worked in mixed discipline groups of four or five. Table 1 outlines the experience. The process was supported by educators with previous experience in DT. Students worked with key stakeholders within and outside the university to enable implementation of their initiatives (prototypes). The ICCAS-R and SPSI-R:SF were administered pre- and post-the learning experience, while the satisfaction questionnaire was administered following the learning experience.

Table 1. Outline of the 9-week DT learning experience

Week	Components
1: Plan	Day 1: Introduction, team building activities, health promotion and project management lecture facilitated by educators with DT and health promotion expertise. Day 2: Creativity workshop, DT empathy phase completed (students observed, conducted in-person/online interviews and surveys, reviewed available literature and reports). Day 3: Define phase (students identified a user-centred problem statement using mixed methods including system mapping, student/staff journey mapping, thematic analysis); ideate phase (students utilised ideation methods such as brainstorming/writing, De Bono's hats, nominal voting to create a problem statement solution). Day 4: Ideate phase completion (as above); prototype (initiative) phase (students presented their problem statement solutions to the physiotherapy and dietetic programme teams, and Healthy UCD health promotion officer). Day 5: Ideate and Prototype (initiative) phase (students developed their prototype based on learnings/insights from day 4); student project management team established.
2-7	6-hour group work developing prototypes (initiatives) and campaign. Students worked in their mixed discipline groups and with the project management team. Support was available from the UCD health promotion officer each week for 1-2 hours at the beginning of the day.
8: Test	Students implemented a 1-week health promotion campaign in collaboration with Healthy UCD and relevant stakeholders. Prototypes (initiatives) included signposting in student union shops on healthy food choices, easy to follow instructional videos available via QR codes for gym equipment in the student gyms, incorporation of vending machines with reasonably priced healthy pre-packaged meals, creation of a walking community and resources on walking trails, an online healthy living campus map and wellness workshops with exercise classes and healthy recipes demonstrations.
9: Evaluate	Students completed one evaluation report per group on their DT process, prototypes, and evaluation from testing of prototypes (surveys, questionnaires, social media analytics, user feedback) for feedback to Healthy UCD.

2.3 Data analysis

The data were analysed using SPSS Version 29. Descriptive statistics are provided. As data was normally distributed, paired *t*-tests were used to compare the pre-post mean and standard deviations for the ICCAS-R and the SPSI-R: SF. The significance level was set at $P<0.05$.

3. Results and Discussion

Ninety one percent (42/46) of students completed the ICCAS-R and SPSI-R:SF while 87% (40/46) completed the satisfaction questionnaire.

3.1 Effect on students' IPC competency

Students' perceived IPC competency increased significantly from 63.8 (SD 8.6) to 79.9 (SD 8.5) post intervention (P<0.001). Significant increases (p<0.001) also occurred across all skill dimensions. Total scores, subscale skill dimension scores and analyses are summarised in Table 2. Thirteen students completed the question rating their ability to collaborate interprofessionally after the learning activities, with all but one (12/13) reporting their ability to be somewhat better or much better following the learning experience.

Table 2. Effect of the learning experience on interprofessional competency

Skill dimensions	Pre mean (SD)	Post mean (SD)	Mean difference (SD)	t-test	p*
Communication	15.7 (2.2)	19.6 (2.2)	3.9 (3.5)	7.1	<0.001
Collaboration	9.6 (1.7)	12.2 (1.6)	2.6 (2.2)	7.7	<0.001
Roles & Responsibilities	13.5 (2.1)	16.4 (1.8)	2.9 (2.2)	5.8	<0.001
Collaborative patient-centred approach	9.0 (2.1)	11.3 (1.9)	2.3 (2.5)	5.8	<0.001
Conflict management/resolution	10.1 (2.1)	12.5 (1.6)	2.4 (2.9)	5.3	<0.001
Team functioning	5.9 (1.3)	8.1 (1.4)	2.1 (1.9)	6.9	<0.001
ICCAS-R total	63.8 (8.6)	79.9 (8.5)	16.07 (12.8)	8	<0.001

SD=Standard deviation; ICCAS=Interprofessional Collaborative Competency Attainment Scale-Revised. *p=significant difference between the groups (p<0.05).

3.2 Effect on students' social problem solving.

Table 3 provides an overview of the mean total scores in social problem-solving and the subscale skill dimensions. Social problem-solving scores remained similar pre-post intervention.

3.3 Student satisfaction and feedback

Most students (87.5%; 35/40) reported the learning experience as engaging, 90% (36/40) reported that they had sufficient support and 82.5% (33/40) were satisfied with its structure. In relation to clinical skills, 95% (38/40) reported improvement in health promotion ability, 75% (30/40) in communication, 90% (36/40) in IPC and 70% (28/40) in problem-solving.

Table 3. Effect of the learning experience on social problem-solving

Functioning	Skill dimensions	Pre mean (SD)	Post mean (SD)	Mean difference (SD)	t-test	P*
Adaptive problem-solving	Positive problem orientation	100.6 (10.44)	103.1 (12.64)	2.5 (15.93)	1.01	0.315
	Rational problem solving	95.33 (12.99)	100.12 (12.62)	4.76 (17.69)	2.5	0.89
Maladaptive problem-solving	Negative problem orientation	97.96 (11.71)	92.89 (9.18)	5.04 (13.01)	-1.74	0.18
	Impulsivity-carelessness style	93.71 (12.53)	94.71 (14.29	1 (20.89)	-0.31	0.758
	Avoidance style	96.42 (10.63)	95.5 (12.05)	0.83 (17.34)	0.378	0.757
	SPSI-R:SF total	102.21 (10.71)	105.64 (10.53)	3.49 (14.07)	1.58	0.122

SD=Standard deviation; SPSI-R:SF=Social Problem-Solving Inventory-Revised-Short Form. *p=significant difference between the groups ($p<0.05$).

3.4 Discussion

The purpose of this study was to examine the changes in physiotherapy and dietetics students' self-reported skills in IPC and social problem-solving before and after a health promotion learning experience underpinned by DT methodology and processes. Overall, significant improvements were observed in students' self-reported skills in IPC across all skill dimensions. In addition, students reported high levels of satisfaction and an improvement in clinical skills in health promotion, communication, IPC and social problem-solving after the learning experience. These results are consistent with previous results that demonstrate improvements in self-efficacy skills in IPC and high levels of satisfaction with DT learning experiences in HCP education (Wang et al,2018; Van de Grift 2016).

In terms of problem-solving skills, no significant changes were noted. Previous data on the effectiveness of DT in developing problem-solving skills in HCP education is lacking (McLaughlin et al, 2019) making it difficult to compare our findings. However, it is worth considering that our students' mean total scores were within the normal range for social problem-solving at baseline, which may have caused a ceiling effect. Further research is needed before definitive conclusions can be drawn on this topic.

The results of this study should be interpreted in the context of its limitations. Firstly, changes to IPC and social problem-solving were self-reported with no objective assessment of competency. Secondly, post test results could have been influenced by social desirability; students may have inflated their responses to demonstrate improvement from the learning experience. In addition, while the SPSI-R:SF is a validated tool for measuring self-reported

changes in social problem-solving ability, it has not been frequently applied in a third level student population. Hence, its ability to show variation in this context may need further exploration. Finally, and important to note, all students had prior experience with interprofessional problem-based learning activities. This previous exposure to theory and practice in IPC and problem-solving may have impacted on how they perceived their abilities in social problem-solving and collaboration.

In conclusion, our findings provide preliminary data that show using a DT approach in an authentic 'real world' learning environment can improve skills in IPC and facilitate an engaging learning experience for dietetics and physiotherapy students. Further research is required to develop and assess the impact of DT on social problem-solving skills in healthcare professional students.

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An Active Learning Simulation for Teaching Hadoop in an Undergraduate Business Curriculum

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Abstract

This paper describes a hands-on simulation for teaching Hadoop concepts to undergraduate students of various majors (Finance, Marketing, etc.) in a business school. The simulation was developed for an introductory course in a Business Intelligence & Analytics (BI&A) curriculum and adapted for use in a Database Management (DB) course. Designing, deploying, and maintaining a physical Hadoop cluster on premises is expensive and cloud-based services are resource-intensive. Additionally, average technical skills of business students make a computer-based simulation too sophisticated to bring Hadoop into focus. The majority of business students, even when majoring in BI&A, will choose careers in which a practical understanding of Hadoop environments will be of great benefit, but these students will not need the deep programming or engineering expertise needed to implement one. This simulation provides an engaging, technically accurate model for how Hadoop stores, tracks, and accesses relational and non-relational data.

Keywords: *Databases, Hadoop, Active Learning, Simulation.*

1. Introduction & Learning Context

This paper describes a simple, hands-on, experiential learning activity to help students understand core Hadoop concepts by simulating a server cluster. The course (Database Management) is offered at a doctoral degree-granting, liberal arts university with a business school, with total enrollment of over 9,000 students. The business school has seven departments offering nearly 40 different specialized majors and minors, and has AACSB International (https://www.aacsb.edu/) accreditation. The course is an introduction to the use, design, implementation, and operation of databases (DBs), and is the only BI&A DB class. The course has a single prerequisite (Introduction to Information Systems), and does not assume any previous DB or programming experience.

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1.1. Hadoop

Hadoop is a framework for organizing hardware and software components to be able to store, distribute, track, and retrieve data for multiple purposes. It is an extremely complex concept, difficult to grasp for non-technical students. It handles relational data (as generated by online transactions) and nonrelational content like movies, pictures, and more. Relational queries used all available data to produce an answer, i.e., Total Sales would be incorrect if only *some* data was used. Nonrelational data is processed differently: you do not need to receive the entire movie to start it, and you no longer need what you have already watched. Duplicate data distributed in different clusters of servers (nodes) enhances service performance and availability if nodes or clusters fail. The activity simulates four core Hadoop concepts: Hadoop Distributed File System (HDFS), MapReduce, YARN (Yet Another Resource Negotiator), and NoSQL. These components sufficiently and accurately describe Hadoop to meet our students' needs, and full coverage would require several deeply-technical courses. In simple but accurate terms, Hadoop uses HDFS to track duplicate data distributed in many clusters. MapReduce identifies where data resides (nodes) and removes duplicate data received in response to a query. YARN is an opportunistic resource scheduling technology for (mostly) nonrelational queries which uses available cluster/node capacity 'wherever' it can. NoSQL refers to DB software to process nonrelational data. While not a simulation component, it is included because relational DBs are not well suited to the nature of nonrelational data.

2. Literature Review

Information systems (IS) courses in business schools have long been plagued by a focus on technology, without consideration of their strategic role, or of skills such as data analysis, project management, and interpersonal skills, which are prized by employers (Kesner et al., 2013). Experiential learning and active learning methods are well-suited to developing these valued skills. Experiential learning is the use of real or simulated experiences to turn theoretical or previous practical knowledge into new knowledge (Kolb, 1984). In its 2022-2023 report, AACSB, the international business school accreditation body, identifies student development, career readiness, and experiential learning as top areas for best practices in accreditation processes (AACSB 2023). Active learning is loosely defined as active student involvement in their own learning through simulations, games, and role-playing activities which help students analyze, synthesize, and evaluate information as they would professionally (Drake, 2012).

Games and simulations are effective in the instruction of complex, abstract technology concepts (Bliemel and Ali-Hassan, 2014), particularly with students without technical backgrounds and varied levels of interest (Conrad et al., 2019). Games and simulations can greatly improve higher education business instruction (Lu et al., 2014) and have been called "essential for preparing the next wave of technical talent" (Debo and Podeski, 2019).

There is a large number of non-academic Hadoop games and simulations in free/paid asynchronous courses, and technical curricula like Computer/Data Science often use software simulations. Liu et al. (2015) developed a YARN cluster performance simulator as a design and evaluation tool. Others use complex infrastructure and a full software stack with students with deep technical background (Dinter et al., 2017; Debo & Podeski, 2019). While effective, these simulations are not appropriate introductory mechanisms for non-technical audiences. A course with MIS and MBA students assigns students to specific roles in competing teams. Using a dozen decks of playing cards, this clever simulation focuses on MapReduce and relational data, leaving out HDFS, YARN, and NoSQL concepts (Conrad et al., 2019). Another role-playing simulation focusing on MapReduce and HDFS uses a learning management system (Blackboard) to simulate these functions (Yang & Guo, 2020). The simple, hands-on simulation described here uses active and experiential learning to help students transform lecture materials in a familiar context to help them understand the complexity of Hadoop. The activity does not require programming expertise, sophisticated infrastructure, and is suitable for non-technical students.

3. Simulation & Materials

This simulation was created during the Fall 2016 semester to explain HDFS and MapReduce using only relational data. After a couple of successful uses, it was adapted for the Database Management course in Fall 2017. It has been expanded and improved through trial and error over the course of its use to include nonrelational queries in a way that is both experiential and fun, making use of student experience with social media platforms and streaming services. All processes and materials were created specifically for this use and are original.

The simulation makes use of around 100 table tennis (ping pong) balls and a butterfly net (Figure 1) to illustrate the functions of HDFS and MapReduce on relational data.



Figure 1. Ping Pong balls and butterfly net

A set of 150 flat, magnetic, geometric shapes in several colors are used to represent nonrelational data (images, sounds), and graphics easily found online are used for students to recreate on a whiteboard using the magnetic color shapes (Figure 2). Lastly, two 50-foot (15.25 meters) nylon ropes in different colors (also Figure 2) are used to simulate nonrelational data for the streaming of movies or songs.

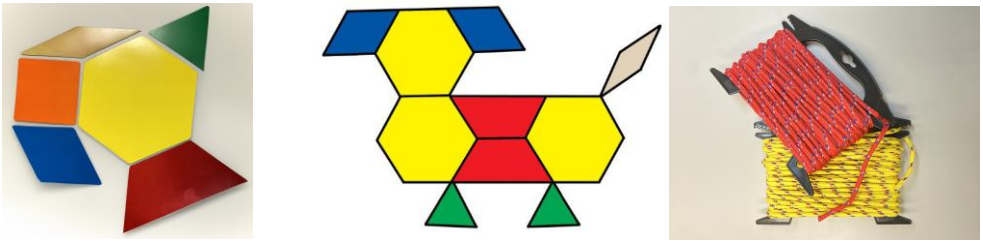


Figure 2. Magnetic shapes, graphics, and nylon rope

4. Running the Simulation

In his theory of Assimilation Learning, Ausubel (1968) describes meaningful learning as using pattern recognition and concept association to understand and connect information to other knowledge to aid learning. In order to achieve meaningful learning, an instructor must (1) define new concepts clearly, (2) provide representative examples, (3) put them into context, and (4) motivate students. Following this definition, the simulation is preceded by lectures in which HDFS is introduced by comparing it to the File Allocation Table (FAT) system used in early versions of personal computer operating systems to manage file storage and retrieval. The lecture also includes explanation of MapReduce, and of the function of YARN for streaming services. The lecture examples are simple, based on real-world activities that contextualize these technologies using the students' own experience with physical filing systems, social media platforms, and streaming services. This is combined with other course coverage of relational DBs to provide a lively, fun break from complex material to bring Hadoop to life and motivate students to understand the operation of a Hadoop environment.

Students are told they will become nodes in a cluster, and the instructor and 3 student volunteers act as control (master) nodes for the cluster. The cluster is populated with relational and nonrelational data by distributing all materials. An explanation of what each set of materials represents and how they are going to be used is provided to bridge the time it takes for the materials to fully make it around the room. Students are told the cluster will be "initiated" once data is "loaded," and once the details of processing relational and nonrelational data in the cluster have been explained. Each element below is described individually as each set of materials is distributed, and once the simulation begins the instructor calls out incoming "queries" the cluster needs to solve.

4.1. Simulating Relational Data (Ping Pong Balls)

The ping pong balls are labeled with letters or numbers and as a set they represent a single large relational file. Students are instructed to take a handful of balls, taking care no duplicates are selected individually. Across the cluster, duplicate data (several balls in the same color with same label) exist, but individual students will not have any. When the instructor asks for "the red file" each node (student) answers the query based on the data it has (the Map function of MapReduce), and the student with the butterfly net is asked to collect all pieces. Students may place the balls in the net or toss them from any distance to the student with the net. Inevitably, this leads to controlled chaos and lots of energy and laughter in the classroom. When all relational data is collected, the student with the net is asked to eliminate redundant data by placing duplicates in the storage bag, and to loudly announce the result of the query ("Red 1, Red 2, Red 3," etc. until all pieces are read). The instructor points out the query result cannot be trusted until everyone in the room surrenders any red ball they possess. This perfectly illustrates the batch nature of relational data and queries, in which all available data must be retrieved to answer a query in a reliable way.

4.2. Simulating Nonrelational Data (Magnetic Color Shapes as Pictures)

Two student volunteers are asked to the front of the room and build the pictures they will soon see projected on the screen. The students decide who will be the runner (collecting the necessary pieces) and who will be the assembler (putting them together on the whiteboard). They are instructed to collect the pieces one at a time, and to avoid collecting more than one from a single node. The nodes are asked to hold all useful pieces in the air so the runner can find them. An electronic file with many more freely-available images than could be used in a single session is kept to facilitate this activity and keep it moving. Students are told each "file" represented by the image on the screen could be any large binary object, but static images are typically used as an example to demonstrate how each piece is only retrieved once, that the location in the image of identical pieces make them different from each other, that it does not much matter which node a useful image comes from as long as each needed piece is retrieved, and that it is not necessary to collect all other duplicate pieces from the cluster. This is a fairy faithful model for how Hadoop clusters handle nonrelational data.

4.3. Simulating Nonrelational Data (Spooled Nylon Rope as Video Streaming)

Lastly, the spools of rope are given to two different students on opposite sides of the room, and everyone is reminded of the function of YARN (largely, streaming). The choice of a length of rope to simulate the streaming function of YARN is very deliberate, and as the rope is handed to the students, the word "yarn" is repeated and emphasized. With this device, the simulation consists of announcing the start of a favorite movie or song, and by the time we arrive at this

point, students are excited to start and students happily offer titles. As a movie and a song are chosen, the instructor begins to pull on the end of one of the ropes, and the student can no longer pay attention to any other query they could address, just as a single node streaming data may use all processing power for that purpose. After a few feet of rope, the instructor moves the spool to a different student to show how the next segment of the movie or song may be streamed from a different node in the cluster. Sometimes, students themselves will pass the rope to someone else when they want to participate with the ping pong balls or magnetic color shapes.

Once all materials are distributed and questions are addressed, the room is ready to function as a Hadoop cluster. The instructor ceremoniously "initiates" the cluster, calls out a relational query by asking for all balls of a particular color, a nonrelational query by projecting an image on the screen to construct on the whiteboard using the magnets, and moves to a student holding one of the spools of rope to start "streaming" a movie, and to the other for a song. As each of these queries is completed, the instructor calls out another, moves the rope spool to a different student, and maintains an atmosphere of controlled chaos for around 5-7 minutes.

5. Results

This simulation was first conceived in Fall 2016 for a different course and adapted for this one in Fall 2017. At the time, Hadoop was part of a larger course module (*Enterprise Applications*), which became its own module (*Big Data & Hadoop*) in Spring 2018. After the pandemic, the module was scheduled earlier in the term to ensure consistent coverage every semester. In the Spring 2021, an online game-based learning platform (Kahoot!) was adopted to develop short, multiple-choice, timed quizzes to assess learning at the conclusion of each module. As the game starts, students are presented with the 4 answer choices the game allows, and the point value of each question starts to go down, so students earn more game points with speedy answers. The questions are written by the instructor and reflect the manner in which students must approach exam questions. The data collected covers the complete *Big Data & Hadoop* module, but some questions are specific to the simulation concepts and the data offers some interesting insights. Over 10 games with a total of 236 players (21.45 average players/game), students answered the three Hadoop questions (Table 1, Q3-Q5) in the seven-question game at the highest correct rate by a substantial margin (Table 2). The three Kahoot! questions which reflect the materials covered in the simulation are answered correctly an average rate of 79.05%, compared to 54.04% for the rest of the questions covering the full *Big Data & Hadoop* module. This suggests the simulation helps students absorb the concepts represented in the activity with greater ease. A more in-depth analysis of the available data is under way to reveal additional insights regarding learning outcomes, but the initial review is encouraging.

Table 1 - Kahoot! Questions for Big Data & Hadoop Module [Correct Answer]

Q1	Per class discussion, which of these is not a Big Data descriptor [Veracity]
Q2	This is not true about Hadoop [It is a single product]
Q3	*A group of Hadoop nodes is a(n) [Cluster]*
Q4	*It's what keeps track of where Hadoop data is stored [HDFS]*
Q5	*NoSQL is [Non-relational]*
Q6	JSON is [A data package]
Q7	This speeds performance for single-attribute operations [Columnar storage]

Table 2 – Kahoot! Games Summary

No. of Games	Ave. Players per Game	Q1	Q2	Q3	Q4	Q5	Q6	Q7
11	21.45	52.12	57.06	*85.37*	*77.31*	*74.47*	50.94	56.07

6. Discussion & Next Steps

The numbers above and the observed level of energy in the classroom suggest the simulation is an effective, engaging mechanism to bring the sophisticated concepts of Hadoop to life. In future offerings, the simulation may be run a couple of times for longer periods to ensure students understand each of the concepts presented in the preceding lecture at full speed. An extension to the game to incorporate data lake functionality is in the early stages. Deeper analysis of Kahoot! data may add to our understanding of the effectiveness of the simulation, and a method of assessment to measure learning outcomes after the lecture but before the simulation, and after the simulation, without undue delay to the course flow, is being considered.

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Increasing Student Success across Faculties through an Immersive Block Model: An Australian Case Study of Innovative Teaching and Learning

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Abstract

Globally, higher education (HE) providers are exploring ways to adapt their education delivery approach in light of changing student demographics and shifting learner preferences. This paper presents 2023 results from a whole-of-institution curriculum reform project at a comprehensive, public Australian university, where traditional semesters were replaced with an innovative 6-week immersive block model. The submission describes the model, then assesses the effectiveness of the immersive block model on improving student learning outcomes across five faculties and two colleges, through comparing pre-COVD, traditional model 2019 student performance data with 2023 results from the first full year of implementation. The analysis demonstrates increased: pass rates (70.6% to 88.1%); and, Grade Point Averages (3.72 to 4.60). Implications for practice at HE institutions considering curriculum reform are discussed.

Keywords: *curriculum reform; curriculum innovation; block model; immersive scheduling; active learning; student success*

1. Introduction

Over the preceding five decades, there has been substantial growth in higher education (HE) enrolments globally. Initiatives to enhance HE participation and accessibility for a broader demographic have increased the number of students participating in HE who are typically underrepresented, including students from low socio-economic areas, students registered with a disability, and part-time students with work commitments (Stone, 2022). This can be seen in anglophone countries like Australia, the United Kingdom (UK), and the United States (US), but also in nations across Europe (Weedon & Riddell, 2016). However, while diversity has

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improved, disparate achievement outcomes in terms of pass rates exist across student cohorts; addressing this gap is a pressing challenge (Marginson, 2016).

Curriculum reform has emerged as a key driver to address the challenges accompanying student population heterogeneity. Curriculum reform emphasizes the power of evidence-based approaches to pedagogy, content, and assessment to improve student achievement (Woelert et al., 2022). Interest in curriculum reform is also driven by the post-pandemic student demand for more flexible learning experiences (Fishman et al., 2022). One type of reform that HE providers are turning to is the immersive block model (Roche et al., 2022).

1.1 Literature Review: Curriculum Reform and Immersive Block Models

Immersive block models are a non-traditional form of HE delivery that aim to enable greater levels of focus, and in turn better support the academic success of diverse HE cohorts (Roche et al., 2023, 2024; Turner et al., 2021). Immersive blocks models involve single subjects studied over shorter teaching periods of 4-6 weeks, differing from conventional 12-15 week semesters (Samarawickrema et al., 2022). They are typically underpinned by active learning pedagogy. Active learning has long been recognized for its efficacy in elementary, secondary, and higher education (Wilson et al., 2023), improving students' . Studies assessing active learning's impact in HE contexts demonstrate improved: knowledge retention and retrieval (Karpicke et al., 2009); real-world problem-solving skills (Crouch & Mazur, 2001); and, student achievement (Freeman et al., 2014).

Literature on immersive block learning has grown in recent years as more institutions experimented with non-traditional teaching models during and post the COVID-19 pandemic (Buck & Tyrrell, 2022; Goode et al., 2023a, 2023b; Loton et al., 2022; Turner et al., 2021). Studies suggest that immersive block models can significantly improve student academic success, especially for pathway education (Goode et al., 2024b), first-year undergraduates (Buck & Tyrrell, 2022; Loton et al., 2022), international students (Goode et al., 2024a), and those from equity groups (Roche et al., 2023). However, questions have been raised in regard to its appropriacy across disciplines and faculties (Konjarski et al., 2023).

This paper contributes to the literature by providing insights into a large-scale curriculum reform spanning multiple faculties at a HE institution. The study addresses the research question: How has an immersive block model underpinned by active learning pedagogy affected the academic success of students in different faculties?

2. The study

2.1. Context

The analysis presented in this paper reports on the Southern Cross Model (SCM), an immersive block curriculum model (Roche et al., 2022, 2024). The SCM is situated within an Australian regional public institution with an enrolment of approximately 19,000 students spanning five faculties, two colleges, and diverse disciplinary areas such as health, science, engineering, laws, business, information technology, education, Indigenous knowledge, and the arts. It is of note that only 25% of the student body secures admission based on high school results, with up to 60% being first-generation university students. Additionally, 40% of enrolled students reside in regional or remote Australia, 40% pursue their studies online, and close to 5% identify as Indigenous – Aboriginal and/or Torres Strait Islander (Roche et al., 2023). These characteristics have remained principally the same over the period of this study.

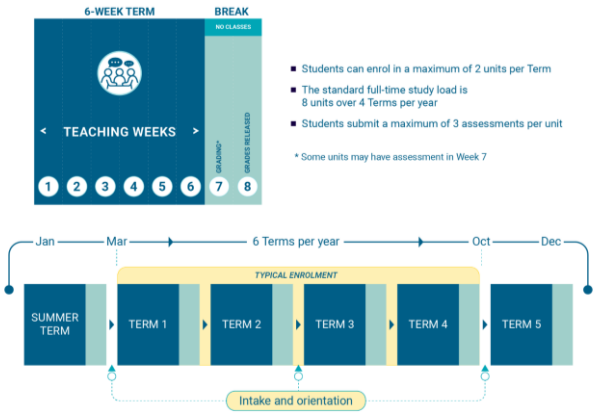


Figure 1. Teaching Terms in the Southern Cross Model. Source: Goode et al., 2023a.

The SCM reconfigures the academic calendar, dividing it into six, six-week terms, each requiring a full-time commitment to two units (refer to Figure 1). A standard full-time enrolment spans four terms (1-4) annually with the majority of students taking Term 5 and Summer Term off. The units in the SCM are designed to match their counterparts in the traditional model in terms of both the learning volume and the learning outcomes. Consequently, a typical student, throughout a calendar year, accomplishes an equivalent number of credit points within the same overall timeframe as in the traditional model.

The SCM required modifications to teaching, learning, and assessment policies and procedures with the intention of enhancing students' learning experiences through a more uniform, interactive, and learner-centric instructional approach throughout the institution (Roche et al., 2024). Institutional policy operationalizes each of these principles across three primary forms of learning: 1) **Self-access online modules** featuring media-rich, interactive content that is

responsive and offers students regular practice and feedback opportunities; 2) **Scheduled classes** characterized by guidance and interactivity, involving tasks like problem-based scenarios, discussions, and simulations, with an exclusion of lectures; and, 3) **Authentic and manageable assessments**, restricted to a maximum of three tasks scaffolded across a unit. The curriculum reform required significant change to institutional policies related to assessment, teaching and learning across core functions: e.g. Assessment, Teaching and Learning Policy - replace lectures with interactive workshops, cap number of assessments per unit at 3, limit use of examinations, new assessment moderation guidelines (for a discussion of these see Roche et al., 2024). The model was piloted in limited courses in 2021 (Goode, et al., 2023) and then implemented in further courses in 2022 (Wilson et al., 2023), with all faculties and colleges moving to the SCM in 2023.

3. Methodology

This study employs a quantitative retrospective observational methodology to explore the impact of the Southern Cross Model on student academic success at the host institution. The study was approved by the institution's Human Research Ethics Committee, approval number 2022/054.

The study drew on student outcomes across all faculties and colleges in the SCM, including two years of achievement (success) data from units that transitioned to the immersive block model in 2023. Data were prepared by the University's Business Intelligence and Quality work unit and are presented through an institutional dashboard.

Measures of student achievement used in this paper are success (pass) rate and grade point average (GPA). Success rates were calculated as the proportion of unit completions from unit attempts i.e., success rate = Completed / (Completed + Failed + Withdrawn). GPA is a numerical calculation that summarizes students' academic performance during a period of study. GPA = Sum of (Grade Point × Credit Points) ÷ Sum of (Credit Points). As is common in Australian HE, GPAs are reported on a seven-point scale: High Distinction = 7; Distinction = 6; Credit = 5; Pass = 4; Fail; Absent Fail; Withdrawn Fail = 0. Withdrawn grades are not used in GPA calculations.

4. Results

Figure 2 shows the success rates in the pre-COVID year of 2019 to the first year of full implementation 2023. The graphs represent student success rates calculated from grades in 2019 (N= 51,625) and 2023 (N= 62,40). The mean success rate in the traditional model in 2019 was 70.6% (95% CI 69.11%-72.04%). The mean success rate in the immersive block model was 88.1% (CI 87.3%-88.8%); the result is therefore statistically significant at $p < .05$.

Figure 3 displays the Grade Point Averages (GPA)s in years from pre-COVID 2019, then compared with 2023, the first year where all faculties and colleges were delivering in the Southern Cross Model. The mean GPA in the traditional model in 2019 was 3.72 (95% CI 3.62-3.81). The mean GPA in the immersive block model was 4.6 (CI 4.54-4.65); the result is therefore statistically significant at $p < .05$.

The acronyms per faculty are: EPB (Educational Partnerships Board); FBLA (Faculty of Business, Law and Arts); FOE (Faculty of Education); FOH (Faculty of Health); FSE (Faculty of Science); Gnibi (College of Indigenous Australian Peoples); SCU Coll (SCU College – pathways programs).

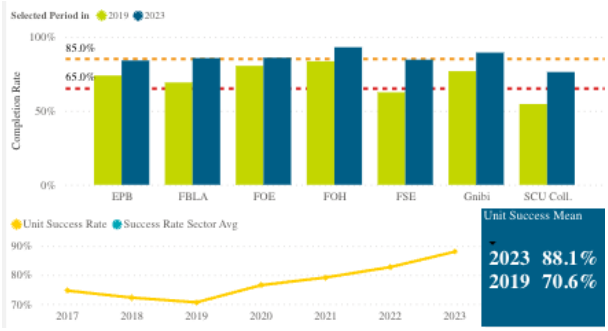


Figure 2. Unit Success Rates 2019 compared with 2023. Source: Institutional Dashboard (2024).

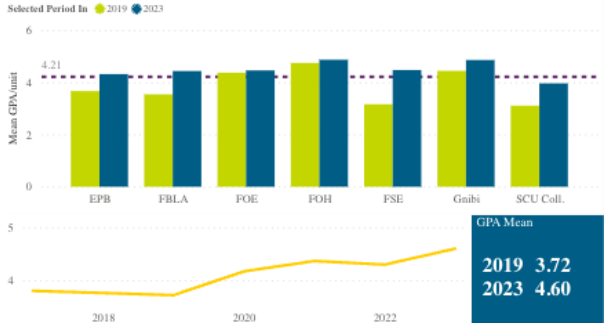


Figure 3. Mean GPA 2019 compared with 2023. Source: Institutional Dashboard (2024).

5. Discussion

This paper has reported on the outcomes of a whole-of-institution curriculum reform at a comprehensive public university in Australia, where a conventional semester model, characterized by learning four units simultaneously, lectures, and examinations, was replaced with an immersive block model grounded in active learning pedagogy. Given the large, complex nature of this innovative curriculum change and its recent implementation, the overarching

research objective here was to offer insights into the impact of this delivery model on student achievement at scale, spanning faculties and colleges.

Notably, the implementation of the immersive block model appears to have significantly enhanced the academic success of undergraduate students as measured by both success rate and GPA. This positive impact is observed for the University as a whole and across faculties and colleges, including disciplines in business, arts, law, education, health, science, engineering, tourism, and Indigenous knowledges. It is of note that this is an observational study without control groups so the findings must be understood in light of this limitation. Further work by the research team will consider comparisons using control groups over time, and interviews with students who experienced the curriculum change, to improve our understanding of whether the improvements in the grades can be confidently attributed to the model. The current study provides promising evidence supporting the growing body of work suggesting that shorter, more focused, and active learning delivery models effectively improve student achievement in HE (Buck & Tyrrell, 2022; Goode et al., 2023a; Loton et al., 2022; Turner et al., 2021). These findings hold relevance in a post-COVID era, as institutions serve increasing numbers of underrepresented students (Stone, 2022).

Variations in impact were observed across faculty groupings, with FBLA (business, law and arts), and FSE (science, engineering and IT) experiencing a strong positive impact on student achievement in the immersive block model. Smaller gains were noticeable in FOE (education), EPB (tourism), and Gnibi (Indigenous knowledge). It is of note that FOE already exhibited high performance in the traditional model. The data further suggest that the immersive block model has provided valuable "transition support" for novice higher education students – those studying here through SCU College offering pathways. Exploring the variability of improvement across faculties or considering the challenges of implementing a whole-of-institution curriculum reform is beyond the scope of the current paper, though drivers of variable improvement, such as staff negotiation and adoption of curriculum models, are explored elsewhere by the authors (Roche et al., 2024).

6. Conclusion

The innovative, whole-of-institution curriculum transformation explored in this paper departs from traditional university learning based on semesters, lectures, and exams. Immersive block models involving two units of study at a time over shorter teaching periods, and underpinned by active learning pedagogy, can deliver improved outcomes across faculties to support increasingly diverse student populations in today's world of changing HE.

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ENLIGHT Methodology for the Impact Assessment of Higher Education Initiatives

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Abstract

This paper presents the ENLIGHT methodology for impact assessment of higher education activities, including the lessons learnt and the conclusions drawn from its testing with three case studies on challenge-based education, mobility and regional academies. The ENLIGHT methodology for impact assessment is designed as a sequential and circular process, structured in six phases which are interrelated and retrofitting the next ones. It builds upon a co-creative process between the ENLIGHT Impact Task Force, action leaders and stakeholders, in order to explore the expected outcomes and desired impacts, capture and manage those changes on learners, academic and non-academic staff, institutions, systems and society. The ENLIGHT methodology has the potential to be taken as a reference in the assessment of the impact of higher education activities and can be used for the establishment of a model impact-direct planning and management in higher education.

Keywords: *Impact; Assessment; Methodology; European University Alliance.*

1. Introduction

ENLIGHT is one of the fifty European universities supported by the European Commission Erasmus+ and Horizon 2020 programmes[1]. Launched in 2020, ENLIGHT is a European-wide alliance composed of ten research-intensive universities[2] committed to raise their potential to transform themselves and the European education landscape, as well as to become key players

[1] More information available at https://enlight-eu.org/

[2] University of the Basque Country (Spain), University of Bern (Switzerland), University of Bordeaux (France), Comenius University Bratislava (Slovakia), University of Galway (Ireland), Ghent University (Belgium), University of Göttingen (Germany), University of Groningen (the Netherlands), University of Tartu, and Uppsala University (Sweden).

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in the promotion of equitable quality of life and sustainability. Explicit in its mission statement is the intention of ENLIGHT to be a transformative and impact-driven alliance.

In order to capture and manage ENLIGHT's transformative effects on people, communities, insitutions and systems, the alliance has set as one of its objectives the development of a methodology for the impact assessment of higher education initiatives. Other complementary objectives include the promotion of common impact-driven research and innovation agendas, raising impact awareness, literacy, and readiness and creating a culture impact in and beyond the alliance[3].

This paper focus on the first objective and presents the ENLIGHT methodology for the impact assessment of higher education initiatives, including the lessons learnt and the conclusions drawn from its testing with three case studies on challenge-based education, mobility and regional academies. The paper (1) introduces ENLIGHT understanding of impact, impact assessment, the main phases of its methodology and the pilot case studies; (2) it highlights the main lessons learnt from the three pilot case studies and how they helped refining the ENLIGHT methodology; and (3) it concludes by presenting the next steps in order to consolidate the methodology's potential to become a reference in and beyond the ENLIGHT alliance.

2. Impact and Impact Assessment in the Context of ENLIGHT

2.1. Impact and Impact Assessment

ENLIGHT's definition of impact has been evolving throughout its lifetime. Largely inspired by the impact concept developed in the context of research and innovation[4], it has been enrichened with the experience of the pilot case studies and exchanges with quality assurance, societal engagement and impact experts in different international fora[5]. ENLIGHT understands **impact** as "the effects or changes that we can see (demonstrate, measure, capture) on and beyond academia, which happen over time because of an activity/ intervention in the higher education environment". On: on learners, academics, staff, leaders, the institution, structures; beyond: on society, economy, environment, etc.. In the context of ENLIGHT, impact is associated with "transformation" and "value" induced in various target groups by its different activities[6].

[3] More information about ENLIGHT impact activities and outputs is available at https://impact.enlight-eu.org/

[4] Please consult the "Understanding Research Impact" section of ENLIGHT's repository of good practices https://impact.enlight-eu.org/understanding-research-impact

[5] For example, ENLIGHT Impact Conference (30-31 March 2023), Impact Thematic Group of the European University Alliances, AESIS, EARMA and UIIN conferences.

[6] Campillo,I., Nunes, G., Puertas, I. (2023).

In this perspective, ENLIGHT understands **impact assessment** as "the identification/ measurement/ evaluation of the changes and effects, and the extent of those changes and effects on different stakeholders over time"[7]. It conceives it as a complex and multifactorial phenomenon, which should be established as a continuous learning process, helping make accurate decisions about future action and future desired impacts. The ENLIGHT methodology for impact assessment is based on these definitions and builds upon the current state of the art of the impact assessment study field[8].

2.2. ENLIGHT Methodology for Impact Assessment

The ENLIGHT methodology for impact assessment has been conceived as a **sequential process**, structured in six major phases which are highly interrelated and retrofitting the next phases in a circular approach. Each of the 6 phases includes a set of specific actions and decisions to be taken in order to proceed to the next phase (figure 1).

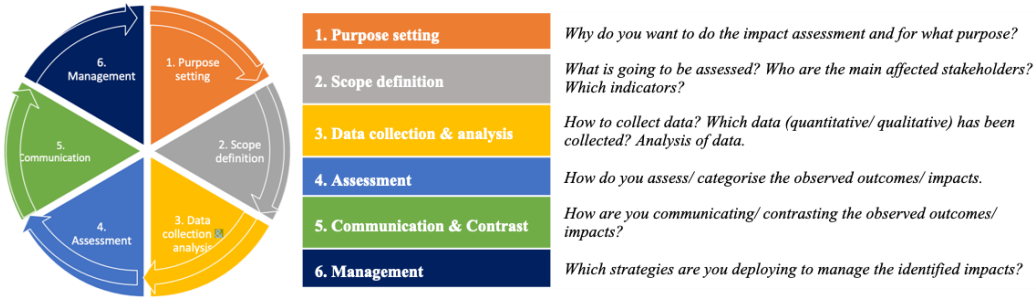


Figure 1. Different phases of the ENLIGHT methodology for impact assessment and respective questions to be responded in each.

The pilot case studies experience has shown that impact assessment is **not a uni-directional nor linear process**, since it is often necessary to go back to a previous phase and/or action in order to adjust the former conclusions to the new realities.

2.3. Pilot Case Studies

In order to test the value of the ENLIGHT methodology, the ENLIGHT Impact Task Force has used three pilot case studies which are considered to be the most relevant and representative of the alliance potential impact on the transformation of higher education: challenged-based

[7] Idem.

[8] It is inspired by Puertas & Bilbao (2023) methodology for impact assessment, adjusting it to the Higher Education field, and taking the expertise, knowledge and experiences acquired in the ENLIGHT alliance (cfr. annex 1: State of the art on impact assessment at ENLIGHT (2023). *Methodology and Toolkit 2.0 for HEI Impact*).

education[9]; mobility[10]; and regional academies[11]. Figure 2 illustrates the linkages between the selected pilot case studies and the overall ENLIGHT expected outcomes and impacts.

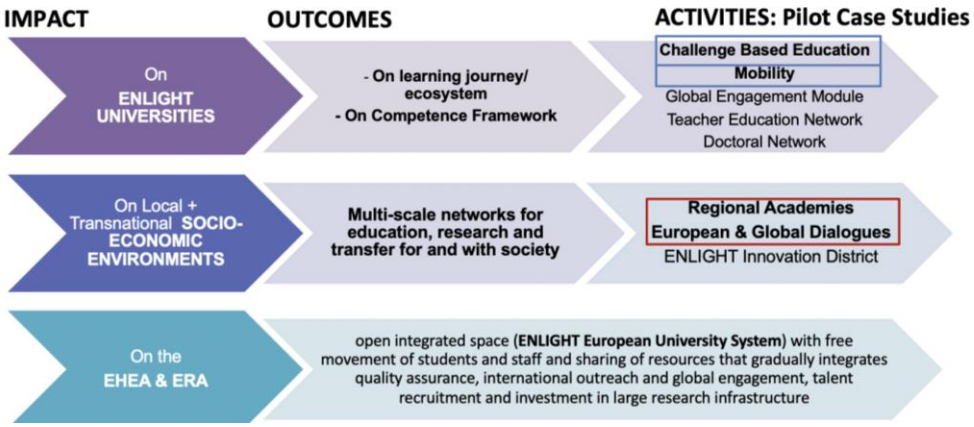


Figure 2. ENLIGHT impact scope and pilot case studies.

In addition, the selection of the pilot case studies has taken into consideration the degree of involvement of affected stakeholders throughout the impact assessment exercise and the data availability for capturing relevant impact-related indicators.

3. Pilot Case Studies: Lessons Learnt

In this section we present the different phases of the ENLIGHT methodology for impact assessment, the expected decisions to be taken in each and the lessons learnt during the implementation of the pilot case studies.

[9] The ENLIGHT Challenge-based Education action line represents all different models of challenge-based courses as well as all supporting and interrelated activities developed in the framework of the alliance to help implement them. Challenge-based Education is understood as "collaborative and hands-on teaching and learning approach, prompting students to work with peers, teachers, and experts in their communities and around the world to ask good questions, develop deeper subject area knowledge, accept and solve challenges, and share their experience" from Nichols & Cator, 2008.

[10] The ENLIGHT Mobility action line is understood in its objective to develop an overarching structural and technical framework for *increased, flexible, inclusive and green mobility,* providing the conditions and the tools for flexible learning and teaching that lead to the establishment of an open and integrated space, i.e. a European University System.

[11] The ENLIGHT Regional Academies represent the local/regional quadruple helix structures, bringing together learners, academics, business, policy-makers and civil society players around societal challenges.

3.1. Purpose Setting

The main objective of this phase is to define the initiative under assessment, identify the reason why to perform the impact assessment and for what purpose. Whether the request for impact assessment arises in response to an external demand or if it is raised by the team involved in the initiative, there are several potential motivational elements leading to an impact assessment. For example, it could be a response to a strategy of *benchmarking and competitiveness* (to compare and improve the image/ reputation of an initiative/ institution in comparison to other(s)); *legitimation* (to increase the positive image towards society/ specific interest groups and reduce potential negative perceptions); *accountability and transparency* (to be accountable to certain interest groups); or *understanding and adaptation* (to understand whether the initiative is bringing about the expected/ desired impacts and steer change in strategies and priorities).

The pilot case studies have demonstrated this first step is fundamental as it affects the scope and all the subsequent phases of the impact assessment. As regards the definition of the initiative, it is very important to have a clear and shared understanding of what the initiative is and is not about. For example, the definition of the ENLIGHT mobility action line had to be clarified to also include online international learning experiences. Likewise, as regards the purpose of the pilot case studies, the main objective was to use them for testing the ENLIGHT methodology and not to make a comparative, benchmarking analysis between action lines or universities.

3.2. Scope Definition

The main objective of this phase is to define the scope of what is going to be assessed. For that, there are several elements that need to be addressed in most of the cases in a synchronous way:

- Identification and classification of stakeholders;
- Definition of the impact pathway, building-up the Theory of Change (ToC) causal chain of impact[12];
- Decision on the impact assessment scope;
- Decision on the approach and composition of indicators.

In the process of defining the scope of the impact assessment and the causal chain of impact, experience has shown it is important to identify and classify the affected stakeholders, as well as take into consideration their expectations; being from those directly involved in the implementation of the action line (action leaders) or those (directly/indirectly) affected by it

[12] "The Theory of Change is essentially a comprehensive description and illustration of how and why a desired change is expected to happen in a particular context. It is focused in particular on mapping out or "filling in" what has been described as the "missing middle" between what a program or change initiative does (its activities or interventions) and how these lead to desired goals being achieved." Definition taken from https://www.theoryofchange.org/what-is-theory-of-change/.

(learners, academics, administrative and support staff, universities' management teams, and societal stakeholders).

The integration of stakeholders' expectations in the causal chain of impact has revealed to be of great value, as it allowed to: (1) identify expected outcomes and desired impacts not initially considered in the versions elaborated together with the action leaders; (2) take into consideration undesired outcomes; (3) observe that the value given to the different outcomes vary according to the consulted stakeholder; (4) establish a differentiation between outcomes, which are mainly associated with "attribution", and impact which is mainly associated with "contribution".

Building-upon on the co-created causal chain of impact, one should define the scope of what actually is going (and can be) assessed, to then define the approach to capture evidence of impact leading to a list of indicators. The composition of indicators for ENLIGHT pilot case studies was made taking as reference the expected outcomes and the desired impact of the causal chain of impact and the agreed impact assessment scope. For that, the ENLIGHT Impact Task Force has used: ENLIGHT project indicators; ENLIGHT universities data; action line specific (performance) indicators; and stakeholders' suggestions for evidence. In addition, the Task Force has also proposed new indicators, which were mainly built upon project indicators or captured via surveys or focus groups. As a result, there were about 40 to 65 indicators defined for each action line. In this pocess, important lessons have been drawn:

- A few number of indicators could be repeated for different outcomes and were of relevance for different case studies;
- Even if, at a first glance, some indicators could look like as output/ performance indicators it all depends on the interpretation/ narrative associated with that indicator, as they can "indicate" a change in a certain direction.
- It is important to contrast these ideal indicators with the action leaders to check their relevance, and the viability of collecting data for those indicators. There were indicators that could not be used in the short-time as some of the activities were still ongoing or the expected changes could only be observed in the medium to long-term.

3.3. Data Collection and Analysis

The main objective of this phase is to collect all quantitative and qualitative related data responding to the identified indicators, as well as to analyse the results of the data collection.

The pilot case studies have demonstrated that for those cases where project indicators and partners related data were used, it was often difficult to capture detailed and broken-down data as desired. This is because the collection process for those project indicators was not specifically designed to capture that type of detailed data. Therefore, the importance of combining the performance and impact assessment exercises early from a planning phase.

In parallel, the ENLIGHT Impact Task Force has run an impact survey targeting the affected stakeholders from all the partner universities and respective ecosystems. In total, 218 individuals answered the ENLIGHT impact survey[13], which allowed the collection of relevant quantitative and qualitative data, as well as testimonies reflecting the experience of the affected stakeholders. The analysis of the survey results has demonstrated the importance of clarifying ENLIGHT jargon and key concepts to the surveyed target groups.

3.4. Assessment

Following the collection and analysis of data, the objective of this phase is to assess the observed impacts. For facilitating this, the ENLIGHT methodology suggests to make first a categorisation of the different types of observed impacts around the following criteria: temporality of the impact generated; intentionality; possibility of repairment*;* intensity degree; and extent/ reach. In this phase it is also important to bear in mind that any quantitative or qualitative assessment implies a value judgment, considering what is seen as positive and negative, what is important and what is not, what was intended and unintended, what was expected and unexpected.

In the context of the pilot case studies, the ENLIGHT Task Force has reflected that "assessment" exercise in the form of a **Narrative of Change 1.0** (NoC 1.0)[14]. The NoC 1.0 goes through each expected outcome and assesses the achievement and contribution to the expected outcomes using both quantitative, qualitative data and stakeholders' testimonies.

3.5. Communication and Contrast

This phase consists of reporting, communicating, as well as contrasting the results of the assessment phase. For this purpose, one should determine to whom is the communication targeted at, what is going to be communicated, and how to communicate it.

The NoC 1.0 was contrasted with the respective action leaders on the accuracy of data analysis and impact assessment. It was also communicated to ENLIGHT Board of Directors. The communication and contrast with the affected stakeholders (learners, academics, administrative and support staff and societal stakeholders) still has to be carried out and should be the basis for generating the NoC 2.0.

[13] Out of the 218 individuals responding to the survey, 214 consented to share their responses: 84 learners, 61 support staff members, 59 academics, and 10 external stakeholders. 117 individuals responded to the ENLIGHT Challenge-based Education specific questions, 98 responded to the ENLIGHT Mobility specific questions, 52 responded to the ENLIGHT Regional Academies specific questions.

[14] ENLIGHT (2023). *Pilot cases' "narratives with numbers" and global report*.

3.6. Management

This phase consists of defining the strategies to be implemented in order to manage the identified changes, seeking to correct/ minimise those effects that are considered as negative and enhancing/ maximising those that have been identified as positive. Likewise, this phase will help defining the strategy for future impact assessment(s), identifying the shortcomings to address and the positive elements of the whole exercise. This phase is still ongoing at the time of the drafting of this paper.

4. Conclusions and Next Steps

The ENLIGHT methodology for impact assessment could be useful for assessing the impact of different types of higher education activities. Through the three pilot case studies the methodology has shown its potential in phases 1 to 4, and partially 5. To complete the full cycle, the NoC 1.0 needs to be further communicated and contrasted with other relevant stakeholders besides the action leaders, such as learners, academics, administrative and support staff and societal stakeholders. The resulting NoC 2.0 should then constitute the basis for the subsequent management phase (phase 6). This is a crucial phase that is well aligned and coincides with the launch of the new ENLIGHT 2.0 activities (November 2023).

We trust this theoretical-practical approach could be of value for other European universities and University Alliances and, at the same time, further enrichened with their experiences. For that purpose, ENLIGHT is leading the FOREU2 Impact Thematic Group and is participating in multiple international fora around the theme of impact of higher education.

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Key role of teachers in sustainable inter-university education

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Abstract

Over the past decade, European education initiatives have sought to promote collaboration between higher education institutions. This collaboration has been encouraged and facilitated by programmes such as Erasmus+ and the European University Alliances. Although institutional agreements and technology platforms facilitate inter-institutional cooperation, local constraints can hamper the success of collaborative projects. To improve the effectiveness of inter-university educational initiatives, this article proposes that teachers be given a central role once again. More specifically, based on observation of the contributions made to the Portfolio project (Erasmus+ K2, 2022-2024) by five teachers from different European universities, the aim is to reveal a posteriori how teachers play a key role in this type of initiative. This was done by analysing the way in which these teachers coordinated to meet the challenges at local and dislocal levels throughout the various phases of the project's implementation.

Keywords: *networked education, innovative pedagogies, inter-university collaboration, teachers' added value, Portfolio project, Erasmus+*

1. Introduction

The landscape of European higher education has witnessed a transformative shift in the past decade with the initiation of several policy-driven endeavors aimed at fostering the creation of expansive education networks among higher education institutions. Notable among these initiatives are the well-established Erasmus+ program and European University Alliances, which serve as linchpins for encouraging transnational education and cooperative agreements. While these initiatives manifest the aspirations of seamless collaboration, the successful implementation of cooperation partnerships encounters multifaceted challenges that extend beyond the formalities of cross-institutional agreement signatures or the adoption of shared technological platforms.

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1.1. The need of hard-core players engagement in collaboration

Coordination plays a crucial role in elevating the quality of education and fostering both professional and organizational growth within educational institutions. This principle extends beyond mere administrative tasks, positioning itself as a vital catalyst for transformative change. It is essential to recognize coordination not just as a logistical tool, but as a strategic mechanism designed to cultivate an environment where autonomy, creativity, and collaboration flourish among educators (Bolarin–Martínez, 2015). Understanding the significance of coordination requires seeing it as more than a structural necessity; it is a dynamic process that empowers educators to take deliberate actions towards their professional development and the enhancement of their teaching practices. By intentionally engaging in cooperative activities, educators can share insights, experiment with innovative teaching methods, and collectively tackle challenges, thereby enriching the learning experience for students. The emphasis on 'intentionally involved' educators highlights the importance of active participation and engagement in the process of coordination (Bolarin–Martínez, 2015). It suggests that for coordination to be truly effective, it should encourage teachers to be proactive in their approach to collaboration, seeking opportunities to contribute their unique perspectives and expertise. This intentional involvement is key to creating a vibrant academic community that values continuous improvement, adaptability, and shared responsibility. Moreover, the promotion of autonomy and creativity through coordination underscores the need for educational systems to support teachers in exploring new pedagogical approaches and developing their instructional strategies. By fostering a culture of innovation, where educators feel empowered to experiment and take risks, coordination can lead to more engaging and effective teaching practices.

1.2. Legal and technological top-down approaches limitations

Unfortunately, verry often, the approach used to foster inter-university collaboration overlooks the critical role of intentionally engaged teachers. Many initiatives aimed at promoting collaboration between universities tend to focus narrowly on administrative alignments and superficial partnerships, neglecting the profound impact that a truly coordinated effort could have on enhancing autonomy, creativity, and cooperative activity among faculty members.

Indeed, the approach commonly employed to foster inter-university collaboration is predominantly centered on the technical development of common platforms or the establishment of legal infrastructures, without a genuine connection to the activities of those who are the lifeblood of the university—namely, the teachers. This technocratic and legalistic focus overlooks the essential human element and the organic interactions that are crucial for nurturing a vibrant academic community. By concentrating on hardware, software, and formal agreements, these efforts often fail to address the needs, aspirations, and creative potential of the educators themselves. Such an approach neglects the fact that meaningful collaboration arises from the exchange of ideas, shared experiences, and the collective pursuit of educational

excellence. Moreover, the success and the sustainability of inter-university collaborations is heavily base on the capacity of middle-positioned actors as teachers, to correctly articulate global and local objectives. We claim that, to handle the multi-level setup of inter-university collaboration, the middle level of teachers is paramount.

Concretely, bypassing teachers in the efforts to foster inter-university collaboration carries significant adverse consequences that undermine the initiative's effectiveness and sustainability. When pedagogical activities across universities are designed without input from teachers, it becomes increasingly difficult to engage educators who are expected to adapt to these preconceived structures. This approach disregards the importance of aligning with educators' teaching philosophies or practical needs, leading to a lack of interest or willingness to participate in such collaborations. As a result, the potential for enriching the educational experience through diverse pedagogical approaches is significantly underutilized.

The absence of teacher involvement in the planning and execution stages of collaborative education creates a substantial knowledge gap regarding the requirements for effective cooperation. This gap manifests both locally and globally, affecting the ability of educators from different institutions to collaborate effectively and aligning institutional requirements from various universities. Without a mutual understanding and shared objectives, collaborative efforts can become disjointed and inefficient, a mere temporally response to an institutional demand.

2. The transformative potential of middle positioned key actors

In general, the tension between overarching strategic goals set at high management levels and the intricate realities faced by individual institutions has been a focal point of significant academic interest (Huisman & Van der Wende, 2004; Enders & de Boer, 2009). Within the context of inter-university collaboration, the critical role of teachers goes beyond the classical critique of top-down approaches. Empowering teachers within these initiatives serves as a method of achieving what neither technical nor legal platforms can accomplish, that is, to find local implementations for global ambitions. This requires a dual vision that encompasses both context and the capacity to exert influence at various levels of agency.

This research seeks to address the pressing problem of HEIs local constraints threatening the attainment of broader strategic goals in collaborative educational projects. The focus is on the crucial role that teachers, as key actors at the grassroots level, play in bridging the gap between global policy objectives and local operational realities. Literature indicates that a bottom-up approach, where the agency of teachers is acknowledged and leveraged, can enhance the success of collaborative educational initiatives (Fullan, 2001; Hargreaves, 2007). Identifying challenges in project development, understanding the dynamics of education coordination, and exploring

the interplay of top-down and bottom-up approaches are integral components of this research inquiry.

The primary objective of this study is to unravel the added value brought by teachers from five distinct European universities participating in an inter-university pedagogical project—specifically, the Portfolio project under Erasmus+ KA2 (2022-2024). We examine teachers' contributions across critical phases of the implementation process:

> Project proposal: phase in which teachers coordinate to implement the different project activities as originally conceived by the proposal
> Chaos: phase in which teachers experience the challenges emerging during the project implementation
> Solution: phase in which teachers coordinate to implementing solutions for project challenges

This research aims to provide nuanced insights into the coordination efforts of teachers in navigating both local (HEI level) and global challenges (project level) in building the solution.

In light of the aforementioned context and objectives, the central research question guiding this inquiry is: How do teachers, engaged in inter-university collaboration within the framework of the Portfolio project (Erasmus+ K2, 2022-2024), contribute to the successful implementation of the project by addressing local constraints and aligning with global project requirements?

3. What inter-university collaboration mean and how to expand this definition

Collaborative networking among professionals who are involved in education (leaders, educators, scholars, policymakers and other educational and social agents) is essential to the success of projects, and even more so in these new times of uncertainty, when face-to-face human interactions are less frequent due to the COVID-19 crisis. (Harris and Jones, 2020). Collaboration has become a beacon of good practice for innovation and improved learning (Azorín, 2017; López-Yañez & al., 2014; Prenger & al., 2021; Robinson & al., 2020; Schnellert & Butler, 2020). It has become a permanent feature of school life as it can foster and strengthen professional links and communication among stakeholders (Azorín, 2020; Abellan, 2020; Harris, 2020). Collaboration has become a necessary component in adapting to the demands of contemporary education (Azorín, 2020). It has become a tool for better connectivity between stakeholders with the different levels of the system to achieve defined educational goals. It is an innovative paradigm that promotes school development and enables problems to be solved collaboratively and flexibly (Azorín & Fullan 2022).

In the field of education, collaboration draws on alliances and connections between education stakeholders. Collaboration is associated with an extensive group or system of connected people or organizations with similar interest that interact and exchange knowledge for mutual

assistance, support, and learning (Hadfield & al., 2006; Kools & Stoll, 2016). Also, it is related to different institutions and professionals who have diverse roles and work together in order to achieve their common goals (Azorín & al., 2020).

It is said (Rincón-Gallardo & Fullan, 2016) that collaborative education leads towards: a) better student learning outcomes; b) interchange of effective pedagogy practices; c) a development of collaborative inquiry; d) growth of interaction and partnerships.

Common research topics about collaborative education (Azorín, 2022) include: the emphasis on the power of community, the possibility of learning from differences and overcoming isolation, the development of interconnected systems or ecosystems, the need to cross borders and work towards a school without walls, the potential for more effective management of resources, the driving force for change and the effective improvement of schools through networking.

In the first approach to collaboration, the coordination efforts seek to leverage the different "resources" distributed among multiple destinations, for example, students, teachers, and materials belonging to a higher education consortium. Research on distributed education focus on how the different resources interact, for example, through e-learning or mobile learning, and how these interactions behave, for example, synchronically or asynchronically (e.g., Oblinger & al., 2001). The use of existing resources distributed in multiple locations tends to be considered as a great opportunity in terms of sustainability, while "decentralization" (of resources) is usually claimed to be an innovative added value for learning.

What seems relevant for the development of distributed education is that the execution is not that complex. To implement it, interested institutions advocate to develop the necessary technological infrastructure and set the "legal frameworks", if missing.

In the second approach to collaboration, coordination efforts leverage the power of the "network", i.e., the consortium. Unlike the distributed perspective, the networked education approach draws on the potential of the partnership, especially in solving problems, exchanging knowledge or, broadly speaking, achieving a common goal (Azorín & al., 2020). Thus, research on "network education" assumes that stakeholders play an important role in ensuring collaborative education. However, this assumption still lacks sufficient empirical evidence.

4. Testing networked education

We tested networked education in a project in which a consortium of five European universities design and implement a micro-minor under a coordination scheme which allow teachers and pedagogical staff to identify the needs belonging to both the global and the local dimensions of cooperation. While the global dimension includes the inter-institutional requirements to execute the activity, the local one mainly includes the pedagogical needs of the dyad teacher-student. We claim that the success of collaborative education relies on the ability to articulate the global

and the local dimensions. This case study corresponds to an Erasmus+ KA2 project, known as "Portfolio", which serves as an exemplar of how successful distributed education can be achieved when stakeholders are actively involved in the coordination process.

We claim that for succeeding to install inter-university education, the key role of teachers needs to be push forward. Teachers can engage in peer-to-peer collaboration with colleagues from different institutions. Building professional networks and communities of practice can facilitate the sharing of experiences, resources, and effective strategies for overcoming coordination challenges. Teachers can promote cultural sensitivity and inclusive teaching practices. Incorporating diverse perspectives into the curriculum, fostering open discussions, and embracing inclusive teaching methods contribute to a positive and inclusive learning environment. Teachers can promote multilingual support in online joint programs. Encouraging language exchange initiatives and providing language resources can help create an inclusive learning environment. Teachers can organize workshops or training sessions on credit transfer and recognition processes. Providing guidance on how to navigate credit systems and ensuring transparency in qualification recognition can empower students and facilitate smoother coordination. Teachers can actively participate in the curriculum development process, sharing insights, and collaborating with colleagues from other institutions. They can contribute to creating a curriculum that reflects a balance of perspectives and meets academic standards.

To do this, as explained above, we rely on a case study, the 'Portfolio' project, and more specifically on a collection of qualitative data of various kinds. Throughout the project (over more than two years), data was collected in the form of direct, participant or participant-observer observations, focus group interviews conducted by the coordinator with the five teachers from the partner universities, and questionnaires for both students and teachers/instructors.

5. Results: teachers' key role in managing local and global contexts and stakeholders

The role of teachers in the inter-university education can be summarize in five dimensions: Institutional recognition strategy, Preparation, Promotion and registration, Execution, and Certification, each containing specific tasks that can be coordinated at global and/or local levels. A global-level task is ruled by top-hierarchies of the consortium; thus, they involve decisions that cannot be made by the teachers. On the contrary, a local-level task can be ruled by low-hierarchies, which implies that a decision can be easily made by teachers.

Although we will not delve into all sub-dimensions in the subsequent sections, Figure 1 presents the complete array of task interdependencies critical for the implementation of the activity. In the following section, we will discuss the principal aspects and lessons from the a posteriori analysis, which is based on the continuous feedback collection obtained during the execution of the project.



Figure 1. Task dimensions for developing inter-university collaboration. Source: article authors (2023).

5.1. Institutional recognition. This dimension involves three tasks

Transversal theme definition: Involving global and local levels of coordination, this task involves determining the transversal topic at an early stage. In the original proposal, the "entrepreneurship" was defined as a transversal topic for the minor content. Teachers from consortium universities warned that discussing certain European values could be sensitive at an institutional level. Indeed, the value of "democracy" intended to be developed during the summer school had to be shaped carefully by the coordinator in charge of it. Working with "European values" was conceived as non-problematic.

Carrier course strategy: The consortium adopted the strategy of implementing "carrier courses". This is a solution in which an existing course at University A is used to validate the micro-course taught at University B. Carrier courses are meant to validate ECTS corresponding to the chosen micro-courses. Thus, a 5ECTS carrier course will be able to be validated, for example, through two 2ECTS micro-course and one 1ECTS micro-course. The carrier strategy has allowed the Consortium to coordinate, execute, and ensure the success of this pedagogical innovation, without depending on institutional agreements which need specific institutional inversion. The validation of a carrier course depends on the number of ECTS of the micro-courses chosen by the students. Students may choose a combination of micro-courses (e.g., 2 courses of 2ECTS each) which prevent them to obtain the required number of credits (e.g., 5ECTS). In this case, the consortium agreed to ask students for a compensatory assignment which help them to meet the academic requirements to validate the credits.

Sustainability strategy: Before starting the micro-minor, it should be decided by the consortium how the activity will be embedded in the curriculum of the consortium. It should be determined how the activity will remain active after the second iteration. Importantly, it should be decided how the funding is assured to continue with the activity one the project comes to an end.

5.2. Preparation

Scheme: The micro-minor was conceived as a flexible minor as students can choose their micro-courses according to their needs. Students must be reminded that flexibility does not mean optional. All micro-courses, once enrolled, they are mandatory for students.

Learning competences: Originally, micro-courses are designed based on a set of competences. Competences valid content and allow teachers to monitor what kind of skills needs further development. Competences should be complemented between the online courses and the summer school. Also, competences can be linked to learning objectives and assignments. A full revision of the competences should be made to verify to which extent they were accomplished.

Timings and schedule: Originally, the consortium envisioned a common start across all Consortium Universities. After creating the micro-courses, the consortium determined that the minor kickoff may not match the carrier course kickoff. This should be carefully revised by all consortium partners. The minor kick-off should consider the async lessons, i.e., micro-courses can start before the first synchronic module. A kick-off meeting should be considered before all academic activities start to inform students about the micro-minor concept.

5.3. Promotion

Promotional information: Originally, promotion efforts were not considered given that the original purpose was to target only students following a course from a consortium teacher. Since two institutions had to publicly open the recruitment at a university level, the consortium had to

develop a promotional and recruitment strategy very quickly. For all types of students, the promotion strategy should be supported by visual tools informing on timings and key dates. Visual information can be uploaded to the website. Thus, the website should be constantly updated, with the latest information regarding courses, content, dates, and video pitches. Each university has its own promotional channels. The internal promotion of the activity will heavily depend on local channels. Social media, although we do not know up to which extend, have a promotional impact. The consortium had to re-consider the "value claims" to attract more students. This considered claiming flexibility and micro-modularity as main value claims.

Value listing: The consortium originally claimed that the main value of the Portfolio activity was its distributed design, in which the micro-courses are offered by several institutions. The consortium agreed that the "micro modularity" feature was the essential property since students are granted the possibility of choosing their own learning experience in a flexible way. This "modular" feature is taken into account into the promotional efforts.

5.4. Recruitment

Enrolment: The conceptual version considered a "close recruitment", which involved registering students from partner teachers only. However, given institutional regulations, two universities from the consortium were obliged to open the offer to external participants, i.e., to all programs of the university, not only among partner teacher's students. Some lessons: registration should consider all ethical and inclusion criteria. It is normal that one course of the portfolio attracts most of students' attention. To avoid that a course is overpopulated, a vacancy system should be implanted. Students were confused about the micro-courses they had taken. Then, an email with a summary should be send in the end of the registration process. Valid emails should be provided.

5.5. Execution:

Concept introduction. The original versions considered that each teacher would oversee explaining to students the "micro-minor" concept. A kick-off meeting is necessary. A kick-off presentation about the Minor concept should be conducted before any academic activity. Students must know the "portfolio" concept. It should be decided what to do in cases in which an async module is the first activity for the students

Timings for gradings: In the original proposal, the consortium had anticipated the finalization dates for each micro-course. However, the date for communicating dates to the institutions departments varied considerably across the consortium. There might be a case in which an institution of the consortium needs the final grades earlier in the process, i.e., before students even finish their courses. This should be anticipated in the planification. Universities in the

consortium have different grading systems (1-5; 1-10;1-20, etc.). In the end, teachers should send a file containing the original grade and the converted grade (upon partners decision).

Satisfaction feedback: Satisfaction surveys were planned to be administrated at the end of the courses, even some days after the finalization. This impacted on the response rate. Course-based surveys should be applied during the last session to avoid a low response rate. Teachers should be in charge of asking students to answer the survey. Minor-based survey should be sent by the coordinators after the course-based survey

5.6. Certification:

With regard to the preparation and issue of the certificate, it should be noted that certification was dependent on the availability of grades. There was no agreed strategy for deciding how certificates would be created and how would create them. There should be a defined planning. For example: grades should be collected by the consortium coordinator and then distributed to the responsible (of the carrier course, for instance). It should be decided who (what partner) creates and sends certificates. An automatized process (canvas) is the most convenient. Minor Certificates should be sent only to those completing at least two online courses. If a student finished only one micro-course, then only a micro-course certificate should be issued.

It should be noted that there was no plan to monitor dropouts. A distinction should be made between those who fail courses due to poor results and those who drop out. There should be a mechanism for monitoring students throughout the course. It may be important to verify when a student has dropped out the course, for example, when submitting an assignment, when participating in an evaluation, etc. It is important to have this information before asking students to answer the satisfaction surveys.

6. Conclusions

Our results emphasize the significance of teacher involvement in inter-university collaborations, showcasing how educators play a pivotal role in the success and sustainability of educational projects like the Portfolio project.

One of the primary challenges of inter-university education lies in the sustainability of activities within an inter-organizational framework. A teacher-centered approach proves to be highly efficient in addressing this challenge, as it directly fuels the core activities that keep the universities' educational machinery vibrant and responsive. By focusing on the pivotal role of teachers, such an approach not only enhances collaborative efforts across different institutions but also ensures the long-term viability and success of these educational endeavors. This strategy acknowledges the critical contribution of educators in navigating the complexities of inter-university collaborations, making it a cornerstone for sustainable educational practices.

In the realm of inter-university education, a pivotal area of research is the development and enhancement of collaborative practices, alongside a thorough evaluation of their impact on educational outcomes. Central to this endeavor is the reintegration of teachers into the core of these practices. By focusing on strategies that trigger and strengthen collaboration, and assessing their effectiveness in improving learning, the role of educators becomes essential. This teacher-centric model not only fosters a more dynamic and engaged educational environment but also ensures that the benefits of inter-university collaborations are maximized for both students and faculty.

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Chronically ill patients and adherence: a new challenge for educators committed to training future health professionals

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Abstract

As academic educators committed to training future health professionals, we should understand and address the new educational needs they may perceive as a result of the global increase in the number of chronically ill patients. This paper aims to present a new learning/teaching strategy that has been implemented in a bachelor course for health professionals, based on the evidence of: a) the complexity of the issue of therapeutic adherence; b) the lived experience of chronic illness as a personal matter; c) the usefulness of therapeutic patient education (TPE) conceived only as a transmissive practice. In this course, some lectures were combined with workshops in which students were asked to deal with a real patient's story for whom they had to define an educational plan. The results show the success of the creative choices implemented from a training perspective and the satisfaction of the learners asked to experiment in the classroom a work practice with a high rate of autonomy.

Keywords: *Medical Education; Chronic ill patients; Therapeutic Patient Education; Collaborative Learning; Self-directed Learning.*

1. Introduction

As academic educators committed to the training of future health professionals, we should understand and adress the new demands coming from health organisations and the changes that people's health has undergone in the last 50 years.

According to a report published in 2003 by the World Health Organisation (WHO), the most significant event of the last century in the world of health and disease has been the global rise in chronic disease. The increase in therapeutic efficacy of medicine and the consequent increase in human life expectancy led to a change in the nature of disease from acute to chronic. Considering the Italian situation, the percentage of people reporting at least one chronic disease in 2020 is 18%. According to ISTAT projections, in 2032 the elderly population will represent

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about 27.6% of Italians: this means that the costs related to their health management will also increase exponentially.

Chronic diseases have many definitions, but it is common ground that they are are permanent, leave residual disability, are caused by non-reversible pathological alteration and require a long period of supervision, observation or care (Goodman et al., 2013). Living with a chronic condition may have different psycho-social consequences: after diagnosis, patients may feel negative emotions such as shame, guilt, anger or sadness; may experience also frustration due to health professionals' requests about dietary or life style. Regarding social dimension, chronic condition may also change family relationships, making patients weaker and more dependent with consequences such as shame or anger (Engle, 2001). Moreover, adult patients may be worried about their employment, future career and life plan (Frank, 2013). In addition, their personal identity, developed over a lifetime, may disappear (Charmaz, 2002). Considering these reasons, many patients may have problems in accepting the new, ill identity, trying to hide or even deny it (Ezzy, 2000).

Chronic patients have also to understand and accept that they are going to face a life-long condition, as well as they has to comply with physician's requirements (Sand-Jecklin, 2007). Adherence can be described as "the extent to which a person's behavior (taking medication, following a diet, and/or executing lifestyle changes) corresponds with agreed recommendations from a health care provider" (Haynes, 1979). Poor adherence to long-term therapies (an increasing phenomenon in every countries) appears related to negative health outcomes and increased health care costs (Iuga, McGuire, 2014): adherence rates to date have averaged around 50% (Payero et al., 2014). Several factors have a potential influence on patient's behaviour. To counter this trend, a large body of research and study on therapeutic education has been developed over the last fifty years. Therapeutic Patient Education (TPE) is a widely recognised health practice, considered an essential part of treatment of long-term diseases (WHO, 2023). However, most of the TPE performed in Italian hospitals and health services consists in lectures done by a nurse or a physician and listend passively by a patient or a group of patients, without any tailorizing of the educative contents or methods applied for each patient. Conversely, according to many studies, TPE could not achieve any goal if it doesn't consider the patient from an integrated perspective, taking into account all the dimensions implied in the patient's choice to protect himself/herself and his/her health (Bury, 1982; Charmaz, 1991). A previously literature review let to identify a systematic group of dimension which can influence the patient adgiustment to chronic disease and his/her chance to be adherent. Patients should possess or achieve: a) an adequate level of cognitive (high and low level), motor (fine and gross) and communicative (reception and expression) skills, useful for understanding and applying medical prescriptions; b) a supportive social network; c) a good level of satisfaction with some life needs, such as autonomy, competence, and relatedness; d) an adaptive decision-making style; e) a good lived experience of illness; f) some constructive cognitive and metacognitive coping strategies

(Bobbo, 2020; Bobbo, 2022). According to this perspective, since each patient may express a different synchrony in the amalgamation of all these dimensions, TPE becomes a very complex strategy to face. Therefore, health professionals who deal with chronic patients on a daily basis should acquire specific skills to promote and implement some personalised educational pathways that have a chance of being successful.

From these evidences, an innovative experience of teaching/learning was developed in a bachelor degree of the University of Padova (Italy), frequented by young students who wish to become health professional (particularly Health Care Educators). The course of 40 hours was carried out from February to April 2023. In this course I'm the teacher.

2. The teaching/learning experience

2.1 The rationale behind the didactic choices that was made

Students who are gain their bachelor represent adult learners that have specific characteristics and expectations which should be known and respected by the teacher in order to enable them to reach a good understanding of the subject and to acquire the competences they are supposed to achieve. Indeed, according to Knowles (1973), adults are driven to learn by intrinsic motivation, seeking to increase their autonomy and competences in the work they want to do in the future. Moreover, young adult are searching for more autonomy in the learning process too, because they wish to prove to themselves and to others that they could be considered adults and ready to work (Green, du Plessis, 2023). Beside, according to Mezirow (1981-2014) adult learning can't procede without reflexivity, that implies debate, argument analysis and decision-making processes.

In addition, specific complex skills and competences, such as those that seem to be necessary for dealing with chronic patients, as described above, cannot be taught using only a trasmissive training perspective (Pratt, Collins, 2000). The complexity of the system of knowledge, skills and competences students should acquire, requires a mixed method teaching strategy, combining both the trasmissive and the active methods: lectures, Collaborative Learning (CL) (Dillenbourg, 1999), Problem Based Learning (PBL) (Wang et al., 2008), Self-directed Learning (SDL) (Barrows, 2000) and Clinical Simulation (CL) (Giuffrida et al., 2023) where mixed and combined in this experience. In syntesis, in this experience a emancipatory perspective was applied (Giroux, 2020).

2.2 Materials and methods used in the didactic experience

The rationale described above could be realised by the use of a new form of workshop, in addition to some lectures: students were called to deal —autonomously and in small groups— with a specific assignament which consists in defining an educative plan for a patient whose

story was proposed by the teacher. Taking two stories from my experience of long visits to health services and hospital units, as teacher I can give the students all the information they need about the patients. Nevertheless, in order to leave them more autonomy in the learning process, I choose to stimulate them to ask me what they think could be useful at different moments in the process of writing the educational plan.

The didactic choices implemented during the course develops in five steps:

1. 15 hours were spent in lectures in which the theoretical basis of the subiect was explained and shared with students;
2. 5 hours were spent to tell two patients histories asking to students, after having listed them, to choose one and to form some group of work.

   The two stories regard:

   — a 60-year-old retired military man suffering from terminal cirrhosis who had a so severe unadherence that he wasn't a suitable candidate for the liver transplantation; but without it he has no chance of survival;
   — a 35-year-old woman with type 1 diabetes since the age of 12 who wanted to become mother so badly that she was prepared to risk her life, despite the opposition of her family, including her husband.

   After the presentation of the two stories, some tools were presented and shared with the students. They are some non validated tools useful to analyse the patient's dimensions define above. The tools were:

   — Nine forms suitable for assessing the different dimensions involved in the patient's adgiustment to illness: cognitive, motor and communicative skills, motivation style, learning style, decision-making style, lived experience of illness, social network, cognitive and metacognitive coping strategies;
   — Five dialogue facilitation tools useful for understanding the patient's: a) social support network; b) experiential learning skills; c) divergent and reflective thinking skills; d) sense of mastery; e) daily micro-planning skills (Bobbo, 2020);

3. Third phase: the next 5 hour were spent by the students carrying out a sort of short interview with the two patients (interacting with me, answering their questions based on the information I knew about the patients). In this first interview, students had the chance in ten questions to understand the patient's strengths and weaknesses and which forms and dialogue facilitation tools they could have used to better understand the patients' educational needs (CS was used).

4. Fourth phase: the next lessons (10 hours) were spent in groups working on this task, and from time to time one, two or more groups asked me to fill in a form or to talk about the experience of patient using the dialogue facilitation tool they have chosen among the battery I give them in the previous phase. In this way they could get more information and better define their educational plan, but through autonomous choices (CL, PBL and CS was used; SDL was stimulated).
5. Fifth phase: at the end of the course, 5 hour were spent checking together, teacher and students, the quality of projects realized by students: group by group presented their educative plan and a discussion was opened to link the patient's needs or goals identified by the students to the theory, recalling concepts and constructs listened in the first lectures. Through dialogue it was possible to develop and fill of the lectures contents, through processes of induction and contradictions mediated by the teacher help (Akhmedov, & Khimmataliyev, 2023). More of this it is possible for students to have feedback of their work through which they can do a training self-assessment (Pinedo et al., 2023).

At the end of the course, learning was assessed by means of a written test with closed questions. The average score obtained by students in the first two examinations was 24 out of 30 (min 15, max 30 for distinction). The students' personal feedback on the didactic choices implemented was very good, and the university's evaluation of the teaching averaged 9 out of 10. Students did not suffer from the workload of the course (workload rating was positive, 9/10).

3. Experience conditions and future implementation

The mix-methods strategy implemented in this experience has at least two conditions that must be met to be successful. The first is that the students should frequent the second or third year of studies (third in this case), because they should have acquired a certain ability of self-directed learning (Dillenbourg, 1999): they often had to search for information on their own and make some decisions about which form or dialogue mediation tools would be better to use at different times during the plan writing process. The second condition concerns the possibility for the teacher to know very well the histories of the patients he/she would use: he/she should know the patient's life preceding the diagnosis, the caractheristics of the patient's social network and the mood whit he/she faces the diagnosis and the therapeutic path.

With regard to a possible future application of this method, the teacher could play the role of the patient if he/she is able to have a thorough understanding of the feelings and emotions that the patient himself/herself may have perceived and expressed living his/her condition: a man or woman whose life has been disrupted by a diagnosis may have indeed many different life perspective (Ezzy, 2000), may be bizarre or grumpy (Charmaz, 1991). So, in the moments of interview or dialogue, the teacher shouldn't just answer to some questions, but try to put himself/herself in the other person's shoes, to live and think like the patient could do. This could

open the chance to make the interview simulation realistic for the students and functional for the learning process. Some similar experiences have been carried out with the help of some actors —the so-called structured patient strategies (Deakin et al., 2006)—. However, having an actor in the classroom for the entire duration of the group-work can be costly for the course.The teacher, on the other hand, can be present throughout the course, and he/she can also know his/her students and therefore be more fluent and effective, adapting his/her action and driving each student towards learning. Moreover, if the teacher is able to play the role in a realistic way, the interview can also become an opportunity for the students to experiment some relational skills in dealing with a grumpy, introverted or aggressive patient, learning to express the emotional work they are called to acquire as health professionals (Bobbo, Rigoni, 2021).

4. Conclusion

This experience, which will be repeated in the coming academic years, has shown the need to make creative choices from a training perspective (Obidovna, 2023), especially when the subject is so complex and, above all, when the teacher has to train professionals who will deal with people who suffer from a fragility that has disrupted their lives and their biographies (Bury, 1982; Williams, 2000). From a pedagogical perspective, it is fundamental that operators learn that each patient is a person, so he/she must be accompanied in the acquisition of a new identity, disrupted the healthy one he/she had before the diagnosis. For these reasons, health professionals should learn to deal with the pain and despair, as well as with the inner resources that a person can find in his/her adjustment, knowing the importance of honouring the patient's history (Charon, 2008). To do this, health professionals should acquire some specific competences that, according to Michielsen and his collaborators, can be identified with person-centred communication, interprofessional communication and teamwork collaboration, which can be implemented through didactic strategies in which students could try, improve and assess the level of their autonomous ability to reflect on a problem, to search for some solutions, to communicate and to negotiate in a working group (Michielsen et al., 2023).

In summary, as educators committed to the training of future health professionals, we have to deal with new strategies to give students more and more opportunities to experiment themselves in autonomous situations, under careful supervision, in order to learn to face the complexity of human suffering. This experience and the strategies used can be a starting point for the development of didactic knowledge which can be improve by combining the didactic path with a more rigorous assessment through a research study based on a pre-post test approach, measuring the knowledge and skills possessed by the learners before and after the training path. This experience has the limitation of having been carried out with a small sample of students (37) and only in one type of health professional profile. It would be useful to prove this training strategy also among nursing students and physiotherapists, as operators who often have to deal with chronic ill patients.

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In situ Clinical Simulations in Primary Care applied to emergency training

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Abstract

A study with a mixed quantitative-qualitative methodology was designed to assess the use of on-site Clinical Simulations in Primary Care applied to training in Myocardial Infarction (MI) Code, Stroke Code, and cardio-pulmonary resuscitation. A total of 95 surveys were completed, and 2 focus groups were conducted with 19 healthcare workers from a health center, representing various professional profiles.

Participants expressed the opinion that the training improved their self-confidence and long-term knowledge, and had been very useful and interesting, as it allowed them to practice aspects impossible to address through other types of training (e.g. material localization). They highlighted the importance of leadership in emergency care and enhanced teamwork. Professionals preferred this methodology for future training activities.

Keywords: *Clinical Simulation; Continous training; Primary Care.*

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1. Introduction

1.1. What are clinical simulations (SIM)?

One of the pillars of Primary Care (PC) is continuous training, not only to maintain an adequate update in the management of the most prevalent pathologies, but also to ensure an optimal response in uncommon but serious urgent clinical situations, such as are Acute Myocardial Infarctions (AMI) and Strokes. Continuous training in the Stroke Code and IAM Code is mandatory among the healthcare professionals of PC in Catalonia as part of the indispensable items of the Healthcare Quality Standards. This training, of annual frequency, is usually taught by healthcare professionals face-to-face through a theoretical presentation or through online training.

The relationship between teaching methodology and long-term retention of skills is well known. According to Edgar Dale's learning pyramid, the retention of acquired knowledge varies depending on the student's role in the learning process itself (Dale et al., n.d.). You feel maximum learning if real situations are simulated or especially by performing the actions in a real area. Therefore, the closer the learning methodology is to the real situation, the greater the degree of knowledge retention.

According to the Center for Medical Simulation, simulation (SIM) is a situation or scenario created to allow people to experience the representation of a real event for the purpose of practicing actions, learning, evaluating, testing, or acquiring knowledge of systems or human The SIM responds to an emerging teaching need and aims for students and professionals to acquire and perfect clinical, communicative and teamwork skills.

A SIM is divided into three phases: prebriefing (to clarify objectives, environment and roles, and to create a safe environment highlighting the training value and that confidentiality is guaranteed), simulated activity (a scenario is created with simulated patients, as real as possible, and participants are asked to act as they would in a real situation, and the rest of the participants actively observe their peers' simulation) and debriefing. This last key phase takes place in a workplace different from that of the simulation scenario. In it, the participants themselves review the event, analyze their actions and reflect on the role of thought processes, psychomotor skills and emotional states, to improve their actions in the future.

Finally, the learning acquired through experience ("learning by doing") is transferred to routine clinical practice by modifying behaviors and attitudes.

SIM as a teaching methodology at undergraduate level is being widely used (Fitch, 2007; Seybert et al., 2008), and also at postgraduate level, especially in the field of emergencies, whether in-hospital or out-of-hospital (Martin et al. ., n.d.), and has shown to improve student satisfaction (4), confidence in handling different clinical circumstances (Theilen et al., 2013;

van Schaik et al., 2011), long-term knowledge retention term (Houben et al., 2011), applicability of learning to clinical practice (translation) (Sánchez et al., 2013), patient safety (Abdulmohsen H, 2010; Lavelle et al., 2017; Wang et al., 2019) and communication and teamwork (Garden et al., 2010; Patterson et al., 2013).

It is common to use simulated clinical situations as part of Basic Life Support courses using the Automatic External Defibrillator (SVB+AED), usually without following a well-structured and defined methodology. The use of SIMs could be very interesting not only in this field, but also in other topics within the field of emergencies (AMI code, Stroke code, convulsive crises, hypoglycemia...), as well as in the management of chronic pathology, home patient or communication aspects.

1.2. Clinical simulations in situ

The use of in situ simulations, i.e. carried out in the workplace itself, in the physical environment and with the usual professional team can further improve learning, especially in terms of aspects of communication and teamwork, while allowing to detect errors in the application of the protocols that can only be observed if the practice is carried out in the real environment. According to Motola et al., 2013, in situ SIMs can be an attractive alternative for institutions that do not have their own simulation center, and can improve reliability and safety in high-risk areas or in high-stress environments, especially in interdisciplinary trainings (Cook et al., 2013; Kurup et al., n.d.; Riley et al., 2010; Sørensen et al., 2017).

Although in situ SIM can facilitate the organization of training activities, since they do not require professionals to travel to another specific center, with the consequences that this fact can have on the usual healthcare activity, there are doubts in relation to the viability of this methodology, since it requires having the emergency consultation available for this activity, and this is not always possible.

1.3. How SIMs are evaluated.

One of the tools to assess learning, both formal and informal, is Kirkpatrick's learning assessment model. According to this model, updated in 2019 (Kirkpatrick & Kirkpatrick, n.d.), four levels of evaluation are determined. In the first level, the reactions are evaluated, that is, how the participants have reacted to the learning (through interviews, comments, interest in the course, participants' perceptions of the value of the course, etc.). The second level assesses the learning of knowledge (with pre/post test, observations, etc.). In the third level, the change in behavior/conduct is evaluated (interviews or focus groups) and finally the fourth level analyzes the results, that is to say the transfer to final results in patients (through safety, quality assessments, etc.). According to (Liao & Hsu, 2019), the results of the analysis of the third level (behavior) predict the results of the fourth level, which are usually more difficult to measure.

1.4. Justification of the study

As we have seen, the scientific evidence indicates that SIM methodology is effective in improving the learning of both technical and non-technical skills among healthcare professionals, but there is less experience with the use of SIM in the field of Primary Care, especially developed in the work centers themselves (in situ).

In this sense, the use of SIMs in this area raises some questions: Does it really improve knowledge retention in the long term? And the satisfaction and trust of the professionals? Would healthcare professionals accept the use of this methodology? Is it suitable for everyone, or is there a professional profile for whom it would be more useful and another profile for whom it could become counterproductive? In which other topics relevant to the PC could this methodology be applied? Is it feasible to integrate this methodology into the usual work activity of healthcare professionals, so that gradually all continuing education activities are practiced in this way?

To answer these questions, the present study has been designed, by evaluating the effectiveness of this methodology, based on the Kirkpatrick Evaluation Model, and the feasibility of implementing this methodology in the Primary Care field.

2. Hypothesis.

The use of the in situ SIM methodology applied to training in IAM Code and Stroke Code in Primary Care is feasible and enhances both clinical and non-clinical skills of Primary Care professionals.

3. Objectives

3.1. General objective

- To assess the effectiveness and viability of a training program in IAM Code and Stroke Code based on the SIM in situ methodology.

3.2. Specific objectives

- Analyze the improvement in non-clinical skills: communication, leadership, and teamwork.
- Examine the improvement in knowledge retention over time through this methodology.
- Analyze how the acquired learning results in changes in the clinical practice of professionals and in teamwork.
- Evaluate the satisfaction level of professionals regarding the use of this methodology.

- Assess the feasibility of implementing this training methodology in the Primary Care training program (interference in the daily activities of the center and necessary resources).

4. Methodology

4.1. Type of study

Implementation study using mixed methods.

- Quantitative study in the form of an analytical observational study based on a pre-post questionnaire with a comparison group, evaluating both technical and non-technical skills, as well as the Simulation-Based Training Quality Assurance Tool (SBT-QA10), which analyzes the simulation experience from the learner's perspective.
- Qualitative study based on the principles of Grounded Theory, involving:
    - Focus groups with healthcare and non-healthcare professionals.
    - Individual interviews with managerial positions.
    - Observations during the development of the training activity.

4.2. Determinations

The results of pre and post-intervention questionnaires, SBT-QA10 after each training activity, transcriptions of data recorded in focus groups, and the observer's notes from simulations will be analyzed.

4.3. Statistical analysis

4.3.1. Quantitative data

To compare and objectify the differences in results obtained before and after the intervention, the paired t-test were used for continuous data, and the McNemar test were applied if variables were binary.

4.3.2. Qualitative data

With the aim of generating the necessary knowledge to answer the research question, we consider Grounded Theory as the most appropriate method of analysis. It allows for the inductive generation of the theory of change underlying the intervention and identification of barriers and facilitators to its implementation, based on the perceptions expressed by study participants, rather than relying on assumptions prior to or by the research team.

5. Results

5.1. Quantitative study

A total of 95 professionals answered the survey, of which 88% were women, 55% aged between 31 and 50, 16% over 50 and 29% over 50. By occupation, 27% were specialists in family medicine, 22% were nurses, 18% administrative staff and the rest other professional profiles.

89.1% of the respondents considered that this methodology had contributed to improve their technical knowledge, and 87.3% thought it had improved their communication, coordination, and leadership skills. 92.7% thought it favored long-term learning, as well as self-confidence in handling this type of emergency (94.5%), with a significant improvement in pre- and post-intervention confidence ($p=0.028$) and serenity ($p=0.05$) and a perception of having improved their training ($p=0.012$). In summary, 84.3% recommended using this methodology in future training activities.

5.2. Qualitative study

Two focus groups were carried out, with a total of 19 interviewees, among whom there were 6 family doctors and 6 nurses, while the rest were other types of professionals, such as nursing assistants, administrators and psychologists.

All of the interviewees expressed their satisfaction with this training methodology, since it was more dynamic, more active and required greater involvement on the part of the professional.

The aspects that were valued positively were that teamwork was improved, leadership was practiced and it helped define the necessary roles in responding to an emergency. The interviewees especially highlighted the fact that by carrying out the training in the workplace itself, it allowed them to improve some essential aspects, such as familiarization with the environment, which allows quick location of emergency material and other types of materials (blackboard to record clinical data and interventions) and useful resources (protocols hanging on the wall), as well as solving some organizational problems.

Regarding the methodology of clinical simulations, the participants highlighted both the importance of prebriefing and debriefing. In the first case, it allows professionals to relax, allowing them to act more calmly and spontaneously. They especially highlighted that emphasis was placed on the educational and non-evaluative objective of the activity. Finally, they valued very positively that the debriefing is the space where it is possible to reflect on the performance and improve the necessary aspects.

It is worth noting that some professionals reported that they had been able to apply the knowledge acquired in responding to emergencies that had subsequently occurred in their workplace in the following days, acting more calmly and with better organization.

As proposals for future editions, the possibility of increasing the complexity of the simulations and allocating more time to this training activity was discussed, as well as expanding the topics to be addressed: anaphylaxis, poisoning, troubled patients or mental disorders.

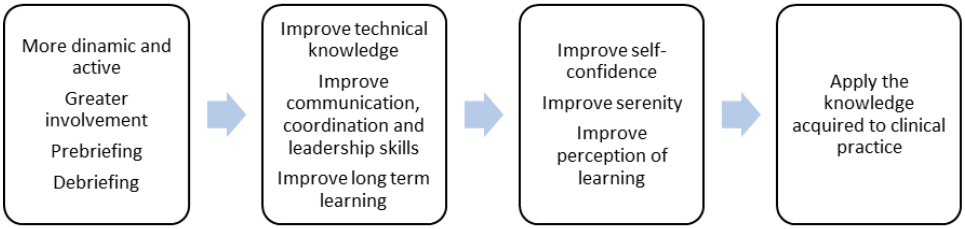


Figure 1. Results

6. Discussion

The use of clinical simulations applied to continuing education in the healthcare field has been used frequently, usually in hospital medical specialties in the field of emergencies (intra or extra-hospital emergencies, intensive care units, anaesthesiology, etc. In Primary Care, emergency care is uncommon but requires an optimal response from health center professionals.To improve skills in this area of PC, both technical and non-technical, the use of SIMs is becoming a tool with great potential, as evidenced by the data from our study, where the professionals interviewed refer to this methodology as helping to improve their technical knowledge, as well as their communication and leadership skills, along the same lines other studies in different areas (Sahin-Bayindir & Buzlu, 2022). Similarly to other studies (Mehrotra et al., 2011), our PC professionals advise the use of this methodology for future training activities on any subject.

Not only that, but also the fact that the SIMs are carried out at the same place of work of the professionals (SIM in situ) allows to improve aspects related to the work center itself, and fulfills the primary objective of the simulations, which is to bring to the maximum learning to a real situation. In this sense, the possibility of carrying out the simulations in multidisciplinary teams is highly valued, which allows a better knowledge of the roles and functions of the other members of the team (Kyrkjebø et al., 2006).

7. Conclusions

In situ clinical simulations applied to primary care emergency training (AMI code, Stroke code and CPR) allow to improve knowledge and teamwork, and could be applicable to continuing training in other areas.

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Enhancing Learning in Biomedicine through Research-based Learning: Empowering Students for Future Success

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Abstract

Background: Research-based Learning (RBL) is globally recognized for improving scientific literacy and critical thinking. Providing authentic research experiences in undergraduate education, RBL enhances student confidence in scientific contribution, improves subject understanding and retention, and fosters the acquisition of technical and soft skills.

Aim: Assess RBL's impact on Biomedical Sciences students' engagement and skills.

Methods: Seventy-six 3rd-year Biomedical Sciences students completed a 5-week Research in Biomedicine course, going to the laboratory, and attending workshops on scientific writing, reference management, and poster creation. They presented their findings through written and oral presentations at a congress.

Results: Survey results showed positive feedback from both the students and tutors: 100% student satisfaction, 94% reported skill development, and 88-94% of tutors noted improved motivation, teamwork, and problem-solving abilities.

Conclusions: The study confirms RBL's efficacy in improving learning, critical thinking, and teamwork in biomedical education. It advocates its broader application, empowering students worldwide.

Keywords: *Research-based learning; pedagogical strategies; active teaching-learning; biosciences.*

1. Introduction

The growing importance of changing a culture where students are passive receivers of information to one where they become active inquirers has been recognized in the university

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ecosystem since the end of the past century. Active teaching and learning methodologies, particularly Research-Based Learning (RBL), have gained recognition, marking a shift from a traditional teacher-focused to a student-focused approach, where students are empowered with authentic research experiences during undergraduate education. So far, several universities have successfully implemented RBL to replace traditional "cookbook" labs (Noguez & Neri, 2008; Saptuti Susiani et al., 2018; Stanfield et al., 2022). By immersing students in real scientific research environments, they not only deepen their understanding of the subject matter because they are applying concepts learned in the courses to real-life situations boosting academic performance, but also enhancing their critical thinking and problem-solving abilities. Students are more likely to invest in their learning when they are actively involved in the research process. Indeed, RBL leads to increased student engagement, motivation, and confidence in contributing to science. It cultivates essential skills, such as communication in science, dealing with uncertainty, independence, teamwork, and organizational and time management skills. It is also advantageous for the teachers as they build strong student-teacher relationships through collaborative design. Moreover, RBL promotes lifelong learning as it can help students develop a passion for learning and a curiosity about the world around them (Auchincloss et al., 2014; Buffalari et al., 2020; Lefurgy & Mundorff, 2017; Meyer et al., 2023; Seymour et al., 2004; Uyanık, 2016). Nonetheless, implementing RBL in the first cycle faces challenges such as teacher training, time constraints, limited resources, logistical issues, and the cost of research supplies for many students. Resistance to change and the need for new assessment methods further complicates the integration process. Proposed solutions include creative resource allocation and cost-efficient models. The students might not be prepared for the level of independence and responsibility required for RBL experiences, so teachers may need to provide additional support and guidance (Corrales et al., 2020; Stanfield et al., 2022). This paper focuses on a case study implementing RBL in a "Research in Biomedicine" course for 3rd-year Biomedical Sciences students. The study aimed to assess the impact of RBL on student engagement, critical thinking, and teamwork skills, through laboratory projects and scientific communications. Moreover, the project seeks to foster collaboration among faculty members, involve students in curriculum design, collect evidence on pedagogical practices, and share the results with the academic community. Ultimately, this initiative aspires to encourage the transfer of knowledge to similar teaching contexts, creating a ripple effect of transformative education and enriching the educational landscape.

2. Methods

2.1. Context and study participants

In the academic year 2022/2023, 76 students from the 3rd-year of the 1st cycle degree in Biomedical Sciences enrolled in the course "Research in Biomedicine", from February to June of 2023. Each group worked on a different research topic, voluntarily assigned by a supervisor, for 5 weeks (1.5 days/week) under the mentorship of 28 experienced investigators. Students

were asked to form groups of 3 and choose the top 3 preferred project topics, in priority order. For the topics chosen by more than one group, a ruffle was made. The research topics were chosen based on ongoing projects of the proponent investigator. Several fields of study were covered, namely human reproduction, pharmacology, virology, and bioinformatics. The students also had parallel lectures on how to elaborate a short communication and a poster, and how to manage references and bibliography using Mendeley. This was designed to help students develop scientific writing and communication skills. Lastly, they also did an exam on biosafety.

2.2. Evaluation

2.2.1. Student assignments

Unconventional assessment methods (not written exams) were employed to immerse students closer to the researcher's environment **(Figure 1**). At the beginning of the course, a biosafety written test was conducted to ensure student´s knowledge of laboratory rules, and therefore give them clearance to go to the laboratory. Throughout the semester the involvement and attendance as well as the performance in the experimental activities (planning, execution, and analysis of the results) were continuously evaluated. In the final week, students had to submit a final report, which could be either a short communication or a mini-review, and then present a poster showcasing their research while practicing communication skills in a congress. This event took place in half a day, including a coffee break, and was open to the academic community. Each group was evaluated by a jury composed of 3 senior researchers or PhD students. The best poster was awarded, for extra motivation, with vouchers for a bookstore.

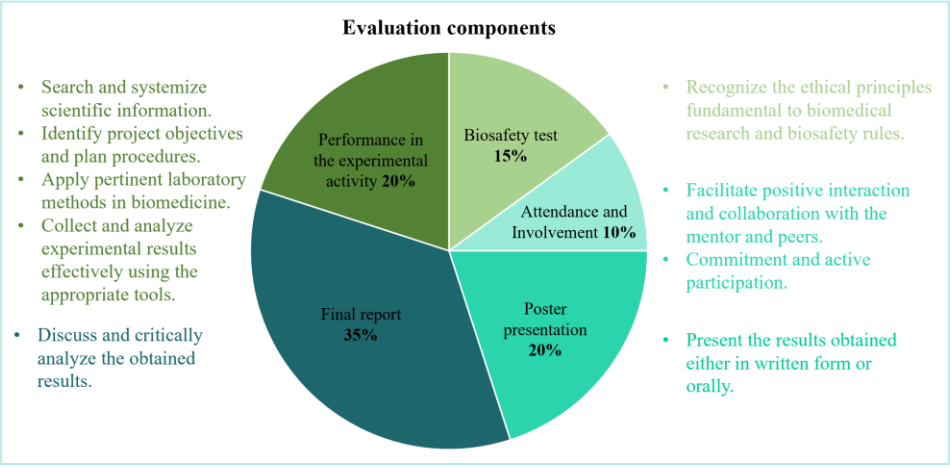


Figure 1. Components evaluated in this course, including their weight and learning outcomes.

2.2.2. Data collection and analysis

Two satisfaction surveys were conducted to collect feedback from students and tutors, aiming to evaluate the RBL methodology and the overall functioning of the course. Out of 76 students,

34 responded to the survey, and 17 out of 28 tutors provided feedback. Utilizing a 5-point Likert scale (1 for 'totally disagree' to 5 for 'totally agree'), the satisfaction surveys also included an open-ended feedback section, so that they could complement their opinion. Positive and negative feedback from students and tutors were categorized, and the frequency of similar ideas was noted. Ethical consent was obtained to perform the present study. For effects of analysis of results, the frequency of "4" (agree) and "5" (totally agree) were summed and considered to be the total of people that agree. IBM SPSS Statistics (version 29) was used for summary statistics (median, standard deviation, frequency) and to calculate Cronbach's alpha coefficient to assess the internal consistency of the survey. A graphical representation of student and tutor opinions (percentage vs. agreement level) was created using Excel.

3. Results and discussion

3.1. Student´s survey

A survey was conducted to assess the level of agreement in terms of RBL benefits, methods of evaluation, course dynamics, overall functioning, and expectations. The mean score for all 24 questions was 4.211 out of 5. The Cronbach's alpha is 0.812, indicating good reliability of the survey outcomes. Key insights (**Figure 2**) include high satisfaction with having several assessment methods (97.1%), and the clarification the students got for their future, in terms of graduate studies and professional careers (79.5%).

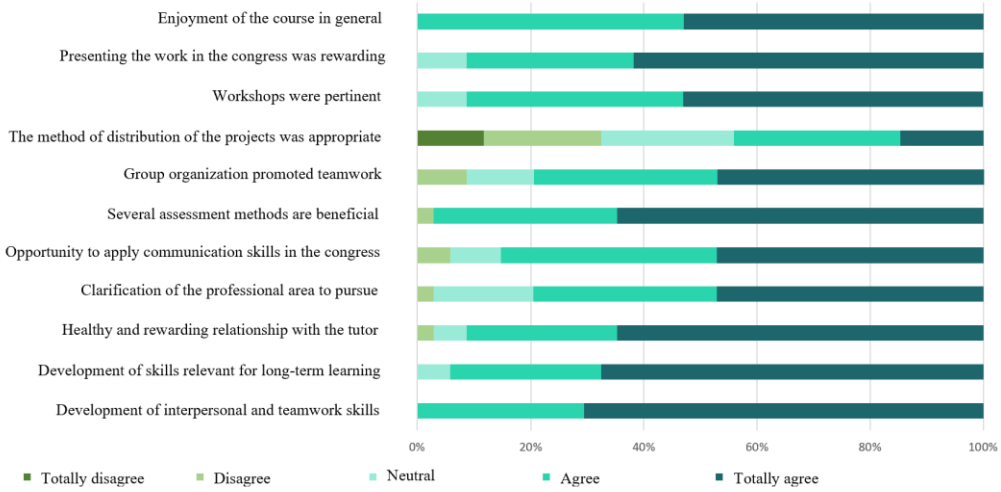


Figure 2. Main results from the student´s survey.

They also enjoyed having workshops (91.2%) and presenting their work in a congress (91.2%), which also allowed them to apply communication skills (85.3%). The congress was deemed a success in showcasing students' work (**Figure 3**).

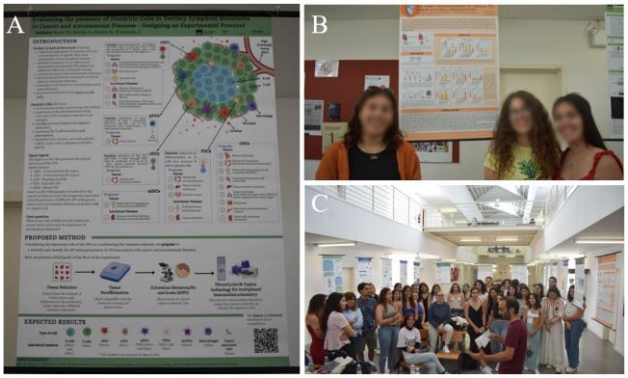


Figure 3. Congress proof-of-concept. (a) winning poster, (b) a group with their poster, (c) announcement of the winning poster prize, and final considerations.

Notably, 100% of students agreed on developing interpersonal and teamwork skills. All of them enjoyed the course in general. Qualitative comments highlighted the course's adaptability for each student's interest, and motivation boost, and suggestions for improvements were given, including project selection methods, standardization between groups, and an increase in course workload. Most students expressed satisfaction with the course, highlighting enjoyment, motivation, and skill development in interpersonal, teamwork, and long-term learning. They liked having the opportunity to be in a research laboratory and acknowledged that RBL is adapted to each person, as each student can choose the research area that interests them most. In the biomedical sciences bachelor, the students have a total of 5 courses that happen in teaching laboratories, where they just follow a protocol and then have to write a report about it. While this might help them to learn technical skills, they are not developing other essential skills like problem-solving skills, contrary to what happens with RBL. Some students mentioned that their final report could be published. While it is recognized that those reports are not deep enough to be publishable, an opportunity could be given to the students who desire to improve them. The students also proposed having more workshops, namely on data analysis platforms. Students' desire for research paper writing and additional workshops indicates a proactive approach toward enhancing their learning experience. Indeed, the positive aspects align with the benefits of RBL mentioned in the introduction. However, certain areas require attention and improvement. Challenges were identified in the initial distribution of students to different research projects, leading to disagreements and misunderstandings (frequency in qualitative comments: 4; only 44.1% of the students agree that the method of distribution was appropriate). Student suggestions include individual project choice and using average classification as a tiebreaker. To give the same opportunity to all the students the tiebreaker was a raffle, which

did not meet the expectations of a few students. It was also noticed that a few students compromised the project they wanted to work on to be in a team with people they are used to working with. Next year we will discuss the best strategies for the distribution of the topics with the students. Standardization between groups, including laboratory hours, also emerged as a concern (frequency in qualitative comments: 11), emphasizing the need for clearer guidelines. Thus, a guide for the conduct of tutors will be extensively developed for the next academic year, and instead of a single list of indications at the beginning of the course, the tutors will have training. Further improvements include a weekly space for basic training procedures like pipetting and making solutions. Another future implementation will be the creation of a student focus group to promote the exchange of feedback on the course, in terms of difficulties that might need to be solved in time.

3.2. Lab tutor´s survey

For the 17 questions that composed the lab tutor´s survey (**Figure 4**), the mean score was 3.982 out of 5. The Cronbach's alpha is 0.695, suggesting a careful interpretation of the results. Notable findings include high agreement on the course's contribution to improving students' knowledge (100%). Tutors generally perceived students as motivated and committed (94.1%), with positive interactions and a healthy relationship (82.3%). Even though tutors felt that students were willing to learn the laboratory techniques that were proposed and showed problem-solving and teamwork skills (88.2%), only half of them agreed that students showed initiative and autonomy when carrying out the tasks in the laboratory (52.9%), suggesting a need for fostering these qualities in future iterations of the course.

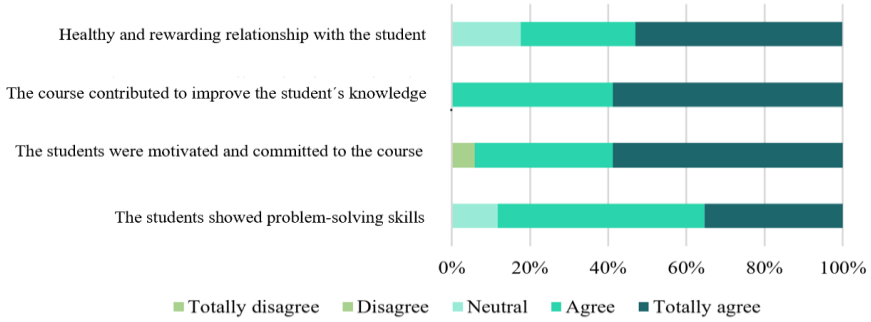


Figure 4. Main results from the tutor´s survey.

Qualitative comments highlighted positive aspects such as effective course operation and opportunities for interaction with motivated students. Improvement suggestions focused on laboratory logistics, due to the presence of many students in the laboratories at the same time, which must be properly scheduled, and basic reagents should be provided for each tutor. Additionally, the students' availability was noted, as they participate in different courses and, it was quite hard to conciliate the different schedules. Concerns about students' maturity and potential interference with parallel tasks suggest the need for interventions to enhance students'

readiness for laboratory work. Overall, the positive feedback from tutors, their willingness to continue in their roles (100%), and the acknowledgment of the course's contribution to students' future preparedness underscore the success of RBL in creating a collaborative and engaging learning environment.

3.3. Implications and Future Improvements

The mean final course classification was 18 out of 20, reflecting overall strong performance by students. The findings collected from the surveys have broader implications for advancing RBL practices in the field of biomedical sciences. In order to increase the number of answers to the student survey, next time it will be delivered before the end of the semester. The study highlights the importance of early development of RBL competencies in undergraduate education. Future iterations of the course could benefit from pre-assessment questionnaires to gauge students' initial research competencies. This is particularly important when facing a very heterogeneous group. The students from this bachelor are well prepared to know how to access scientific literature using databases, due to the problem-based learning methodology used in other courses students attend. However, for 1st cycle degrees that don´t offer this kind of preparation at priori, it is advisable to give a workshop on this. The proposed weekly training space for laboratory procedures and the focus group for teacher-student interaction are innovative ideas to further enhance the course. Successive iterations of the course must be analyzed to track its evolution and effectiveness. This approach aligns with the continuous improvement philosophy, allowing for refinement based on yearly feedback.

4. Conclusion

The pedagogical experiment described herein demonstrates the positive impact of RBL on student engagement, critical thinking, and teamwork skills in the context of biomedical sciences, bridging the gap between theoretical knowledge and practical application. Our research findings indicate that the course methodologies effectively promoted RBL benefits. However, areas for improvement remain, particularly regarding project distribution methods and standardization between groups. These insights can be used for improvements and adaptations to refine the course's design and implementation, ensuring that students' satisfaction is maximized, and their learning outcomes are achieved. Despite the challenges, creative solutions and successful examples demonstrate the potential for widespread adoption, paving the way for a future where RBL becomes integral to undergraduate education.

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Promoting Death Literacy in Palliative Care Nursing Education Using Narrative Pedagogy

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Abstract

Undergraduate nursing students develop their training in a real context, where they are frequently confronted with clinical cases of clients in the end-of-life process but feel uncomfortable with palliative and end-of-life care. This pre–post study with a pre-experimental design evaluated the impact of an educational intervention on nursing students and their compassion levels, spiritual preparedness, and attitudes toward death. A total of 62 students participated in a training program consisting of 25 contact hours based on narrative pedagogy (theoretical and practical classes). The results showed that educational intervention positively impacted different dimensions, particularly self-compassion and spirituality, as well as reduced fear of death and increased neutral acceptance. Nursing education should prioritize the inclusion of death, dying, and end-of-life care across the nursing curriculum's fundamental courses.

Keywords: *Palliative care; education; nursing; death literacy; compassion; narrative pedagogy.*

1. Introduction

Palliative care has gained relevance in health services, becoming an integral part of the holistic approach to people with chronic, incurable, and progressive illnesses. The World Health Organization (2014) highlighted this goal and approved a commitment to strengthen palliative care as a component of integrated treatment throughout life. Providing compassionate care for dying patients is a crucial aspect of nursing. It enhances nurses' ability to promptly attend to their patients' physical, spiritual, and emotional requirements. However, nurses often hesitate to discuss death with both their patients and colleagues (Tamaki et al., 2019). Nurses can gain information and cultivate adequate attitudes toward end-of-life (EoL) care through death

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education (Mastroianni et al., 2015). Undergraduate education should offer nursing students a chance to cultivate the competencies needed for EoL encounters. According to Shaw and Abbott (2017), students who are provided with such education are more inclined to develop into proficient healthcare providers.

Based on Human Caring Science Theory (Watson & Woodward, 2020), spiritual care should be a paramount cornerstone in nursing practice and education. In this sense, promoting spirituality and spiritual care is relevant, along with compassion (the intentional sensitivity to suffering and the commitment and motivation to alleviate it). Considering the specificity of caring for a person and family in palliative and EoL conditions, as well as the positive attitudes toward death when nursing students perform clinical placements (Novais et al., 2021), improving these attitudes in training programs in palliative care nursing is important. Several studies have demonstrated that training and courses in active learning strategies (such as simulation, drama, narrative pedagogy, and roleplaying) can enhance the confidence of nursing students and foster more positive attitudes toward death and EoL care (Ozpulat et al., 2023; Tamaki et al., 2019; Zhu et al., 2023).

To the best of our knowledge, no Portuguese studies have described these experiences for undergraduate nursing students. To effectively provide outstanding EoL care in a real-world setting, nursing students must receive sufficient preparation during their undergraduate studies. The gold standard of nursing practice is contingent upon the value of the nursing education imparted, as well as students meeting the necessary qualifications. Therefore, this study aimed to evaluate the impact of an educational intervention based on narrative pedagogy on senior nursing students' compassion levels, spiritual preparedness, and attitudes toward death.

2. Methodology

2.1. Study design

This pre–post interventional study with a pre-experimental design was conducted between October 2023 and November 2023. The STROBE cross-sectional reporting guidelines were used to report this paper. Research permission was granted from the Ethics Committee of Polytechnic University of Leiria (CE/IPLEIRIA/54/2023). Likewise, necessary permissions were obtained from the scale owners and students who agreed to participate in the research (via the button to accept to participate in the e-survey).

2.2. Participants and Recruitment

The population included 120 students in the 4th year of the nursing degree. The sample was obtained using a convenience sampling method. Eligible participants were students aged over 18 years; enrolled in the palliative care nursing course; and fluent in Portuguese. International

incoming mobility students were excluded. A total of 62 students participated (response rate = 51.67%) with an average of 22.61±2.84 years of age (range: 20–32). The vast majority were female (90.3%), single (95.2%), lived in a rural context (51.6%), and stated having a spiritual belief (74.2%).

2.3. Educational Intervention

The contents and approaches were developed by two faculty members associated with the palliative care nursing course and two nurses with clinical experience in the same area. The sessions were tailored to the needs identified during the initial assessment (pretest). The curriculum included the main themes affiliated with the four pillars of palliative care, namely symptom control associated with "total pain"; therapeutic and effective communication; family care; and interdisciplinary teamwork (Wantonoro et al., 2022). Conventional pedagogy has its limitations when dealing with sensitive topics such as death, namely a lack of flexibility, experience, and interactivity. Alternatively, narrative pedagogy can be used to investigate difficult topics using narration, explanation, and reconstruction of stories and experiences (Zhu et al., 2023).

The narrative training program lasted five weeks, with each participant receiving a total of twenty-five hours of training. The theoretical component lasted fifteen hours (eight sessions: seven 2-hour sessions and one 1-hour session) and the practical component lasted ten hours (five 2-hour sessions). Each week, using expository and interrogative methodology, there were lectures on the following contents: a) values and attitudes towards death and the EoL; b) compassionate communication and person-centered approach, and management of bad news/family conference; c) “total pain” and symptom management in evitable suffering; d) comfort measures in EoL – education of patients, families, and caregivers; e) spirituality and spiritual care competence; f) bereavement support; g) interprofessional teamwork in palliative care; and h) self-care of professionals. Concomitantly, practical lessons were presented in 8-12-person classes and used active learning strategies centered on self and relational skills, especially using autoscopy, roleplaying, case-based learning, team-based learning, and autobiographical narratives. In addition, real clinical cases were used to bring the simulated context closer to that of clinical practice in areas such as the communication of bad news, the development of the family conference, symptom control, and care at the EoL. All practical sessions maintained the same structure throughout the program, including a first phase of negotiation and task assignment (prebriefing); a second phase implementing the training activities using ready-made narrative materials and self-made materials based on students’ own experiences of life and death; and a final debriefing phase to foster critical reflection.

2.4. Data Collection

The e-survey took approximately 12 minutes to complete and was submitted only after all the survey contents had been completed to ensure non-missing values. Data were collected before and after the intervention and included four parts:

1) Socio-demographic data (age, gender, marital status, place of residence and spiritual beliefs);

2) Death Attitude Profile-Revised (DAP-R) Scale (developed by Wong et al., 1994; Portuguese version by Loureiro & Jesus, 2010) to assess students' attitudes toward death. The DAP-R consists of 32 items grouped into five distinct dimensions corresponding to different attitudes: fear of death (7 items), death avoidance (5 items), neutral acceptance (5 items), approach acceptance (10 items) and escape acceptance (5 items). All use a 7-point Likert scale (ranging from 1 = strongly disagree to 7 = strongly agree). Fear of death and death avoidance are attributed to negative death attitudes. Neutral acceptance, escape acceptance, and approach acceptance are attributed to positive death attitudes. The total DAP-R alpha coefficient had good reliability.

3) Compassionate Engagement and Action Scale (CEAS) (developed by Gilbert et al., 2017; Portuguese version by Cunha et al., 2023). This 30-item scale with a 10-point response score (ranging from 1 = never to 10 = always) is divided into three domains: compassion for others (10 items); compassion from others (10 items); and (3) self-compassion (10 items). Each scale separately assesses the individual's compassionate attributes and actions when facing a situation of difficulty or suffering. Higher scores indicate higher compassion levels. The scale has good internal consistency.

4) Spirituality and Spiritual Care Rating Scale (SSCRS) (developed by McSherry et al., 2002; Portuguese version by Martins et al., 2015) consists of 17 items and identifies nurses' perceptions of spirituality and spiritual care. Participants are asked to rate four factor-based subscales: Spirituality, Spiritual Care, Religiosity, and Personalised Care, using a 5-point scale (ranging from 0 = strongly disagree to 4 = strongly agree). The scale's alpha value was 0.76.

2.5. Data Analysis

The data were analyzed using the Statistical Package for Social Sciences (SPSS, v.24.0). Central tendency (mean) and dispersion measures (standard deviation, range) were used for descriptive statistics. The dependent group t-test was used to analyze the pretest and post-test scores. The level of significance was set at $p < 0.05$.

3. Results and Discussion

In the DAP-R's initial assessment, neutral acceptance was the dimension with the highest mean score, while death avoidance had the lowest mean score. Individuals often avoid confronting mortality due to their fear and uncertainty regarding death. This behaviour underscores the importance of promoting death literacy. With the development of the program, the average response tended to decrease in death avoidance and fear, the latter showing statistical significance ($t = 1.98$; $p = 0.026$). These data are consistent with the evidence highlighted in other studies (Novais et al., 2021; Williams et al., 2022; Zahran et al., 2022). Only neutral acceptance was statistically significant after intervention ($t = -1.99$; $p = 0.026$), meaning that participants viewed death as an integral part of life (Table 1). Notwithstanding, there was a slight increase in post-intervention response scores in two subscales: approach acceptance (death viewed as a passageway to a happy afterlife) and escape acceptance (death viewed as an escape from a painful existence).

Regarding the CEAS, there was also an improvement in the mean score of all the instrument's dimensions, with a statistically significant positive effect in the self-compassion dimension ($t = -1.87$; $p = 0.034$). Self-compassion has been demonstrated to be an important mediator of professional self-care (Mesquita Garcia et al., 2021; Mills et al., 2017). Therefore, it is a relevant dimension for palliative care nurses, which is why the results achieved in this domain are considered positive. Compassion in healthcare has been gaining greater attention, particularly concerning perceptions and implications for ill people and healthcare professionals, as well as the systematization of interventions that promote compassionate care (Malenfant et al., 2022). Compassion, as an empathetic construct, is crucial in care settings as it promotes information and dialogue and creates a space for dying and accepting death by family caregivers (Skorpen Tarberg et al., 2020). Therefore, compassion was a prominent area in lesson development related to communicating bad news and managing family conferences.

Education and self-reflection are paramount for the development of spiritual care competency among healthcare professionals (Gijsberts et al., 2019). Spiritual care includes creative, narrative, and ritual work. In this sense, the students were asked to write an individual critical narrative to holistically evaluate their experience of suffering or the process of death and dying, thus mobilizing their feelings and meaning of purpose associated with humanized care. Connecting, or reconnecting, with a unique sense of spirituality can serve as a powerful resource for resilience (Miller et al., 2023). After the intervention, there was an overall change in the score of four SSCRS domains. However, only the "spirituality" domain stood out with a statistically positive change ($t = -2.25$; $p = .014$). Educational interventions based on narrative pedagogy seem to help nursing students develop compassion and promote positive attitudes toward death and spiritual care preparedness.

Table 1. Pretest and Posttest Scale Scores.

Instruments	Pretest		Posttest		Paired samples test			
	Mean	SD	Mean	SD	Mean	SD	*t*	*p*
Death Attitude Profile-Revised (DAP-R) Scale								
DAP-R – death fear	3.62	1.29	3.09	1.30	0.49	1.85	**1.98**	**.026***
DAP-R – death avoidance	3.06	1.37	2.75	1.39	0.33	1.97	1.24	0.11
DAP-R – neutral acceptance	5.47	0.89	5.81	0.76	-0.35	1.29	**-1.99**	**.026***
DAP-R – approach acceptance	3.47	1.29	3.87	1.49	-0.39	1.99	-1.44	0.08
DAP-R – escape acceptance	3.11	1.23	3.26	1.46	-0.20	1.87	-0.81	0.21
Compassionate Engagement and Action Scale (CEAS)								
CEAS – self-compassion	6.41	1.04	6.78	1.14	-0.38	1.51	**-1.87**	**.034***
CEAS – compassion for others	7.38	0.98	7.58	1.10	-0.11	1.53	-0.53	0.30
CEAS – compassion from others	6.49	1.15	6.58	1.17	-0.04	1.45	-0.22	0.42
Spirituality and Spiritual Care Rating Scale (SSCRS)								
SSCRS – spirituality	4.08	0.61	4.35	0.55	-0.28	0.91	**-2.25**	**.014***
SSCRS – spiritual care	4.08	0.39	4.17	0.49	-0.06	0.56	-0.82	0.21
SSCRS – religiosity	1.67	0.70	1.64	0.78	0.04	1.09	0.29	0.39
SSCRS – personalized care	4.52	0.51	4.61	0.52	-0.08	0.75	-0.83	0.20

Standard deviation (SD); * $p<0.05$

3.1. Study limitations

The present study has some limitations such as the sample size and the duration of the educational intervention program, which prevented the deepening of some contents. Some of the items had high initial scores and did not increase, a result which could be due to a ceiling effect. Furthermore, we only employed a quantitative approach to assess the effects of death education. Qualitative research methodologies are advisable for a more comprehensive evaluation of students' emotional experiences. Another drawback of this study was the use of a cross-sectional design rather than a longitudinal method, which could further examine the impact of training across various levels of nursing courses and types of training. Another constraint arises from the utilization of self-report questionnaires, which may tend to provide the socially desired results.

4. Conclusion

Nursing education has been updated by developing knowledge and practice, in a continuous flow of exchange between the academic and clinical components of nursing. Holistic palliative care encompasses a multiplicity of care where nurses are particularly important in facilitating the different transitions faced by the ill person and their family. Narrative pedagogy involves acquiring knowledge that goes beyond formal knowledge (cognitive dimension) and encompasses an affective disposition where the use of self in the relationship involves areas such as compassionate and spiritual care, allowing for the development of a positive attitude towards death. This educational intervention showed a positive impact on different dimensions,

particularly in the areas of self-compassion and spirituality, and reducing fear of death and increasing neutral acceptance. Our findings may assist educators in gaining a deeper comprehension of the significance and immediacy of death education, while also offering a novel approach to the subject.

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The use of ChatGPT in Chemistry: the bibliometric analysis

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Abstract

ChatGPT (Chat Generative Pre-Trained Transforme) is a recent technology developed by OpenAI that interacts in a conversational way to user prompts. This tool was released in November 2022 and was immediately seen by someone's as a threat to integrity regarding student assessment, and by others as an ally in teaching/learning and research. This article aims to provide an overview about ChatGPT and Education through a bibliometric analysis from 2023 to January 2024. An analysis and review of ChatGPT and chemistry education is also carried out. The results show that the USA has more authors with publications on the topic and Medicine / Health is the major area. When it comes to Chemistry Education, the 12 publications on the topic consider Chat GPT a tool to be used, but the answers given in ChatGPT must be verified as there is a high percentage of errors and inaccuracies.

Keywords: *Artificial intelligence; Education; Bibliometrics; Computer-based Learning; Chemistry Education.*

1. Introduction

In recent years there has been a great development of digital technologies (such as virtual reality and augmented reality) and artificial intelligence, which have been incorporated in different contexts in teaching/learning process in different areas of knowledge. ChatGPT (Chat Generative Pre-Trained Transformer) is an online artificial intelligence (AI) chatbot developed by OpenAI, launched in November 2022 (*ChatGPT*, n.d.). In other words, in simple terms, it is a language that generates answers to questions asked by users in a natural, humanlike way. ChatGPT can be used by students to obtain answers to questions specific to their work, to write an essay or a report about laboratory or non-laboratory work, perform mathematical calculations and tables and even write computer code. This generative artificial intelligence has created a buzz in academia concerning the potential negative impacts might cause to education. There are articles published in the media talking about the possibility of writing essays by ChatGPT,

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however demonstrating/proofing that this has occurred is difficult to occur, as ChatGPT does not have any proof of the text generated by it. However, this cheating is not illegal. However, there are those who have another perspective on the subject and consider using ChatGPT as a learning companion and as a teacher and research assistant. Therefore, it remains unclear whether these technologies could be adopted to benefit teachers' teaching and student learning or could constitute a disadvantage or even a risk to their use. This study aims to map the global scientific publications related to the use of ChatGPT in education in general and in particular in chemistry education.

2. Materials and Method

2.1. Literature Search

The method used to develop this work includes the following major stages:

1- *Planning*: defining the major research questions

2- *Search*: defining the database sources of literature search, search strings employed in the search strategies, and inclusion and exclusion criteria, followed by the literature search and selection

3- *Literature analysis*: analysis of the include papers and interpretation of results.

The major research questions that this study addresses are the following:

A- Regarding education, which scientific areas have ChatGPT been used in?
B- What countries do the publications come from? Which Publisher is most active regarding the topic of ChatGPT and education?
C- Regarding the study of the use of ChatGPT in chemistry, what topics, activities, studies and implications are covered?

The scientific publications analyzed in this study were identified and collected in Web-of-Science (WoS) using the field tag Topic (TS), which searches in fields Title, Abstract and Keyword of the publication. The search strategy employed the use of terms “ChatGPT” AND Education, Chemistry Education. This search strings were used in combination and the retrieved articles were further extracted to Excel.

2.2. Study Selection

It was not necessary to apply restrictions regarding the year of publication since ChatGPT was only launched at the end of 2002, so the published articles are obviously in the time range from 2023 to January 30th, 2024. In addition, the exclusion criteria were: (1) non-English studies; (2) restricted to document type article, early access and review article (3) studies that were not

education or chemical education studies; and (4) studies with scopes outside the current review focus (or not related to chemistry topics) (Figure 1).

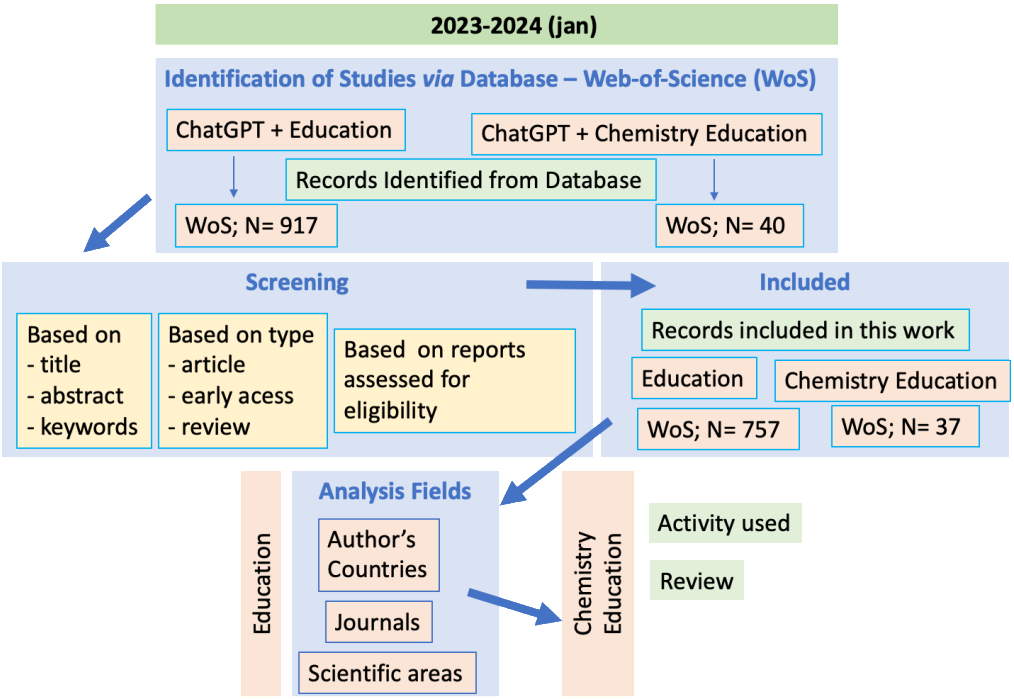


Figure 1. Method Flowchart

3. Results

The appearance of ChatGPT at the end of 2022 caused a great frenzy in the academic community, leading to 757 publications on this topic in 2023. The journals that published about ChatGPT and education are indexed in 132 areas of research. The data represented in Figure 2, the research areas represented are the only ones with fourteen or more articles. In represented area Medicine/health, are included publications from different specialties such as radiology, ophthalmology, etc., which is the major area with 39% of the publications represented. The following scientific area comprises two areas, the Education δ Educational Research plus Education Scientific Disciplines, and has 38% of publications. Multidisciplinary chemistry accounts for only 3.5%.

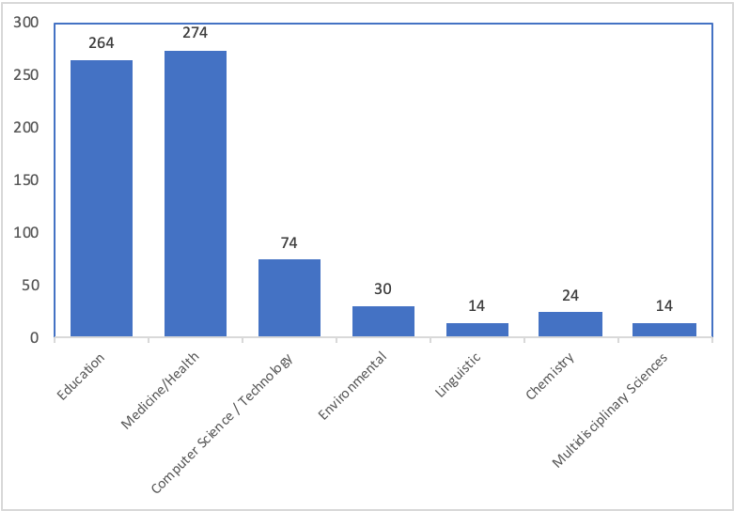


Figure 2. Research areas with fourteen or more articles about ChatGPT and Education

Both in Education and in Chemistry Education, the journals with the majority of publications about ChatGPT are in the area of education, in the first case Medical Education, Cureus Journal of Medical Science with 18,4% followed by JMIR Medical Education with 10,4% and in the second case, ChatGPT and Chemistry Education it is the Journal of Chemical Education the first with 63,6% (Figure 3).

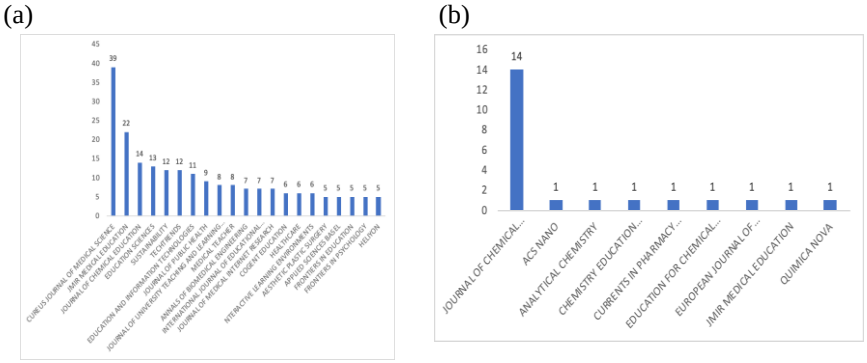


Figure 3. Journals with publications about ChatGPT and education (a) Journals with five or more articles in education in general; (b) Journals with one or more articles in chemistry education

Based on the authors' affiliation, the United States of America (USA) has the highest percentage of publications, 25.5% on this topic, followed by China (8.9%) and India (6,7%). In the case of Chemistry Education, the authors of the publications are mostly Americans (32.6%), as with publications on education in general, followed by those from the People's Republic of China (20.9%) and then Australians (14%) (Figure 4).

a) b)

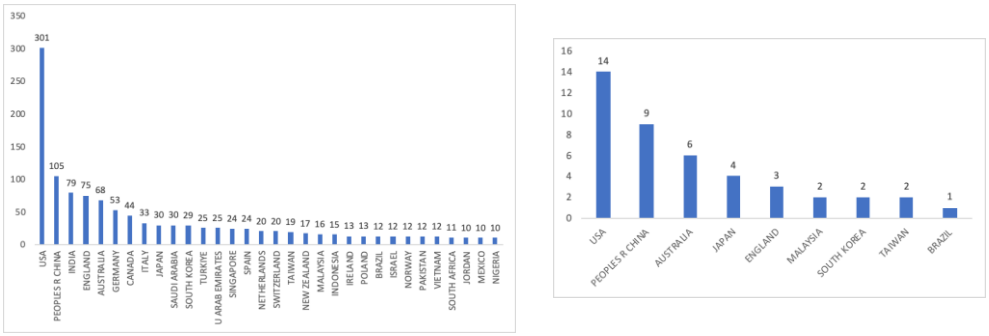


Figure 4. Author's countries with publications (a) about ChatGPT and Education with more than ten articles; (b) about ChatGPT and Chemistry Education with more then one article

4. Discussion

Since 2022, the year in which ChatGPT appeared, this artificial intelligence tool has aroused enormous curiosity in the scientific community, which led to an explosion in the number of articles in the following year. If initially the concerns were related to academic integrity and the way of evaluating students, the big question quickly became trying to find out what impact it had on teaching and learning, and how it could be used in the tasks of this process, whether by the student or the teacher, as well as in research.

The largest number of publications occurred in the area of Medicine/health and, of course, in Education with the area of computing/technology being further away. As education is one of the search keywords, it is natural that the major number of publications were obtained in this area. The same cannot be said with Medicine/Health. The high number of publications in this area is due to the nature of the knowledge and the characteristics of the tool; it's easy to ask questions and get an answer. The use of ChatGPT in area of computing/technology is due to the fact that ChatGPT appears to be very successful to help in programming by providing lines of code.

The two journals with the largest number of publications are Cureus Journal of Medical Science and JMIR Medical Education. The aims and scopes of these journals explain their position on this ranking, which respectively include teaching / learning medicine and health. The third and fourth journals are in the area of chemistry education. Both journals publish articles that are studies that seek to understand how the use of technology can increase knowledge. In addition to another area present is computing/technology, it is strongly linked.

It is notable that developed countries, with the exception of India, publish the most, with the USA and China leading the ranking. Geographically, in the first 10 places in the ranking there

are countries from 4 continents. This data is also directly related to the data with the universities that publish the most.

4.1. Case of Chemistry Education

The articles published on Education and ChatGPT of interest to this work are in their entirely published in the Journal of Chemical Education (JCE). This is a Journal of the American Chemical Society, USA.

Fourteen articles were identified in from 2023 to 2024 (January) in JCE, based on the title and keywords, but after reading the abstract, two articles were excluded as they did not fall within the scope of this work. Therefore, after full papers reading, it was possible to a group them according the authors' approach to the topic "ChatGPT and Chemistry Education": (1) author's opinion regarding the use of the possible advantages/potentialities and disadvantages/limitations of using ChatGPT in education and research in the area of chemistry (Alasadi & Baiz, 2023; Emenike & Emenike, 2023; Tyson, 2023); (2) The use of ChatGPT to carry out lab reports. For the authors ChatGPT gave a readable answer but with little analysis result. ChatGPT generates clear, error-free writing with generally correct information, especially within abstract and introduction sections. The student needs to understand the chemical principles for to formulate the correct question in order to get the appropriate answer, and also need to analyze the output of ChatGPT (Humphry & Fuller, 2023; West et al., 2023). (3) Comparative analysis of ChatGPT responses to exam and assignment questions. In general, the authors' opinion that ChatGPT responds better to questions that use "describe" and "discuss" than to questions that focus on the application of knowledge and interpretation with non-textual information (Clark, 2023; Fergus et al., 2023; Leon & Vidhani, 2023; Watts et al., 2023). Analyzing ChatGPT responses by students could be an exercise in developing critical thinking (Guo & Lee, 2023).

5. Conclusions

In conclusion, ChatGPT is a technological tool that aroused great curiosity in the area of education, which led to the publication of a large number of articles in different areas, namely Medicine/Health and Technology/Computing. American authors are those who have published the most on the topic, followed by Chinese and Indian authors. In Chemistry Education, ChatGPT is the American Journal of Chemical Education that has practically all publications. The authors point out ChatGPT as a tool that still needs to be improved, as the answers obtained are not correct, however it has potential.

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Readiness of the Student Community for Using Artificial Intelligence in Higher Education

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Abstract

What challenges or opportunities exist when using artificial intelligence (AI) at the university? This work presents the experience lived in a Futurist Applications of AI in Education Workshop in which professionals from different educational levels, roles, and areas worked together to construct proposals to enhance the use of AI in higher education. As a parallel research process, a questionnaire was applied to inquire about the perceptions of the uses of AI and the personal and professional applications of managers, professors, students, and stakeholders. The results reflected a broad intention to understand, use, and implement AI to develop and strengthen the processes of access, teaching, and learning in higher education.

Keywords: *Higher education; educational innovation; STEM.*

1. Introduction

The advances in Artificial Intelligence (AI) and its increasingly present inclusion in everyday social dynamics have changed how people and organizations function and interact (Kumar et al., 2023). The uses of AI in the different social spheres and areas of knowledge are varied. For example, in the areas of medical services (Huynh-The et al., 2022), human resources and recruitment (Vrontis et al., 2022), and tourism (Babeş-Bolyai University & Popovici, 2023).

AI has also had a significant impact on education (Baltazar, 2023). AI can encompass intelligent tutoring systems, automated grading systems, and personalized learning platforms, executing both routine tasks and more complex decisions, such as guiding students through interactive lessons (Adiguzel et al., 2023). In this area, various international organizations have begun creating guides, curricula, and strategies to teach and assess AI literacy (Office of Educational Technology, 2023).

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Studies emphasize the need to develop AI literacy skills, as well as the proposal of medium and long-term plans to support training (Cetindamar et al., 2024; Perchik et al., 2023). In addition, they highlight that the effectiveness of AI in education is closely linked to the knowledge, skills, and readiness of users for its adoption (Flavián et al., 2021; Martínez-Plumed et al., 2021). Given that the preparation of all participants in university communities is a key element for implementing AI in Higher Education (HE) at the international level, it is important to identify the current state of universities, especially in Mexico and Latin America.

1.1. Background

In HE, the use of AI has been addressed in various ways. Some works explore the creation of guidelines for its integration and options for including it in a relevant way in the curriculum (Neumann et al., 2023), generating a model by identifying student learning patterns in order to facilitate and qualify teaching and learning (Sallu et al., 2023), and establish policies regarding the use of AI tools (Xiao et al., 2023).

Overall, the number of studies on AI primarily focused on HE reflects the growing interest in understanding how technology influences universities. The adoption of AI by universities, driven by the COVID-19 pandemic, has changed the dynamic and generated questions regarding the skills necessary for teachers (Alnasib, 2023), students (Dai et al., 2020; Tung & Dong, 2023) and staff or stakeholders (Baabdullah, 2024; Issa et al., 2022). For example, Alnasib (Alnasib, 2023) proposes that teachers' readiness to integrate AI into a HE context may be influenced by the perceived benefits of AI in teaching, in HE, available facilities and resources, and behavioral attitude and intent towards AI.

This work aims to study perceptions about the readiness and willingness of the university community to adopt and use artificial intelligence technologies in HE.

2. Readiness of the university community for the use of AI

The research was carried out as a parallel research exercise in an action-participatory research intervention. Participants, selected for convenience, responded to the instrument through an online survey using the Google Forms tool. To be included in the study, people had to belong to the student community at the time of the survey; that is, they had to be students, professors, or staff active at a university and answer the survey. If not, participants were excluded from the study.

Demographic data was collected. Participants were also asked to answer whether they were AI users and knew how to code and were asked to write down the tools used or used respectively. All respondents were invited to participate voluntarily and were presented with an online informed consent form prior to their responses.

The measurement instrument was obtained from Alnasib (2023). It is broken down into 46 items along six dimensions: perceived benefits of AI in HE (7 items), perceived benefits of AI in teaching (14 items), attitude toward AI (7 items), willingness to use AI (6 items), behavioral intentions to use AI (5 items), and facilities and resources for AI use (7 items). Two items were eliminated in the opinion of the researchers. The items eliminated were "*I think it is fun to use AI technology*" from the AI attitude axis and "*AI technology is useful for teaching and learning activities*" from the perceived benefits of AI in the teaching axis. In total, the instrument had 44 items.

2.1. Action-participatory research intervention

Within the framework of the IA education Summit in the IFE Conference held in Monterrey, Nuevo León from January 23 to 25, 2024, the Futurist Applications of AI in Education Workshop was held, in which the educational community was invited to participate in a collaborative exercise to generate educational strategies based on AI.

The workshop was designed to provide a space for dreaming, designing, and pitching futurist ideas about applications of AI for education. The objective was to gather professors, academic leaders, AI researchers, education researchers, and EdTech entrepreneurs from different countries and institutions into a space for innovative AI uses for futurist education.

The workshop started with a presentation of the participants and organizers and a brief introduction to the objectives and activities of the workshop. Participants were asked to fill out the questionnaire during the first ten minutes. Next, the participants formed teams randomly. Each team developed a futurist proposal for using AI for Education, including details about its implementation and possible ethical issues. Following this, each team selected a representative to pitch their idea. Notes were taken during the workshop.

3. Results of the research and intervention

25 valid surveys were obtained from the participants. The demographics of the participants are described in Table 1.

Attendees came from various institutions, ranging from students and professors to managers, directors, and CEOs, some with 1 to 5 years of experience in their role (44%), and others including more than 15 years of experience (36%), with training in various areas (business, engineering, science, psychology, humanities, architecture, among others). 100% of the participants said they were AI users (with the highest frequency daily (0.64%) and weekly (20%)), using tools such as those described in Figure 1A, with Chat GTP being the most mentioned. However, only 52% (13 people) said they knew how to program (Figure 1B).

Table 1. Demographic distribution of study participants.

Demographic Characteristic	Nominal Distribution (%)
Gender	
Female	9 (36)
Male	16 (64)
Age (years)	
21-30	4 (16)
31-40	5 (20)
41-50	9 (36)
51-60	6 (24)
>60	1 (4)
Country of residence	
Mexico	18 (72)
Peru	3 (12)
Spain	1 (4)
Argentina	1 (4)
Colombia	1 (4)
Chile	1 (4)
Educational level	
Bachelor	4 (16)
Masters	8 (32)
Doctorate	11 (44)
Other	2 (08)
Type of institution	
Public	4 (16)
Private	21 (84)

Considering the six dimensions of the survey, the participants' average perceptions were similar when their responses were analyzed by age range and gender regarding their intentions of use and perceived benefit of AI for their daily academic and work life. There was only a slight difference between participants over 56 years and the rest of the group, who considered the facilities and resources available for AI use moderately favorable. However, no significant difference was found. The participants' perceptions based on their role in their institution (Figure 2) show a difference in the opinion of researchers who consider that their institutions still need to be fully equipped concerning facilities and resources for AI.

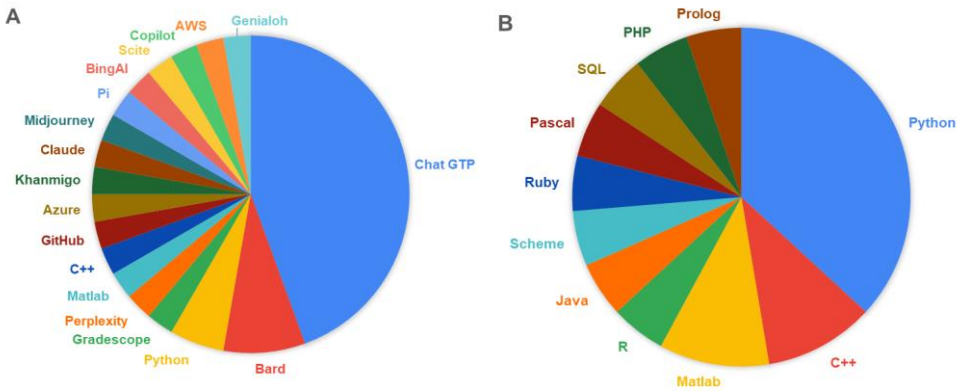


Figure 1. AI tools employed by participants. A. As Users. B. As programmers.

4. Discussion

Both the workshop and the ideas of the attendees, as well as the responses to the survey on the disposition of the university community towards the use of AI, generated relevant information for the study of three essential aspects: (a) The development of the incorporation of AI in the teaching and learning processes that include the areas of governance, academics and research of the university; (b) The development of AI-based tools to support the processes of those who teach and those who learn, and (c) The incorporation of AI-based tools to generate classroom proposals that generate social impact.

These approaches coincide with recent works highlighting the need to include AI in the curriculum with the participation of the educational community's actors, including its governance (Neumann et al., 2023; Sallu et al., 2023). Likewise, the results show the openness of teachers, students, and stakeholders (Baabdullah, 2024) to understanding the use and incorporation of AI in educational processes in general (teachers and students) (Alnasib, 2023) and their academic and professional activities. These findings extend the framework of the effects of AI for education proposed by Nguyen (2023) to reveal the advantages and disadvantages of its incorporation and provide clues for the effective incorporation of AI in HE.

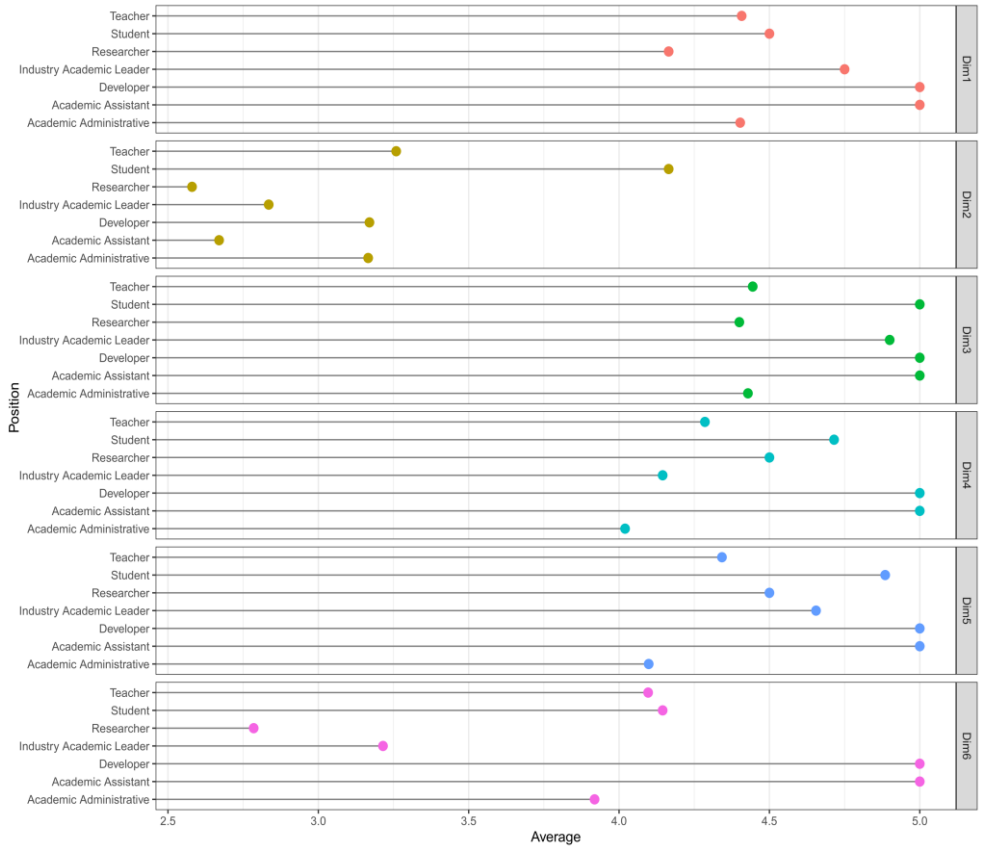


Figure 2. Perceptions on the use of AI. Dim1: perceived benefits of AI in HE, Dim2: perceived benefits of AI in teaching/learning, Dim 3: attitude toward AI, Dim 4: willingness to use AI, Dim5: behavioral intentions to use AI, Dim6: facilities and resources for AI use.

Although participants are open to using AI (Dim1), students perceived more benefits (Dim2). This could be related to innovations such as voice-activated digital assistants and AI-powered chat options that generate answers to academic questions and increase students' willingness to use them (Ahmed et al., 2022). The benefits are less clear for the rest of the participants. This may be related to the understanding of incorporating AI in education in a focused way, with adequate resources to facilitate the teaching (training). The perception of these participants also relates to the need for investment in resources that improve the quality of education (Dim6) (Nguyen, 2023). Additionally, it is necessary to build policies and ethical guidelines that guide its use throughout the educational community, particularly for students (Abdullah et al., 2023).

Statistical analysis cannot be performed to see the effect of the type of participant. In future work, survey validation will be applied in Spanish-speaking countries, and thus, the preparation of HE communities in Mexico and Latin America will be studied.

5. Conclusions

Through experiences such as this, where different generations come together to share their ideas, it is possible to normalize the use of AI in an intergenerational way. It is also possible to identify useful points of analysis by future studies with an interdisciplinary focus that develops joint efforts of institutions to 1) facilitate access, 2) accompany its responsible use, and 3) ensure AI use sustainability in institutions. As AI advances in technological growth and impacts different areas of HE, it becomes increasingly clear how to leverage it to improve the quality of education and the organizational structure of institutions to facilitate informed decisions about its application and its implications for the future.

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From Users to Allies: Exploring Educator and Generative AI Roles in Shaping the Future of Higher Education

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Abstract

This article articulates the nuanced challenges of integrating Generative AI (GenAI) into educational settings, aiming to dispel overly simplistic narratives driven by unwarranted enthusiasm or unfounded apprehensions. It introduces a conceptual framework for the application of GenAI within higher education, delineating four key strategies that leverage the dual roles of educators—as both creators and designers—while positioning GenAI as either a facilitative agent (creature) or a utilitarian tool. The identified strategies—Interactive Co-Creation, Adaptive Design, Learning Scaffold, and Efficient Structuring—underscore GenAI's potential to revolutionize teaching methodologies by enabling personalized education, enhancing content quality, and expediting course development processes. Emphasizing GenAI's capacity to cater to diverse student needs, simplify educational content creation, and foster engaging learning environments, the model provides educators with a roadmap for integrating GenAI into their instructional practices to harness the full potential of educational technology.

Keywords: *Generative AI; educator's role; instructional design.*

1. Introduction

Over the past decades, artificial intelligence has made significant progress, leading to revolutionary innovations and extensive use of technology. One key milestone in AI research and applications has been the introduction of generative AI models. While AI has been generally used for predictions, Generative AI (GenAI) has been designed to generate diverse and contextually relevant content based on large sets of training datasets (Walczak and Cellary, 2023). The most popular generative models consist of large language models (LLMs), and text-to-text, such as ChatGPT, CodeWhisperer, and Bard, which can be leveraged to discuss a topic in a human-like way and provide new ideas in real-time conversations (Qadir, 2023). Other generative models that offer content in different formats include text-to-image, such as Midjourney and DALL-E, and text-to-video, such as Wibbitz and InVideo.

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The use of GenAI in the education field deeply affects the curriculum design, the resource allocation as well as the teaching and learning methodologies. While fostering collaboration, engagement, and deep learning, it provides students personalized learning experiences, tailors instructional content to individual needs and helps prepare for their personal and professional challenges (Chan & Zhou, 2023). Because applications are boundless, this paper attempts to contribute to the extant literature by presenting a practical framework for the possible classification of GenAI for educational purposes. This may serve as a working guide for faculty designing and implementing their courses. Recognizing the benefits and the challenges of GenAI, we also highlight that integrating this technology must be accompanied by the right level of experimentation and willingness to address the open challenges.

2. Review of Student and Educators Uses of GenAI in Education

GenAI can be exploited by students in a variety of manners: to find learning materials, to translate content from one language to another, to brainstorm and receive support on a specific topic, to simulate the questions of a test, etc. Moreover, it can help them develop higher-order skills essential for learning and growth, such as critical thinking, problem-solving, creativity, and innovation (Qadir, 2023; Hartley, 2023). When carefully directed by instructors, students can use GenAI to enhance learning responsibly, for intelligent argumentation rather than for plagiarism, and accurately, verifying the information and its sources.

GenAI has many possible applications in teaching. First, by including instructional design software, learning management platforms, and interactive content creation, it can assist educators in learning design. One example is SlideSpeak, which seamlessly transforms text into structured presentations. Other tools can help define the learning objectives and plan the learning activities inside and outside the classroom. Second, GenAI may be useful to create and craft teaching materials by personalizing and adapting the content according to the target students, their educational level, and the learning objectives. AI-based tools foster interactive and immersive learning environments by suggesting relevant content and activities based on collaborative, hands-on experiences and realistic virtual simulations (Qadir, 2023). This can ultimately enhance students' engagement and retention, leading to more meaningful learning experiences, and promote 21st-century competencies . Third, GenAI can facilitate evaluation activities by detecting plagiarism (Lodge, 2023), ensuring more efficient and objective grading (Qadir, 2023), and providing tailored and immediate feedback to students' assignments, according to their individual needs and progress (Kadaruddin, 2023). Lastly, GenAI can instantaneously address structured problems and obtain specific information for various purposes and areas. This helps save instructors' time and increase their efficiency and learning.

3. A Theoretical Framework for GenAI Use in Higher Education

The paper presents a theoretical framework for possible uses of GenAI that can enhance education and improve the teaching-learning process, while recognizing that "*The ultimate goal of AI is not to create machines that are intelligent, but to create machines that make us more intelligent*." (Kurzweil, 2023). Existing frameworks related to the application of GenAI in education mostly adopt the students' perspective and generally consist of macro-categorizations of use cases and the collection of the learners' perceptions towards these tools. Bahja, Hammad & Hassouna (2019), Ilieva et al. (2023) as well as Chan & Zhou (2023) provide some examples. In this study, we suggest a framework that looks at how educators can use Generative AI (GenAI) based on their educational goals and the capabilities of this technology. We focus on the idea of "*roles*" in the learning process. We look at two main aspects: the role of the university professor and how GenAI can support them in their teaching..

3.1. The Roles of Educators

The role of a university educator encompasses a dual identity as both a designer and a creator, akin to the diverse roles observed in the field of instructional design. An educator, in the capacity of a *designer*, takes on the strategic planning of course structure, module development, and overall curriculum design. This involves assessing teaching methodologies, deciding the sequence of content delivery, and determining the teaching mode—whether it be in-person, remote, synchronous, or asynchronous.

On the other hand, the educator as a *creator* mirrors the contemporary concept of a "creator" on social media, reflecting a capacity to craft educational content in various formats such as text, slides, podcasts, and videos, as well as designing assessment tools like quizzes to evaluate student learning. In the realm of instructional design, educators who transition into this role draw on their pedagogical expertise to gather data on learning and teaching patterns, creating innovative educational materials. They work collaboratively with stakeholders to develop content tailored for a technologically adept student body, often in both public and private sectors, across a multitude of positions such as curriculum developers, online learning specialists, and technology integration specialists. This shift to instructional design is motivated by the desire to engage with educational content differently, often in a more traditional office setting or remotely, rather than in a classroom (Hung & Chen 2012, Bovill et al. 2016; Pollard & Kumar 2022).

3.2 The Roles of GenAI in Supporting Educators

In higher education, the integration of GenAI poses both opportunities and challenges that have different focuses depending on the metaphor that one chooses. It is worth noticing that one of the most up-to-date attempts to discuss this issue, as well as providing examples of application is the taxonomy proposed by Mollick & Mollick (2023). In their paper, they identify 7 types of use cases:

GenAI as a mentor, a tutor, a coach, a teammate, a student, a simulator, and - as a last item in the list - as a tool. We propose to simplify these roles into two: "human-like" roles played by GenAI as a "creator" or agent, or its role as a tool. This dichotomy reflects deeper questions about the nature of technology and its role in human society.

The "creature" metaphor associates GenAI with human-like qualities, focusing on cognitive capabilities and the potential for these technologies to influence human behavior and relationships. This perspective brings forth a set of philosophical, psychological, and sociological questions, emphasizing the need for a nuanced understanding of GenAI's implications on a human level. It suggests a concern for the ethical, social, and personal dimensions of integrating GenAI into daily life, including education.

Conversely, viewing GenAI as a "tool" shifts the discourse towards practical considerations, such as the reliability, functionality, and application contexts of these technologies. This approach encourages a focus on how GenAI can enhance educational practices, support learning outcomes, and integrate into existing pedagogical frameworks without losing sight of academic integrity and the fundamental values of education.

When crossing the two dimensions of analysis discussed above it is possible to end up with four different combinations (represented in a 2x2 table) that educators could adopt (Figure 1).

		role of GenAI (in supporting the educator)	
		Creature	**Tool**
role of the educator	**Creator**	Interactive Co-Creation	Content Amplification
	Designer	Adaptive Design	Resourceful Planning

Figure 1. Approaches for GenAI use in higher education.

For each approach, there are practical implications for teaching as described next.

*3.2.1. **Creator-Creature: Interactive Co-Creation** (collaboration between educators and GenAI allow tailoring and enhancing learning with a touch of personalization and creativity)*

In the Creator-Creature approach, educators leverage GenAI to enhance the creation and delivery of educational materials, (Motlagh et al., 2023; Dickey & Bejarano 2023, Walczak & Cellary 2023). This method involves GenAI assisting in the research of academic resources, crafting course contents including diverse media forms, and providing personalized, immediate feedback to students on their work. Mollick & Mollick (2023) emphasize the importance of tailored feedback, which supports effective learning. Kadaruddin (2023) highlights how GenAI-driven adaptive assessments cater to individual learning needs, especially for students with learning disabilities, by adjusting difficulty levels. Allowing the students to participate in co-creation would

also reduce test anxiety, marking a shift from traditional standardized tests to evaluations that respect each student's unique learning journey.

3.2.2. ***Creator-Tool: Content Amplification*** *(enhancement of content creation processes, making them more versatile and accessible across different formats and languages)*

In the Creator-Tool approach, educators utilize GenAI as a robust support mechanism for various tasks, such as summarizing information, translating educational content into multiple languages, and generating examinations and tests based on specific teaching materials (Motlagh et al., 2023). This method streamlines the content creation process, enabling educators to efficiently prepare diverse and comprehensive educational materials, including in-class exercises and quizzes, thereby enhancing the learning experience through tailored, accessible, and varied formats.

3.2.3. ***Designer-Creature: Adaptive Design*** *(a partnership for creating learning experiences that adapt to student needs and contexts in real-time)*

In the Designer-Creature approach, educators collaborate with GenAI to meticulously design educational experiences, emphasizing the creation of lesson plans, learning objectives (LOs), and interactive activities that cater to the specific needs and levels of students, while reaffirming the use of Bloom's taxonomy to ensure the learning objectives are effectively targeted (Dickey & Bejarano, 2023). Dickey et al. (2023) also illustrate how GenAI can be tasked to simulate a professional role within a specific educational context, thereby enriching lesson planning with realistic, professional insights. Furthermore, comprehensive course activity plans can be designed with precise time allocations to optimize learning outcomes. Kadaruddin (2023) underscores the importance of designing interactive and immersive learning experiences that not only enhance comprehension and critical thinking but also equip students with essential 21st-century skills. This method represents a strategic shift towards leveraging GenAI's capabilities to create more engaging, relevant, and personalized educational experiences.

3.2.4. ***Designer-Tool: Resourceful Planning*** *(GenAI used as a tool in resourcefully planning and optimizing educational materials and assessments)*

The Designer-Tool approach leverages GenAI to enhance the sourcing and personalization of educational materials, particularly underlining its utility in creating adaptive content for students with learning disabilities (Motlagh et al., 2023; Mollick & Mollick, 2023). This strategy enables the generation of learning materials that are not only flexible but also tailored to individual student needs, thereby fostering motivation, encouraging self-directed learning, and empowering students. Additionally, Motlagh et al., (2023) highlight the application of GenAI in assessment and evaluation processes, specifically through the use of GPT output for plagiarism detection, thereby streamlining and enhancing the integrity of educational evaluations.

4. Opportunities and Threats of GenAI

The integration of generative AI opens up paradigmatic shifts in pedagogical approaches. It contributes to creating dynamic, personalized, and inclusive systems that effectively prepare students to face a constantly changing world. Integrating these tools into instructional design can transform education by customizing virtual learning to the needs of individual students. Engaging learning experiences such as immersive activities, interactive quizzes, and GenAI-driven collaborative games can improve student retention and engagement (Qadir, 2023; Hartley, 2023). Moreover, chatbots using machine learning algorithms and AI improve access to personalized information. Greater efficiency can be achieved through the automation of exam grading, task assessment, and the generation of real-time feedback, without precluding the supervision by the teacher, who can supplement draft evaluations with targeted comments (Ruiz-Rojas et al., 2023).

However, challenges abound. ChatGPT and similar applications collect large amounts of data from chat logs, forums, and social media posts, including sensitive and personal data, without proper consent. This practice raises concerns about compliance with data protection regulations and ethics in handling student information (Ruiz-Rojas et al., 2023). For the same reason, the information generated by GenAI may result in biased or discriminatory outcomes, including gender, race, or social class biases. Another risk is the over-reliance on generative artificial intelligence. Despite the continuous progress of these tools in generating coherent and relevant content, they can still present difficulties in understanding complex contexts or interpreting abstract concepts (Ruiz-Rojas et al., 2023), thus compromising the accuracy and quality of responses or even resulting in nonsensical or false information (i.e., misinformation) (Qadir, 2023). Even more concerning, authorship issues and the difficulty of distinguishing if the content is generated by a human or a machine are widespread, both for students and teachers.

Finally, while AI-generated content is generally original and relevant to the topics and now contains appropriate references (Chan & Hu, 2023), it still lacks a personal perspective. With the advancement of technology, paradoxically, skills such as critical thinking, communication, and problem-solving have become increasingly essential to exploit these tools effectively. Table 1 summarizes sample opportunities and challenges of GenAI implementation.

5. Conclusions

Integrating generative AI tools within educational frameworks heralds the promise of revolutionizing pedagogical approaches, fostering dynamic and inclusive learning ecosystems equipped to navigate the challenges of a rapidly evolving educational landscape. However, this paradigm shift is accompanied by a host of multifaceted challenges that necessitate nuanced considerations and robust strategies for effective implementation. In light of these considerations, the integration of generative AI tools in education necessitates a balanced approach that

Table 1. Opportunities and Challenges of GenAI in Education

Opportunities	Challenges
1. Creation of virtual and collaborative learning experiences	1. **Data privacy concerns**: AI tools collect sensitive data without proper consent or attribution
2. Improved student engagement and retention through gaming and other detailed feedback	2. **Potential biases and discriminatory outcomes** in AI-generated content that is train from the same datasets and does not understand context
3. Personalized learning experiences	3. Risk of **over-reliance on AI** leading to inaccurate or nonsensical information (hallucinations)
4. Efficiency and time-saving for teachers by automating routine tasks	4. Difficulty in **attribution and authorship** determination
5. Promotion of inclusion and equity by enabling focus on individuals	5. **Lack of personal perspective** in AI-generated content leading to replication rather than new knowledge creation
6. Higher focus on critical thinking & problem-solving skills to add real value	6. **Addressing skills gaps** through training as users need to own the tools to use them appropriately

amalgamates technological advancements with pedagogical imperatives. This paper proposed a methodological framework that can be used as a guide when designing and developing GenAI supported learning experiences. Deciding what level of engagement with GenAI as a tool is suitable to accelerate and support learning, rather than replacing understanding and synthetic elaboration is one of the first tasks that educators could engage in when designing their courses. Finally, it is important to progressively adopt and evaluate the impact and effectiveness of these tools by collecting educators' and students' feedback to identify beneficial applications as well as areas of improvement. Collaboration and experimentation among educators, researchers, policymakers, and AI developers would also be crucial to refine and optimize the use of Generative AI in ways that respect intellectual property, reaffirm boundaries of meaningful and fair use, and define sustainable strategies for augmenting knowledge creation and innovation, rather than replication and standardization.

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Using Universal Design for Learning to Increase the Accessibilty of Tertiary Education

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Abstract
Most universities have support centers for students with disabilities, and the number of this population of students continues to grow. Although support centers provide students with necessary supports to be successful at university studies, they require students to self-disclose, which many are not willing to do. Universal Design for Learning (UDL) is a framework that enables instructors to plan their courses in a way that makes the material accessible to all students from the outset, without the need for modifications and acccommodations. UDL has traditionally been employed in primary and secondary school, but there is a growing body of evidence to support its use in tertiary education. This paper provides a definition of UDL, theoretical underpinnings, evidence to support its use in tertiary education, and implications for practice.

Keywords: *Universal Design for Learning; accessibilty; instructional principles*.

1. Introduction

Universal design began as an initiative in architecture, whereby environments were designed at the outset to be accessible to people of all ages and abilities, without the need for customisation or specialised design (Burgstahler, 2012). Based on this premise, Universal design for learning (UDL) emerged within the field of education. UDL is a framework that makes it possible for all learners, regardless of ability, to benefit from curriculum planning that caters for a wide variety of learners (UDL-IRN, 2011a). UDL-IRN (2011b) suggest that UDL places the student at the centre of instruction through a curriculum that is deliberately designed to reduce barriers to learning and to reach and accommodate all students before they experience academic or motivational failure.

CAST is recognised as the guiding UDL organisation and developed the UDL Guidelines, which are grounded in research on cognition and learning (Meyer, Rose, & Gordon, 2014). UDL is centred around three planning and instructional design principles that guide curriculum

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design with regards to providing content, activities, and pedagogy that address multiple means of representation, action and expression, and engagement (CAST, 2015). These three principles are further defined by 9 guidelines and 31 checkpoints derived from best practices in the literature (CAST, 2018). These can be applied in instrucrtional planning in various ways and at different levels.

Although UDL was initially designed and implemented in primary and secondary school classrooms, there has been a growing movement to employ its principles in the planning and delivery of university curricula. Employing UDL as a pedagogy for post-secondary education would make it possible for students to have full access to course content, despite disabilities or language barriers (Chodock & Dolinger, 2009). UDL was also seen as well-aligned to online course environments through the use of simple supports that ensure all students can access the course materials. Examples of these supports include: a welcome page including a brief video instructing learners on how to navigate the course, captions and transcripts for videos, and accessible documents able to be read by a screen reader (Singleton et al., 2019).

There has been an increasing number of students with disability attending university courses internationally (AIHW, 2017). Cunninghame et al. (2016) conducted a study on the current status and experiences of students with disabilities attending university and found that students with disabilities had a lower success and retention rates than their non-disabled peers. Cunninghame et al. (2016) also discovered that a major issue with the available support services for students with disabilities. Is that the onus is on the students to approach the service provider and disclose, and sometimes provide proof of, their disability. After receiving support, many times students must then continue to disclose their disability to the instructors of every course they enroll in, in order to receive any accommodations. Teaching staff were often unsure about how to provide adjustments, and raised concerns about course integrity in regards to providing adjustments. Lastly, there was an inconsistent approach across institutions regarding the provision of access plans and applying reasonable adjustments. One of Cunninghame et al.'s main recommendations was, "Pedagogical methods, materials and technology should (where possible) adhere to the principles of universal design, and further efforts should be made to provide a variety of options for engaging with learning content and spaces" (p.11).

2. Theoretical Underpinnings

When translated to the educational context, UDL conceptualises learners as diverse in their needs and challenges the view that students learn in some normative way, which education is often designed around (Myer et al., 2014). This conceptualisation is significant for tertiary education, as it emphasises that students having diverse learning needs is"normal," which is an inversion of the thinking behind providing students with accommodations (Singleton et al., 2019). Pproviding multiple means of engagement, representation, and expression in the

classroom normalizes the diverse needs of students rather than stigmatizing them. As a result, students of all abilities are provided with opportunities to engage in the classroom and have their diverse needs met (Singleton et al., 2019).

The theory and practice of UDL are supported by over 800 peer reviewed journal articles. One teaching theory supporting UDL is constructivism, as it considers the different ways that students construct knowledge (Burgstahler, 2011). UDL is based on cognitive neuroscience research, using what is known about the brain during learning to design environments to support all learners. Thus, the three principles of UDL are based on the neurological organisation of the brain (CAST, 2018). Providing multiple means of engagement is aligned with the affective neural networks, involving interest, effort and persistence, and self-regulation. The principle of representation is supported by the recognition neural networks, comprised of perception, language and symbols, and comprehension. The last principle, action and expression is aligned with the strategic neural networks and includes physical action, expression and communication and executive function. One of the key aims of UDL implementation is to support students' metacognition, so can become expert learners (Myer et al., 2014).

3. Evidence to Support the Use of UDL in Tertiary Education

UDL provides equal opportunity for all students to engage in the classroom, by allowing them to access knowledge and demonstrate their understanding flexibly. The literature supports the efficacy of UDL in the tertiary education context. Studies reported high student satisfaction with the implementation of UDL in higher. education (Ayala & Christie, 2011; Dean et al., 2017; Griful-Freixenet et al., 2017). When the satisfaction rates of students with disability and without disability were compared, both groups highly valued the UDL model (Ayala & Christie, 2011).

Students indicated that one of the main values of UDL was clarifying course content and increasing their feelings of engagement and capacity to participate in their learning (Ayala & Christie, 2011; Tzivinikou, 2014). Students were highly satisfied that UDL principles enabled them to demonstrate their understanding of course content in the ways they felt best suited their needs and capabilities (Anderson et al., 2018). Students also highlighted that UDL reduced their overall feelings of stress while completing their coursework (Rao, Edelen-Smith & Wailehua, 2015).

Students preferred teacher-generated content that was tailored to the course content, as opposed to third party materials (Dean et al., 2017). They also valued digital technologies such as software that enabled them to post to online learning environments with text, audio, and video (Rao & Tanners, 2011). The use of audio distribution in classrooms was found to create a calm and focussed learning environment (Flagg-Williams, 2016). Other instructor strategies that students valued included short weekly assessments (Rao &Tanners, 2011), as well as

community-forming exercises such as turn-taking in making class notes (Smith & Buchannan, 2012) and peer mentorship (Street et. al, 2012).

Although university instructors implementing UDL principles in their courses felt that UDL improved their teaching, teacher attitudes toward UDL were also a barrier (Ayala & Christie, 2011). Kennette and Wilson (2019) discovered that students perceived UDL elements to be more useful than did faculty members. This could be rectified through appropriate staff training and awareness in the advantages of (Black et al., 2015). Instructor concerns about UDL included the time required to prepare lessons and the impact it may have on student attendance (Bongey et al., 2010). Staff perceptions of the usefulness of UDL impacted the degree that it is implemented in the classroom (Kennette & Wilson, 2019). In summary, appropriate training and mentorship in the implementation of UDL is key to its efficacy.

It has been observed that despite this high satisfaction rate, it is difficult to materially prove UDL efficacy through improvement in student grades, particularly since UDL aims to achieve increased flexibility and engagement (Bongey et al., 2010). Smith and Buchannan (2012) did find that students performed better in assessments where students were given a choice, however further research is required to evaluate this aspect of UDL., however, grades may not be the best indicator of its efficacy. Other considerations for the implementation of UDL is that it does rely on student digital literacy and access to technology, which should be supported by the tertiary institution (Dukes III et al., 2009; He, 2014). Consideration should be given to how learning needs can be met without creating barriers for others (Griful-Freixenet et al., 2017). For example, Kennette and Wilson (2019) found that students did not perceive group work to be useful due to dysfunction, and Watt et al. (2014) raised concerns about the impact that the provision of lecture notes and recordings had on class attendance rates.

4. Conclusions/Implications for Practice

CAST (www.cast.org) guidelines organise the implementation of UDL according to three core principles: multiple means of engagement, multiple means of representation, and multiple means of expression. Burgstahler (2011) of the University of Washington's program, DO-IT has adapted this framework to provide a series of guidelines for tertiary instructors. The strategies recommended for instructors include:

- Presenting information in a variety of formats in a way that is clear, engaging and accessible
- Providing various means for students to communicate and input information
- Ensuring that physical actions are able to be carried out by as many students as possible
- Ensuring instructions are clear and are easy to understand

- Ensuring safety equipment and mechanisms are able to be used and understood by as many students as possible.
- Creating a class climate that values and respects diversity
- Maintaining regular interactions between students and instructors
- Providing specific feedback on a regular basis
- Assessing students by a variety of means
- Familiarising yourself with university policy and means of accommodating student needs

The literature supports the use of UDL in tertiary education, particularly from a student point of view. Both students with and without disabilities appreciated having choices, tailored material, increased engagement and heightened understanding of course content. High levels of student satisfaction make a convincing argument for the use of UDL when designing and delivering university courses. Unfortunately, although some university instructors felt that implementing UDL principles in their practice improved their teaching, instructor attitudes were cited as a barrier, and students felt that UDL incorporation was more useful than the faculty did. The fact that some of the research suggests that instructors without adequate training undervalued UDL principles and felt that students with accommodations had unfair advantages highlights the need for professional development in the area of UDL and supporting students who need accommodations. In addition to professional development, it would be beneficial for instructors to have access to UDL peer 'experts' who can mentor them as they apply what they learn to their practice. Online communities of UDL practice would be places that instructors could find and share resources, experiences, and expertise. The Universal Design for Learning Implementation and Research Network (UDL-IRN is a community of practice based in the US. The group is focused on supporting the use of UDL best practice, working on greater interdisciplinary understanding, and enabling collaboration among education stakeholders. The organisation's website contains resources, research and many opportunities for online and face to face collaboration through conferences, webinars, etc.

The majority of published research on UDL was conducted in the United States, so universities in other countries may need to contextualise findings about best practices to the their specific contexts. Online professional learning for UDL exists from CAST, different US state networks, and in Ireland, through the Association for Higher Education Access and Disability (AHEAD, n.d).

Over four decades of research on UDL and two focused specifically on UDL in higher education suggest that incorporating the principles is best practice for supporting all university students in

accessing the curricula. Incorporating UDL principles is the first step in supporting all students in doing this, including those with disabilities or those whose first language isn't English.

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Strategies for Inclusive Learning: A Marketing Faculty's Journey with Students with Intellectual and Developmental Disabilities

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Abstract

The Multidisciplinary Individual Study Program (MISP), initiated in 2021 at the University of Aveiro, provides inclusive opportunities for individuals with Intellectual and Developmental Disabilities (IDD) in Higher Education. Developed in collaboration with a Portuguese retail sector company, this program allows students with IDD to enhance scientific, pedagogical, personal, and social skills. Promotes unique educational experiences, combining formal education, personalized curricula, and real work internships. In this innovative project, stakeholders, including students, families, faculty, mentors, and business partner, play crucial roles in the success of the program. This article focuses on the teaching experience of two marketing teachers who had some of these students in their classes. It aims to explain the program characteristics and highlight the challenges, adopted strategies, and transformative impact on student development. The emphasis is placed on stressing the feasibility of inclusive higher education programs and providing suggestions and implications for fellow educators and institutions.

Keywords: *Teaching experiences; Intellectual and developmental disabilities; Inclusive education; Inclusion; higher education; marketing education.*

1. Introduction

The participation of individuals with Intellectual and Developmental Disabilities (IDD) in Higher Education undeniably contributes to their overall development, fostering the acquisition of relevant skills that will enhance their employability and social participation. The University of Aveiro (UA) implemented, in 2021, a pioneering program in Portugal called the Multidisciplinary Individual Study Program (MISP). Its main objective was to "provide meaningful (inclusive and supported) opportunities for social and personal development for individuals with intellectual and developmental disabilities in Higher Education, through

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participation in academic and social life within the University" (Jordán de Urríes et al., 2022, p. 63).

Based on scientific evidence that already documents both the advantages and skills, and the challenges that students with IDD can gain when fully included in regular educational environments (e.g. Corby et al., 2022; Grigal et al., 2019; Heras et al., 2021), and other international experiences (Machado et al., 2020), the program was developed in partnership with *Jerónimo Martins Group, S.A.* (a Portuguese business group in the food distribution and specialized retail sector).

This program allows individuals with IDD to develop scientific, pedagogical, personal, and social skills, as well as enhance their employability profiles. As UA students, they can not only attend classes but also participate in all institutional and academic initiatives and have access to internships in a real work environment. These students can choose from a range of available course units across various UA programs, enabling them to tailor their academic path. Integration is truly comprehensive and inclusive, as these students attend these curricular units alongside their university peers in regular classes (with no specific units designed for this purpose). Now in its third academic year, it is already possible to share the success of this innovative initiative and some related best practices.

The purpose of this paper is to share the pedagogical and teaching experience of two marketing teachers who willingly embraced this project by integrating students into the curricular units they teach. Faced with this proposal for inclusive education, there were several challenges in pedagogical practices when aiming to include all students in the teaching/learning process while simultaneously addressing the specific needs of students with IDD.

Hence, this paper will provide a more detailed explanation of the program and delineate the roles of each stakeholder involved. Subsequently, an exposition of the teaching experience will ensue, explaining challenges encountered, the roles assumed by teachers and regular students, employed strategies, and offering suggestions and implications for fellow educators and institutions.

2. The Multidisciplinary Individual Study Program (MISP)

As previously mentioned, this course was established in 2021 and resulted from the collective effort and involvement of various stakeholders and institutions. Its primary objectives, as outlined in the creation decree, were: "i) equipping individuals with Intellectual and Developmental Disabilities (IDD) with specific skills in selected scientific areas, as well as personal, social, and transversal competencies, by providing them with the opportunity to study in Higher Education alongside their peers; ii) fostering the development of skills necessary for individuals with IDD to enhance their employability profile and increase their civic

participation; and iii) promoting the mobilization of knowledge, capabilities, and attitudes relevant to the inclusion of individuals with IDD in the community" (Universidade de Aveiro, 2021).

The proposed course facilitated a unique combination of formal educational offerings from various university departments, allowing students to create a customized curriculum aligned with their personal, academic, and professional goals. Outside the classroom, students received mentoring and support in regular classes and participation in campus activities.

The course spans four semesters, during which students attend classes alongside their peers in regular environments. Additionally, it includes two internships in employment settings, at the end of the second and fourth semesters. Students are required to complete five course units per academic year, taking two or three units each semester, totalling 60 European credit transfer and accumulation system (ECTS).

In general, the course was designed with the characteristics outlined in Table 1.

Table 1. Summary of the main characteristics of the course.

Project	Multidisciplinary Individual Study Program
Curricular Program	10 optional curricular units for Higher Professional Courses and 1st cycle courses at the University of Aveiro (5 curricular units/academic year)
Legal Framework	Subparagraph e), point 3, Article 4, Decree-Law N.º 65/2018 of August 16, non-degree-granting course
Target Audience	People with Intellectual and/or Developmental Disabilities (IDD) holding a certificate of completion of compulsory education
Location	Course based at the Department of Education and Psychology, involving multiple Departments and Schools of the University of Aveiro
Duration and ECTS	Two academic years and 60 ECTS credits

Regarding the involved stakeholders, as depicted in Figure 1, there are numerous actors, each with a specific and crucial role well-defined, and extremely important for the success of the course.

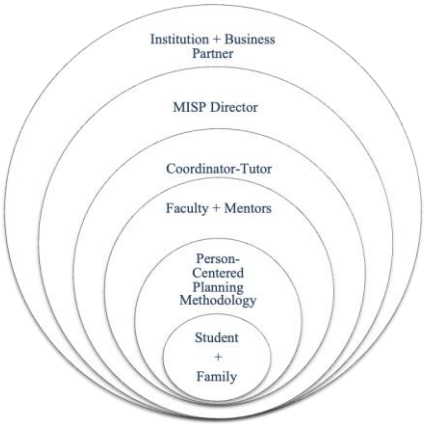


Figure 1. Stakeholders of the Multidisciplinary Individual Study Program (MISP).

Following this, we move on to the identification and brief explanation of each participant and their roles, delving into the specifics of how each individual contributes to the overall success of the course:

- Student and Family: The student serves as the focal point of the entire program and its offerings, with all decisions centered around them. The family plays a crucial role in providing support and coordinating with the university team.
- Person-Centered Planning: The individual at the core of the program makes decisions, with professionals supporting and facilitating access to information for informed choices.
- Faculty: Teachers play a key role in welcoming these students into their disciplines, promoting their inclusion, and establishing dynamics to help enhance their skills.
- Mentors: Each program student is paired with a regular student in each course, serving as a mentor who provides support inside and outside the classroom. This support is established at one hour per week and operates on a voluntary basis.
- Coordinator-Tutor: This figure is vital, providing support to program students, offering training to mentors, and serving as a liaison between all involved parties: students, families, teachers, and mentors.
- Course Director: Like any other university course, this program has a director who, in addition to coordinating scientific and pedagogical matters, bridges with other university bodies and partner institutions.
- Business Partner: Support is provided for maintaining the coordinator-tutor role, offering scholarships, facilitating curriculum internships, and participating in the project team and a course monitoring and evaluation committee.

– Institution: The university hosting the course ensures structures and support, as well as handling all formal aspects related to the general administration of the course and its implementation.

3. Teaching Experience

The teaching experience extends beyond a mere act of transmitting knowledge; it is a collaborative process fostering both academic and personal development. The role of a professor, particularly when working with students with IDD, has proven to be a distinctive and enriching journey.

Initially, all professors at UA were invited to participate by volunteering to host students with IDD. The challenge posed by the program management transcended mere experimental pedagogical practices; it entailed integrating one or more students with IDD into regular classes. In this case, it specifically involved teaching marketing curricular units (CUs) within the Marketing undergraduate degree and the CTeSP in Sales and Marketing Management. These included Marketing I, Merchandising and Point of Sale Management, and Sales and Marketing Project.

As students enrolled in our courses, questions arose: How can inclusive practices be developed? What methodologies can facilitate inclusion, participation, and learning for everyone? How can the other students be sensitized to differences? These inquiries were addressed with the support of the coordination team and relied heavily on a trial-and-error approach, constantly adapting to the specific needs of each student.

Building upon this principle and rejecting the utilization of specific teaching methodologies tailored solely for students with IDD, the initial step involved gaining a deeper understanding of what was presented to the professor and the profile of the student(s) attending the courses. In this regard, the significance of the coordinator tutor as a supportive element for both students and professors is underscored.

The next step involved sensitizing the classes beforehand about the existence of this program, its functioning, and the imperative to integrate students with IDD. This prior awareness-building proved indispensable and facilitated the preparedness for receiving students with IDD, fostering collaboration and respect for individual dignity. During this phase, students in the class were encouraged to assume the role of mentors. Each student on the course had at least two mentors for each semester, per course. Finding volunteers for this role was never an issue, as there were consistently students eager to contribute. The mentors' responsibilities included aiding in integration, clarifying doubts, and assisting with studies both inside and outside the classroom. The students' generosity pleasantly surprised us. Across all courses, there was a palpable willingness to support these students and collaborate on projects within and outside the

classroom. These mentors played a pivotal role throughout the process, ensuring not only complete integration but also offering study support and liaising with instructors regarding these students' challenges. This comprehensive support system was instrumental in the program's success. Inside the classroom, it is crucial to consider the specific challenges of each student with IDD and tailor methodologies and materials to meet these individual needs.

The pedagogical approach involved actively engaging students with IDD in all regular course activities, including participation in work groups, completion of in-class assignments, and involvement in extracurricular activities (e.g., projects, competitions, study visits, among others). Fostering collaborative learning among peers contributed to building trust, enhancing acceptance, fostering a sense of belonging to the community, and promoting the social skills of all students. In these activities, students with IDD had specific objectives tailored to their circumstances, while maintaining consistent expectations and rigor in treatment and assessment. This approach ensured they felt equally treated, mitigating discrimination and stigmatization. Naturally, individual assessments were customized to each student's limitations, and the assessment model was adjusted to accommodate the student's profile. This adaptation included changes to issues such as the response format—opting for true or false questions instead of open-ended ones—and, in another instance, allowing a student to answer questions electronically rather than manually. This flexibility in assessment was essential to accommodate diverse student profiles.

Throughout their education, students with IDD actively participated in various educational and recreational activities alongside their peers. This collaborative engagement contributed to the development of their personal, social, and professional competencies, fostering their socio-professional inclusion. It is crucial to emphasize once more the kindness of colleagues who welcomed these students, both inside and outside the classroom. Their support played a fundamental role in establishing inclusive environments and fostering a genuine educational community.

This teaching experience underscores the growing importance for professors to leverage empathy and prioritize interpersonal relationships, enabling a better understanding of the emotions, interests, and challenges faced by these students. Particularly, fostering motivation and facilitating learning and development requires professors to be attuned and available—a foundational aspect of the teaching role. Being prepared for teaching involves the ability to navigate the daily demands presented by a diverse student body at any educational level. Our teaching experience has been immensely enriched through collaboration with these students. It represents an ongoing journey; every challenge overcome, and every connection is a step towards a deeper comprehension of the authentic essence of inclusive education.

The outcome at the end of the semester’s conclusion goes beyond numerical assessments, highlighting the remarkable progress exhibited by students with IDD. It signifies more than

academic accomplishments—it serves as a testament to an educational community that acknowledges, values, and empowers each student, irrespective of existing barriers.

4. Conclusions and Future

The acquisition of marketing skills has proven particularly beneficial for individuals with IDD, enhancing their communication abilities, as highlighted by Heras et al. (2021). In our marketing classes, we prioritize communication skills and self-expression through presentations, case study discussions, pitches to external juries, and various pedagogical activities. Active participation of students with IDD in these activities promotes social interaction and inclusion across different classes.

These methodologies, inherent to marketing education, facilitate the enhancement of social skills in students with IDD, fostering relationships, friendships, and a sense of inclusion in diverse social contexts. Additionally, the mastery of personal skills acquired in marketing classes contributes to increased self-confidence and self-esteem among students with IDD.

These students actively contribute to effective teamwork, express their perspectives, and adapt to changing circumstances, preparing them for active roles in professional contexts. Skills such as expressing ideas, problem-solving, creativity, and resilience, stimulated by marketing education, enable their integration into the labour market, aligning with the findings of Grigal et al. (2019) and Papay et al. (2018). Beyond technical skills, students gain insights into market dynamics, relationships between economic agents, consumer literacy, and civic and citizenship skills, promoting active social participation.

Despite facing challenges, the teaching experience based on this innovative project in Portugal offers valuable insights. Recommendations include broader program communication to standardize the presence of these students in higher education, in line with Corby et al. (2022). Professors should be familiar with student profiles in advance, facilitating better course preparation and adapting materials, assessments, and necessary support. Effectively promoting inclusive education requires sensitizing professors to inclusive pedagogy, emphasizing the human and relational dimensions of teaching and learning. Collaborative efforts among educational institutions, professors, and students are essential for successful inclusive practices.

Despite challenges, the observed evolution and changes in students—emotionally, socially, and intellectually—within their limitations demonstrate the empowering impact of this experience on individuals with IDD, fostering their integration into the community and the labour market.

The success achieved in this first edition underscores the possibility of making higher education more inclusive and democratized, aligning with the findings of Rodríguez Herrero et al. (2020). The experience not only enriches students with IDD but also provides an opportunity for

professors and students to engage in a project that transforms mentalities and enhances ethical and human dimensions.

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At Least a Rainbow Flag: Queer Students' Perceptions of University Responses to Queerphobic Terrorist Attack

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Abstract

This paper explores how queer students perceived the higher education institutions' responses to a deadly queerphobic terrorist attack which took place on October 12, 2022 in Bratislava, Slovakia. Drawing on data collected after the attack from 34 college students from Slovakia, the study employs thematic analysis to uncover key themes. Symbolic gestures, such as displaying the pride flag, were described by participants as important steps toward inclusion, but the study reveals the need for institutions to move beyond symbolism. The participants emphasize the importance of inclusive policies, training programs, counseling resources, and real systemic changes to create truly safe and inclusive spaces. The paper underscores concerns about institutional reluctance to implement such measures, despite research supporting their positive effects.

Keywords: *LGBTI+ inclusion; diversity and inclusion in higher education; institutional response to terrorism.*

1. Introduction

To promote and support student health and wellbeing, including academic success, it is critical that colleges create safe and inclusive spaces for all students, especially the LGBTI+ minority (Rankin et al., 2010). Both overt and subtle forms of discrimination on campus result in student's worse mental health (Woodford et al., 2014; Amodeo et al., 2020). Positive perceptions and institutional response perceptions significantly influence LGBTI+ student's likelihood of remaining at an educational institution, their academic success (Garvey et al., 2018) and even rates of experiencing sexual assault victimization (Coulter & Rankin, 2020).

In this paper, we examine how LGBTI+ students perceive higher education institutions' responses to a deadly terrorist attack targeting their community. Focusing on LGBTI+ students' perceptions allows us to explore their unique experiences of marginalization, particularly concerning physical violence. Our analysis reveals that symbolic gestures, like displaying the

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rainbow pride flag, significantly influence students' sense of inclusion after such attacks. However, both participant feedback and existing research underscore the need for institutions to move beyond symbolic gestures and adopt inclusive policies, training, and counseling to support the LGBTI+ community effectively.

2. LGBTI+ Issues in Slovakia

Slovakia has legal protections against discrimination based on sexual orientation and gender in employment, commerce, healthcare, and education. However, tolerance towards LGBTI+ individuals in Slovakia is among the lowest in the European Union (European Commission, 2019, Poushter & Kent, 2020). The experiences and attitudes of LGBTI+ people in Slovakia were surveyed in a 2017 online survey (Kuruc & Jablonická Zezulová, 2017). More than half of the respondents reported having experienced harassment, violence, or verbal assault related to their LGBTI+ identity with 16 % of the victims having experienced physical violence. Another online survey (FRA, 2020) found that 1 in 10 surveyed LGBQ individuals in Slovakia experienced an attack within the last 5 years. Victims rarely report such incidents to the relevant institutions such as the police, employers or school. Despite the well-documented negative effects of intolerant climate in education (Woodford et al., 2014), educational institutions may be amongst the least safe spaces for Slovak LGBTI+ individuals with a significant portion of the discrimination perpetrated by teachers or staff at schools. Schools are also some of the most likely places where harassment, violence, and verbal assault is experienced by Slovak LGBTI+ individuals (Kuruc & Jablonická Zezulová, 2017).

2.1. October 12 Terrorist Attack

On the evening of October 12, 2022 a 19-year-old man shot three people with a handgun in front of *Tepláreň*, an openly queer bar. Two members of the LGBTI+ community, one of them a student of the Faculty of Arts of the Comenius University, succumbed to their wounds. The third wounded person survived. The assailant committed suicide few hours after the attack. Before the attack, the assailant posted a 65-page manifesto on Twitter, outlining ideological reasons for the attack, including antisemitic, homophobic and transphobic conspiracy theories. The manifesto and online comments indicated that he adhered to a militant white supremacist accelerationist ideology. His actions were influenced in part by the acts of past far-right shooters, far-right social media platforms, and the rise of far-right populism (Basha, 2022).

The attack was condemned by political figures and government institutions in Slovakia. Some institutions included displays of LGBTI+ symbols. A bill establishing same-sex partnerships was proposed in the Slovak parliament, but it failed to pass the initial vote. The criminal investigation of the attack was closed in 2024, classifying the act as a terrorist attack. The police opened several cases against individuals publicly supporting the attack.

3. Methodology

The goal of our case study was to investigate how LGBTI+ students reflect on the responses of their universities after the terrorist attack. We were interested in how their school responded to this event, how they perceived the response, and what response would they consider appropriate. In the study, we chose a qualitative approach. Data collection took place in the form of a questionnaire consisting of open questions. The questionnaire was anonymous, participants could indicate their gender and preferred pseudonym, which we use when referring to them throughout the paper. To obtain the research set, we used a deliberate selection. The student LGBTI+ club Light* and other individuals helped us distribute the questionnaire. In total, our sample of participants consisted of 34 people. We analyze the data obtained through thematic analysis (Braun & Clarke, 2006). We used MaxQDA for data analysis. First, we coded the entire set of data, while using an inductive approach - we did not start from predetermined codes, but we identified meaningful segments that the participants pointed to in their answers and subsequently assigned codes. Based on the iteratively obtained resulting codes, we searched for common themes that these codes pointed to.

4. Results

Based on the data analysis, we identified five topics, which we present in this section.

4.1. Official Statements

Most of the colleges the participants studied at have commented on the terrorist attack. These statements often contained a condemnation of this attack, which several participants perceived as the bare minimum. Participants evaluated more positively if, in addition to condemning the attack, the school also expressed solidarity towards and support for its LGBTI+ students. Some of them also appreciated the support they received from teachers. Matthew said: *"An official statement was issued condemning the attack and a number of lecturers stressed in class that LGBTI people can feel safe on campus and offered us space to talk face-to-face if needed."* and further stated that this reaction of his school has significantly helped. On the contrary, the participants perceived it as insufficient if the school only condemned the attack, but did not specifically express support for LGBTI+ people in any way. Alex described: *"Of course the school condemned the attack. At the same time, however, the faculty management actively prevented various forms of expression of solidarity with the LGBT+ community. I'm not sure if it was due to personal opinions or just trying to "get along with everyone" and maintain the status quo, but solidarity actions and statements at any higher level were (to the best of my knowledge) rejected without exception."* Like other participants who reported the same experience, Alex also felt hurt by this attitude.

Several participants also considered it important that the school, in connection with the attacks, directly condemned queerphobic violence. Contrary to this, some of them had the experience that their school did not mention the affected community at all in its statement. Teo stated: *"...the rector wrote a status condemning this attack. However, in his statement, like many politicians, he avoided naming the community against which this attack was directed"*. Adam had a similar experience when his school responded only after he publicly called for a response. Following his call, *"they subsequently wrote that they condemn various forms of discrimination, without mentioning Queer people"*. However, several participants also had a positive experience. For example, Bea stated that her school: *"Condemned any violence against LGBTI+ [people]"*. This reaction made her feel grateful.

Several participants noted that their school did not react at all or at least they were unaware of any reaction. They mostly took this lack of response quite hard. They were disappointed with their school and felt that it was not interested in them and that they were left alone. Judita described her experience with the words: *"It was terrible, lack of interest and ignorance of the tragedy. The absence of any reaction really shocked me."* It was especially devastating to the students if their school had previously expressed deep condolences for another recent tragic event, and at the same time, did not reflect on the terrorist attack on Tepláreň at all or addressed it to a much lesser extent. Lea attributed her school's lack of response to the fact that it was a religious school. Nevertheless, she was disappointed by the lack of response: *"Even though the school is a christian school, they should have expressed their condolences for this tragedy as part of solidarity. Don't keep quiet."* It confirmed her opinion that *"Dogmatic Christians do not see a problem in such situations because it does not affect them. They are not willing to express even words of sympathy."*

4.2. Raising the Pride Flag

The participants also considered the display of the rainbow pride flag to be one of the important expressions of support and belonging. Similar to the condemnation of the attack, some participants even saw this act as the least their school could do. We can find such an attitude in the words of Emil, who said about the reaction of his faculty that it was *"zero, they simply refused to at least raise a rainbow flag to show solidarity."* Similarly, Momo opined that the university should have responded to the attack by *"hanging a rainbow flag on the main building, for starters."* His experience was that the university did not hang the pride flag at all, and the faculty also did not manage to do it in a completely exemplary way: *"I remember that a rainbow flag hung at our faculty for a few days. Upside down, but the gesture probably counts..."*

4.3. Provision of Counseling

Several participants perceived that their school should have provided counseling to its LGBTI+ students after the attack. However, based on participants' responses, this was often not the case.

In the data, we found a direct link to only one university that provided counseling to its LGBTI+ students directly after the attack. The students also perceived a lack of general LGBTI+ friendly counseling services provided by their schools.

4.4. Education on the LGBTI+ Issues - Lectures, Discussions, Training

Several participants expressed the opinion that the attack should have encouraged universities or individual faculties to organize lectures, discussions, and training on topics related to the LGBTI+ community and thus help eliminate the fear of the unknown. Based on the participants' statements, we conclude that, in this regard, too, most faculties failed to step up. Only Tereza mentioned that her school started organizing supplementary education on the topics of queer students and pupils. She evaluated the experience positively: *"I am very grateful for this training, it also seems to me to be a good tool for connecting the queer community at the faculty."* Lea mentioned her experience, which, however, distressed her at the time: *"One professor discussed [the attack] in lecture from the aspect of terrorism. I left the lecture, since it was fresh after this event and it didn't feel good to listen to it."*

Several participants pointed out that although their school responded to the attack quite well, some teachers made inappropriate remarks. Mish felt that further training of staff could improve the situation. She evaluated: *"Perhaps it would not be a bad idea to organize training for teachers on sensitive expression and handling of similar topics."* The same opinion was reached by Lu, who stated that *"inclusive education courses should be made mandatory for people who teach."*

4.5 Steps Towards Real Change

Several participants expressed their conviction that the attack should have motivated their school not only to words and gestures of solidarity, but also to take steps that would lead to real change. Among the expected changes were the use of preferred pronouns and names in student documents, inclusive allocation of dormitories, introduction of inclusive bathrooms, improvement of the process of reporting discriminatory incidents and, last but not least, stronger action against queerphobic expressions and attitudes of teachers. Most of these participants reflected that no real changes had taken place and if the university did promise something, *"mostly it was just empty promises"* (Emil). Even Momo, who was actively involved in challenging his university with specific proposals, eventually got the feeling that it was a futile struggle: *"We had the opportunity to discuss [these issues] with the university management. Some of the demands were completely rejected, others were promised to us, but until this day these promises have not been fulfilled. It was from this meeting that I left even more devastated than when I came there. This fight stopped making sense to me at that point", further adding, "The university should be proactive in this regard. We, as a student body, should not go to the leadership and beg for basic respect. For a little inclusivity. I'm sorry, it annoys me. I believe*

that the university could have done so much more. It still could. Even though we offered them specific options for change for the better at a meeting, nothing happened. It terrifies me." Simona also expressed a similar opinion that the school should be more active and take more real steps. In contrast to Momo, she perceived that certain changes are taking place at her school, which she evaluated positively: *"Changes that are gradually made and implemented are important and valued"*, but at the same time she perceived that these changes are happening slowly and the school should have made a more radical shift: *"Listening to excuses like "give us time, we have to get used to it" should have long since passed, because this is how society has been talking since time immemorial, and I don't know how many people still have to die for the majority society to understand."*

In the data, we found only one mention of satisfaction with real changes. In this case, however, the change did not come from the school management, but from the teachers: *"I now perceive a very specific environment through the teachers who appealed to create better conditions for LGBTI people in society, talked to the student body and returned to the topic as positive. I think something has moved forward."* (Matthew)

5. Discussion

Our analysis shows that in response to queerphobic terrorism symbolic gestures such as displays of the pride flag or inclusion of LGBTI+ community within official statements were perceived by queer students as meaningful steps towards inclusion. Yet, many colleges failed to provide any response, while in some cases the public debates sparked by the attack were commented on by queerphobic teachers, exacerbating queer students' feelings of exclusion.

Symbolic gestures, such as raising LGBTQ+ flag, can be seen as merely performative (Kultaca & Radke, 2022), especially when they are not followed by more significant steps towards social change. The responses of our participants, as well as previous research indicate that in order to increase perceptions of inclusion for LGBTI+ students, higher education institutions need to go beyond such symbolic gestures and create truly safe and inclusive spaces (Rankin et al., 2010) via inclusive policies (Garvey et al., 2017, Pitcher et al., 2018), LGBTI+ training and resource centers (Garvey et al., 2017, Gilbert et al., 2021). Even small steps can have positive effects on student wellbeing by validating their experiences and increasing their sense of belonging, and signaling inclusive values outwards may have an effect on public opinion by raising awareness. However, such efforts are futile if they're not followed by actionable steps that signal institutional commitment to bringing about social change.

The participants often expressed their concern that the management of their schools fails to implement such policies due to fear of backlash or other negative effects. These apprehensions are not supported by research which shows that such policies have only positive effects (Black et al., 2014) and that college experiences involving interaction with LGBTI+ individuals

(Sevecke et al., 2015; Barbir et al., 2017), *"safe zone"* symbols (Katz et al., 2016) and coursework focusing on related issues (Rogers et al., 2009) contribute to expanded knowledge, reduced stereotypes, and increased acceptance of diversity, particularly in relation to LGBTI+ matters among all students.

It is important to note that our data was collected several months after the attack, which could have been reflected in participants' accounts. Their reflections in retrospect, after little to no changes were made, may have been more shaped by disappointment, especially if the overall climate immediately after the attack was hopeful. Future research should focus on how different institutional gestures and actions are perceived by their students in more detail, and what effect they have on feelings of inclusion and wellbeing.

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An Approach to the reality of Health, Safety, and Risk Prevention Training of future Early Childhood Education Teachers as Undergraduates at University Faculties of Education in Spain, as well as their perceptions on the subject. Part 2

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Abstract

It has been observed that there may be a gap in the training of future school teachers in Spanish universities, which could potentially impact their ability to meet established European standards in promoting a culture of health and safety protection in societies. The aim of this study is to examine the perceptions of students enrolled in the Early Childhood Education degree (ECED) at Zaragoza University (UNIZAR) regarding the importance of the health-safety-risk prevention training during their undergraduate studies. Furthermore, to evaluate their satisfaction with the training received. To achieve this, an ad-hoc questionnaire was developed, validated and administered to all students who took the last ECED course at UNIZAR. 97.9% agreed that acquiring competencies in health-safety-risk prevention was important to them; 97.2% that the training received as undergraduates was insufficient. Students recognized the significance of acquiring basic competencies in health-safety-risk prevention and identify specific areas where further training is required.

Keywords: *education; training; early childhood education; health, safety, risk prevention.*

1. Introduction

The safeguarding of individuals' health and safety, both within and beyond the workplace, is a fundamental aspect of the policies of the most advanced nations. Consequently, in the European Community, the inclusion of health and safety education in training programs at all educational levels is considered a crucial requirement (Commission of the European Communities, 2007).

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In 2013, EU-OSHA (European Agency for Safety and Health at Work) published a report titled "Safety and Health at Work and Education". A "Whole-School Approach" on OSH (Occupational Health and Healthy) was proposed based on the integration of risk education and safety and health management throughout the school's activities as part of school life. Also actively involve staff and pupils in school safety management and improve both risk education and environmental training for staff and pupils.

The purpose of this approach is to promote the role of education in shaping citizens' understanding of health throughout their adult lives. As such, it was recommended that young children starting in nursery and kindergarten be progressively taught about general health concepts, safety, well-being, and social aspects, including work. Furthermore, it stated that the education of adolescents and young adults (vocational training, higher education) should focus on the gradual acquisition of social and professional competences that promote the concept of health, safety, and well-being at work and in life in general (Burgos, 2013; Burgos, 2014; Instituto Nacional de Seguridad y Salud en el Trabajo, 2018).

Teachers are seen as key actors in promoting and consolidating a culture of health and safety protection, which is seen as essential for achieving adequate social and economic development (Instituto Nacional de Seguridad y Salud en el Trabajo (INSST), 2018).

This is due to their fundamental role in education during the basic stages of life. Nevertheless, despite recent efforts in the Faculties of Education of the Spanish Universities still fall short of the established ideal in this respect. One highlighted deficit is the lack of basic health and safety training for teachers (Pisaniello et al., 2013; Caldas, 2018).

To improve this situation, it has been proposed to provide basic training in health, safety, and risk prevention for students in the Faculties of Education (Caldas, 2018). This would enable educators to contribute more effectively to their own well-being and to the health and risk prevention education of their students adapted to each level of education. Therefore, it is recommended that early childhood school teacher training includes very basic health and safety and risk-prevention skills (Instituto Español de Seguridad y Salud en el Trabajo (INSST), 2023).

It will enable teachers to promote essential learning for their pupils and contribute to the development of a culture of prevention. Additionally, to promote their own well-being as teachers at schools.

2. Objective

This study is part of a larger project that aims to comprehensively assess the state of health, safety, and risk prevention training in the Early Childhood Education (ECE) Teaching degree across the Faculties of Education of public Universities in Spain.

The current survey is aimed to examine whether students enrolled in the ECE program at the University of Zaragoza consider health, safety, and risk prevention training during their undergraduate studies to be important for their future careers as teachers. Additionally, to determine whether the training received on this subject is perceived as sufficient for their prospective role and functions as ECE school teachers.

3. Material and Methods

To accomplish this objective, a two-phase quantitative study was conducted:

3.1. Phase 1

The study developed and validated an ad hoc questionnaire to gather data from final-year Early Childhood Education (ECE) students at the Faculty of Education, University of Zaragoza. The questionnaire was devised following a review of modification requests for verification reports of Bachelor's Degrees in ECE and Primary Education, forming the initial phase of the research. A qualitative approach was employed, involving collaboration with two expert groups: professional teachers in ECE and Primary Education (n: 6-10), and occupational health and safety experts (n: 6-10). Feedback from both groups was collected to refine the questionnaire, resulting in a unified version incorporating all suggested improvements. This iterative process led to the development of a validated questionnaire, detailed further in the subsequent sections.

Between September and December 2020, a pilot study was conducted to validate questionnaires for final-year Bachelor's Degrees in Early Childhood Education and Primary Education students at the University of Zaragoza. The study utilized Survey Monkey for online administration, with 101 participants. Optimal scaling analysis using CATPCA was employed to validate the questionnaires, resulting in four factors. These factors included perceived training needs, risk prevention training sufficiency, and the relative importance of risks for students. Cronbach's Alpha coefficients indicated good internal consistency for the first two factors and acceptable consistency for the third and fourth factors.

3.2. Phase 2

We obtained data related to the research objectives by administering an ad hoc questionnaire to all final-year university students in the ECE Teaching degree program at the Faculty of Education, University of Zaragoza (academic course 2020-21). The administration was carried out via email before the end of the academic year, under the supervision and approval of the *University's Data Protection Service*, following the established official procedure. The questionnaire was completed by final-year ECE Teaching degree students (n=96) at the Faculty of Education of the University of Zaragoza, representing 80% of the total enrolled students in this course.

Table 1. ***Dependent variables of the questionnaire.***

Question	Dependent variables
Q1	University
Q2	Age
Q3	Gender
Q4	Degree specialization
Q5, Q6, Q7	Previous academic background
Q8, Q9, Q10	Work experience
Q13	Having taken a subject related to health
Q14	This subject (P13) was aimed at training future students in health.
Q15	This subject (P13) was aimed at training future students in safety.
Q16	This subject (P13) was aimed at training future students in risks and their prevention.
Q17	This subject (P13) was aimed at training future students in teacher well-being.
Q18	This subject (P13) was mandatory/optional.
Q19	Name of the subject (P13)
Q21	Training received on the "prevention culture"
Q22	Training received on the importance of establishing a "prevention culture"
Q23	Training/information received during the degree to establish the prevention culture.
Q24	Training/information received about freely available teaching materials to educate future students about health, safety, and risk prevention.
Q27	Training/information received on the "Whole School Approach"

Table 2. ***Independent variables of the questionnaire.***

Question	Independent variables
Q11	Basic training in the degree program on health, safety, and risk prevention
Q12	Assessment of common risks faced by education professionals
Q20	Importance of incorporating basic content on health, safety, and risk prevention in early Childhood Education
Q25	Agreement with the recommendation for progressive education on health, safety, and risk prevention in schools
Q26	Importance of providing future teachers with basic training in their degree studies on how to educate their students in school regarding health, safety, and risk prevention.
Q28	Ranking of the importance of different health, safety, and risk prevention content in the education of early childhood students
Q29	Perception of having received sufficient training on risks during the Early Childhood Education Teaching degree
Q30	Information or training received during the Early Childhood Education Teaching degree on health, safety, and risk prevention

4. Results and Discussion

99% of the total sample were female. Furthermore, of the total number of students who responded to the questionnaire, 84.4% were between 20 and 25 years old and the rest >26.

40.6% had previous academic training, be it another university degree, an intermediate degree, a higher degree or other. Within this group, 66.7% had received training in safety and risk prevention. This means that 25.99% of the total sample had received safety and risk prevention training in their previous studies.

61.5% were working or were working at the time of the questionnaire, with 59.3% working in education and 15.3% in hotels and restaurants.

Table 3. ***Employment sectors in which fourth-year ECE Teaching students at the University of Zaragoza have worked or were working in the 2020/2021 academic year.***

Sector	N	%
Education or education-related	35	59,3
Hospitality	9	15,3
Public-facing jobs	8	13,6
Health or care work	4	6,8
Other	3	5,1
Total	**59**	**100,0**

Of this group of students who had worked or were working, 36% said they had received safety and risk prevention training in their job. However, of the total sample, 21.25% said that they had received safety and risk prevention training in a job that they had done or were doing at the time of responding to the survey.

4.1. Cultural Preventive Training

4.1.1. Prevention culture

62.5% of the surveyed individuals reported not having received any information or training on the need to establish a 'prevention culture' in our society. Additionally, 66.7% stated that they had not received any information or training on the need to establish a 'prevention culture' in schools from the early stages of education. 69.8% reported not having received any information on these recommendations during their ECE Teaching degree training.

4.1.2. Whole school approach

92.7% stated that they had not received any information or training on the school as an integral prevention element or 'whole school approach' (European Agency for Safety and Health at Work, 2013) during the degree.

4.1.3. Assessment of a number of common risks faced by teachers

54.2% gave the highest priority to risks related to psychosocial factors and stress (burnout, harassment, organisation and complexity of work, etc.) whereas 7.7% gave the highest value to the risk of voice problems: dysphonia.

It is interesting because of the mismatch between their assessment and the reality of the prevalence and frequency of these health problems among teachers, given that in Spain *the voice disorder* or *dysphonia* is the most common occupational disease in teachers (Moreno-Chaparro, 2023).

4.2. Formation of Students at School

4.2.1. Evaluation of different contents related to safety, health and risk prevention in the education of pupils in early childhood education

96.9% agreed with the recommendation for progressive training of pupils at school.

In terms of the value given by the respondents to the items that should be taught in early childhood education, the least valued content was 'Drugs' (72.9% of the respondents gave the lowest importance to this content), which also coincides with the least valued item by the sample when it comes to including it in the training of early childhood educators, “Substance or drug use” (60.5% believe that content on substance or drug use should be included in the ECE Teaching deegre.) The same is true for "Risks associated with the use of computer screens and new technologies". These values may be due to the fact that future teachers do not consider these risks to affect pupils in early childhood education.

4.3. Training future teachers in Early Childhood Education

4.3.1. Undergraduate training

69.8% stated that they had received training in a health-related subject or area during their ECE Teaching degree studies, 98.5% of which was a compulsory subject. Of this group, 83.6% said that this subject or course was intended to prepare them to contribute to the training of their students in health issues.

In relation to the health, safety and risk prevention, 92.7% of respondents felt that they had not received “sufficient” information and/or training on these items during their ECE Teaching degree.

The content in which they have received the most training ("basic hygiene and nutrition habits", 88,5%) coincides with the most valued content in the list of items.

4.3.2. Importance of basic health, safety and risk prevention training during undergraduate studies

97.9% considered important that future teachers receive basic training during their undergraduate studies in how to train pupils at school in health, safety and risk prevention.

99% agreed or strongly agreed that the ECE Teaching degree should include basic training on how to protect themselves against the risks normally associated with teaching, to know the typical and common risks in their profession, and to know questions of interest relating to accidents at work and occupational diseases.

5. Conclusions

The quantitative study carried out has allowed us to verify that among the students of the University of Zaragoza ECE Teaching degree:

- 97.9% considered important for future teachers to receive basic training during their studies on how to train pupils at school in health, safety and risks prevention.
- 96.9% agreed with the recommendation for progressive training of school pupils in health, safety and risk prevention (basic training).
- 99% thought that basic training should be provided at MEI level on how to protect themselves as teachers against the various risks to which they are exposed in their work.
- 92.7% stated that they had not received any training or information on the "whole school approach" and 62.5% denied having received any training or information on the "culture of prevention".

With regard to the assessment of the importance of the different health, safety and risk prevention items they were asked about:

The respondants may have had a more favourable rating and given a higher degree of importance for the risks that they reported having received training on.

The results show that there is a lack of training in health, safety and risk prevention and in the well-being of teachers.

It should be considered to establish a common curriculum for all ECE Teaching levels in order to ensure a minimum and compulsory basic training in health, safety and risk prevention and in the protection of the health or well-being of early childhood education teachers, as it has been proposed (European Commission, 2021) (Instituto Nacional de Seguridad y Salud en el Trabajo -INSST, 2023).

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Using UX Design in inclusive teacher education in higher education to bridge the research-to-practice gap

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Abstract

Teachers in inclusive classrooms do not use the results of scientific research on evidence-based practices; this gap between research and practice can be seen as a result of theoretical content in teacher education and should be reduced. UX design is an approach from Computer Sciences to build a bridge from providers to users. The following study looks for ways to bridge the theory-practice gap with the help of the UX design approach in inclusive teacher education. Therefore, the use of UX design was implemented in a course for student teachers for inclusive education. The results on three levels - technical improvement of the whiteboard, students' experiences and the seminar method - showed positive results and revealed the potential of UX design methods in inclusive teacher education, which should be explored in further studies.

Keywords: *teacher education; UX Design; experiential learning, whiteboard.*

1. Introduction

In the context of teacher education for inclusive education (Ainscow, 1997) there is an ongoing concern about the research-to-practice gap (Bondy & Brownell, 2004; Lancaster & Bain, 2019; McLeskey, Billingsley, & Ziegler, 2018): The results of scientific research on evidence-based practices are not used in inclusive classrooms. This leads to inadequate results of inclusive support and negative effects on teachers' attitudes and self-efficacy.

A potential factor for this lack of implementation is the complexity of the processes of implementation (Cook & Odom, 2013). Another factor could be teacher education itself, which makes the transfer from knowledge to action difficult (Parrilla, 1999), the so-called research-to-practice gap in teacher education (McLeskey et al., 2018). The oftenseen emphasis on theory-guided acquisition and reflexivity results in distance from practical tasks of teachers, which leads to the demand of fundamental changes in teacher education: "These changes require that teacher preparation programs move away from specifying knowledge related to instruction (i.e.,

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learning about teaching), and move toward the identification of a set of complex practices that become the core curriculum of teacher preparation" (McLeskey et al., 2018, p. 6). Hence, teacher education at universities requires innovative approaches and practical experiences in teaching to bridge this research-to-practice gap.

2. User Experience Design – an interdisciplinary method in Higher Education

2.1. Computer Sciences

Computer Sciences have to transform sound (digital) concepts into practical applications. Human-Computer-Interaction (HCI) students have to learn how to survey user experience (UX): "The field of HCI focuses on the design, implementation, evaluation of interaction systems that support human activity … and thus it trains students on a wide range of UX topics, from accessibility to user-centered design and software development" (Kang et al. 2022, p. 1). Guo (2021, p.46f) summarizes the term UX following ISO 9241-210 (cf. International Organization for Standardization, 2009), that may be defined as "user's perceptions and responses that result from the use and/ or anticipated use of a system, product, or service", including "emotions, beliefs, preferences, perceptions, comfort, behavior and accomplishments that occur before, during, and after use" (Guo, 2021, p.46). UX refers to all aspects of a person´s experience – emotion, behavior, and cognition – while interacting with computing systems (e.g. Hassenzahl, & Tractinsky, 2006). User Experience is measured with various methods (UX tools), also methods and strategies of "Experiential Learning" (EL) are used, which include the following principles (Kang et al. 2022, p. 2):

- "Expose students to new experience. These experiences can be any hands-on activity to new information.
- Guide students to reflect on new experience. This guided reflection helps students to connect new experience to prior understanding.
- Encourage students to abstract new knowledge from reflection.
- Help students apply the new knowledge with a new practice set."

The most common types of EL are case studies, internships, labs and role plays (Kang et al. 2022, p. 2). When using EL (among others), there is good evidence for an increase in technical knowledge, a higher understanding of the course content and a higher motivation of the students (Gittings et al., 2020). The practical doing ("hands-on") of the students is particularly emphasized here, which underlies all types of EL (Kang et al., 2022, Barr & McNeilly, 2002). Experiential learning is based on empirical evidence and fosters academic and workforce skills (Hamer, 2000; Urquidi-Martín et al., 2019). "The power of experiential learning to successfully prepare students to be work-ready cannot be overstated" (Kang et al., p.1).

2.2. UX Design in teacher education

We classify this "experiential learning" in the area of "human-centered design", since the needs of the human being (the user) are at the center of the cognitive interest. This basic structure can also be seen in the field of teacher education, where the human being is also at the center - the human being as teacher and the human being as student. The task of inclusive teacher education is to provide student teachers with comprehensive knowledge and skills to best support students with heterogeneous backgrounds (see e.g. Köller et al., 2023, p.69).

The core task of teacher education is to impart professional competence, which can be divided into subject knowledge, subject didactic knowledge, pedagogical knowledge, organizational knowledge and counseling knowledge (Kunter, Klusmann & Baumert, 2009, p. 155, cf. Shulman, 2017). This professional knowledge serves to provide a learning setting that is optimized for the needs of the students (Helmke, 2021) and supports the learning processes of heterogenous groups of students with a well-designed learning offer. There is extensive evidence of such professional knowledge and skills (Baumert & Kunter, 2011; Hattie, 2008).

In contrast to more theory-centered, reflective methods in teacher educaion, activating approaches that involve practical action are particularly suitable (Hillenbrand, 2021; Lancaster & Bain, 2019; McLeskey et al., 2018): Scientifically based content in close connection with practical action show demonstrable effects on understanding, ability and self-efficacy (Sokal & Sharme, 2017). However, the current teacher education in Europe and Germany does not take these findings into account (OECD, 2018; Köller et al., 2023).

Due to the parallelism of the task and structure between Computer Sciences and teacher education, it makes sense to test the usability of UX design as a concept of teacher education to bridge the research-to-practice gap. However, the literature so far contains hardly any studies and discourses on the use of UX design in the field of inclusive teacher education (e.g. Minichiello et al., 2018; Schmidt & Huang, 2022; Oldenburg, 2023). Nevertheless, approaches of UX design can make a valuable contribution to bridging the research-to-practice gap. The methods of UX design do not need to be explicitly taught in teacher training, as is the case in Computer Sciences, but initial experiments show the applicability of the principles of experiential learning.

3. Research Questions

This paper aims to give first insights into the use of UX design in teacher education, that forms part of a collaboration with the University of Pretoria (see Human-Vogel & Du Plessis-De Beer in this volume). We focus on the following questions: Can the use of UX design in teacher education contribute to the development of the board's software interface as part of technical improvement? Can it foster teacher students' competencies in the use of digital learning tools?

Can the use of UX design as a teaching method in teacher education support learning processes in higher education? To answer these research questions, the use of UX design methods, here: experiential learning, was implemented in a course for teacher students for inclusive education, using digital whiteboards to support learning processes for inclusive groups of learners.

4. Method

Interactive digital whiteboards are widely used by teachers in different ways. However, the expectation of positive support for the teaching-learning process has received little research attention (Akar, 2020; Shi et al., 2019; Tsayang et al., 2020; Yang et al., 2012). Experiential learning can be used to promote teacher-student competence in the use of such technologies, as well as in the adaptation of the digital tool itself. Prospective teachers test the use of such digital tools in the subject they are studying for an exemplary teaching arrangement with a view to an inclusive learning group.

The research project evaluates the use of interactive, digital whiteboards in teacher training in various subjects. 50 student teachers (Master's level) test and document the whiteboards according to the test criteria ISO 9241-210 (cf. International Organization for Standardization, 2009; DIS, 2009). As part of the project, the students used their professional teacher knowledge (specialist knowledge, didactic and pedagogical knowledge) to test the use of digital whiteboards on the basis of central procedures in their subject, e.g. images in religious education. To this end, they formulated a literature-based question with hypotheses and developed media and digital artifacts, which they then implemented on the whiteboard. Through this testing, they were able to bridge the gap between scientific findings and practical possibilities for action. The article reports on first applications and experiences.

5. Results

The results of the evaluations of the presentations can be seen on three levels:

- First level describes the technical improvement of the board's software interface.
- Second level describes the user experience of professional users with the board on a holistic level.
- Third level shows results of using UX design as a method in seminars for teacher education.

First level: Following the tests, all presentations were evaluated, bundled, concretized with regard to the technically oriented categories "Tools", "Operation", "Software", "General", "Improvement requests", to the manufacturer's development department and discussed intensively with representatives of the manufacturer with regard to the practicability of

implementation. In this way, the students were able to conduct extensive usability testing of the whiteboard's interface usability from the perspective of professional teacher competence knowledge.

Second level: In accordance with the aims of UX Design, not only technical improvements were worked out and communicated to the company, but also emotional experiences of joy, frustration, motivation and self-efficacy.

"It took us a long time in the group until we managed to insert the photos sent to us on the board. In some cases, this was only possible via the "toolbox". We just couldn't understand it and really started to get annoyed about it. I was totally frustrated and told myself that if it was that complicated, I wouldn't be able to use it in the classroom at all. But: When we finally managed to do it in the group, it was great fun and we tried out a lot of things."

"Great - finally we are being asked as a young generation of teachers what we really need at the boards!"

Third level: The students described positive experiences with the UX Design as a methodological setting in the seminars. Experiential learning led to the transfer of professional knowledge to concrete implementation in practical action, thus demonstrating to them the meaningfulness of theory-based knowledge for practical teaching action.

"For the seminar, we first researched scientific literature on digital, game-based learning in our group. There were some exciting results that we were then able to use for our research questions on the boards. We were able to use research findings on digital game-based learning and adapt them to our teaching project. We were able to try out theory in practice and actually use it for practical lesson planning."

6. Discussion

The experiential learning in this project, "hands-on", bridges the research-to-practice gap in inclusive teacher education: Based on their professional knowledge the pre-service teachers developed the adaption of a digital tool focusing the requirements of different subjects for inclusive classrooms. Apart from that, the UX design project aims at increasing the competence of pre-service teachers in the use of digital whiteboards in their specific content area. The project results in relevant experiences in identifying more user-friendly adaptations of the digital tool. The company will use these results in technical adaptations applying knowledge and skills in the specific subjects for inclusive classrooms. The project also increases pre-teachers' confidence, motivation and satisfaction with the tool and their learning, it demonstrated the impact of UX design in teacher education to bridge the research-to-practice gap.

A general limitation of this research project is the limited measurability of the methods in the UX design approach, which does not meet the quality criteria of qualitative or quantitative empirical research. This could affect the validity and reliability of the presented results, which are based on the direct experience of whiteboard users (cf. Oldenburg, 2023). It is also unclear whether the resulting adaptations of digital tools will be successful in the market, which may follow criteria other than usability. Another limitation is the limited generalizability of the findings, which relate to the specific needs of student teachers in inclusive settings. Nevertheless, given the practical challenges in inclusive schools, systematic testing of UX design for teacher education is worthwhile.

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Deaf Signing Students in Higher Education: the benefits of a congregated programme for deaf students in teacher education

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Abstract

Deaf students have typically had lower rates of access to, and progression through higher education. In Ireland, deaf people have traditionally been excluded from initial teacher eduation for primary teaching. In Dublin City University in 2019, a pilot initiative commenced to provide a dedicated entry pathway for deaf students to initial teacher education for primary teaching. Owing to the very unique nature of this pathway, a comprehensive evaluation of this four year pilot initiative was carried out at the request of the Department of Education. This paper will report preliminary findings from that mixed-methods evalution. In particular, the findings reported below focus on the benefits found for the creation of a congregated pathway for deaf students (rather than allowing individual students into a variety of different universities) and the subsequent potential for building capacity at the university and in the community for the improved integration of deaf students.

Keywords: *deaf; higher education; interpreters; access; teacher education*

1. Introduction

Deaf students have typically experienced lower progression rates to higher education, and once there, poorer retention within their programmes (Garberoglio et al., 2019; Newman et al., 2011). The reasons for this are complex and multifaceted but likely to include poorer overall academic attainment for these students (Marschark et al., 2015), structural barriers in accessing higher education (Mathews, 2020), and soft barriers such as low expectations of parents (Michael, Cinamon & Most, 2015), teachers (Johnson et al., 2022) or themselves (Johnson, et al., 2022; Weisel & Cinamon, 2005). In Ireland, where this research is based, deaf students have been showing improved access to higher education over the last number of decades (Higher Education Authority, 2015), though they have been identified as more likely to withdraw from their programme of study compared with other students with disabilities (Treanor et al, 2013).

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However, their participation in particular programmes of study has been consistently poor. One such programme is initial teacher education for primary teaching where there was a specific structural barrier inhibiting deaf people entering the programme.

This barrier was the requirement for a high level of the Irish language in the summative examinations in secondary school, examinations which are used as a means of gaining entry to university. This has been dealt with in detail elsewhere (Mathews, 2020). Briefly, Irish is a required subject for entry to initial teacher education for primary teaching in the Republic of Ireland. However, deaf students have typically been exempt from its study in school. Indeed, it is not delivered as a subject in schools for deaf children. Nonetheless, it had been required of deaf candidates applying for initial teacher education for primary teaching. Aside from the obvious issues of equity, this had a considerable negative impact on the deaf education system given the absence of deaf teachers in the sector and the subsequent lack of cultural (Johnstone & Corse, 2010) and linguistic (Hall, 2017) role models for young deaf children.

Following a consultation process in 2011, the major stakeholders in education in Ireland (such as the Teaching Council, the Department of Education, the Colleges of Eduation, and others) acknowledged that this was an anomaly that needed to be addressed and encouraged the development of a pilot initiative to bring a cohort of deaf signing students through initial teacher education for primary teaching (Mathews, 2020). The pilot was developed in Dublin City University, creating an entry pathway to initial teacher eduation for deaf sign language users. This represented the first ever cohort of deaf signing students to study on campus, and thus presented a unique opportunity to capture the experiences of students, academics and interpreting staff in a teacher education programme. The entry pathway itself is a unique contribution within the Irish higher education landscape in that it brought a congregated cohort of students with a shared characteristic (deaf sign language users) through a single entry pathway. Typically, initiatives providing for improved access allow students to make their way into individual programmes of study. This pathway took a different approach, believing the congregation of deaf students together might bring particular benefits.

2. Methodology

The purpose of this study was to evaluate the Bachelor of Education (Irish Sign Language pathway), a designated entry route for deaf sign language users to primary teaching which was a pilot initiative supported by the Department of Education and the Higher Education Authority from 2019 until 2024 . Also included in the evaluation was a suite of capacity building activities within the university that commenced before and ran for the duration of the pilot. These capacity building activities were designed to support the inclusion of deaf students and increase the visibility of the field of deaf education generally at a national level. They included Irish Sign language classes, deaf awareness training, deaf education seminars and a one-day symposium

on two contemporary issues in deaf education. Data was gathered through a mixed methods approach combining survey responses, interview data and field notes of the principal investigator who also lead the development of this pathway. A team of three researchers (the authors of this paper) was involved in the collection of data. Surveys combining closed and open-ended questions were administered to those who took part in the capacity building activities. Semi-structured interviews were carried out with deaf and hearing students (n=4), academic staff (n=8), and interpreters (n=6) about their experiences during the programme. In total, 156 people completed surveys and 18 people completed interviews. Since the second and third year of the programme were badly impacted by Covid-19 restrictions, data collection concentrated on the first and last years of the four year degree programme, and the year following graduation (2019/20, 2022/23 and 2023/24). Data collection is ongoing. This paper will present preliminary findings from the evaluation concentrating on a single theme: the merits of a congregated pathway for deaf students.

3. Results

One of the interesting features of this pilot initiative is that it brought a cohort of deaf signing students into a single teacher education programme at Dublin City University (rather than allowing individual deaf students into various teacher education programmes across the country). While creating a dedicated pathway was somewhat contentious in that it restricted the choice of teacher education setting available to deaf applicants in a way that hearing applicants were not restricted, it allowed for concentration of funding in a single location and this brought a number of benefits to the pathway.

First, it facilitated capacity building to take place at a relatively intensive level. Capacity building was conceptualized at two broad levels in this pilot: first, at the level of the university where we delivered Irish Sign Language (ISL) classes and deaf awareness training to staff and students to directly improve the inclusion of students on campus, and second at the level of the community where we rolled out a seminar series (4 seminars) and a one-day sympsosium to instigate a longer term improvement in the field of deaf education into which our students would graduate. This approach reflects an adaptive approach to access for underrepresented groups where "it is acknowledged that recruitment, without significant system adaptation, is inadequate" (Keane, Heinz and McDaid, 2022) A number of common features permeated capacity building activities. First, where possible, deaf people's experiences were foregrounded (e.g. we worked with deaf presenters where possible). Second, when activities were delivered in DCU, they were delivered across all three campuses of the university rather than just the campus where the deaf students were enrolled, signalling that this was a university-wide initiative. Third, we tried to reach as broad an audience as possible (e.g. we delivered our seminars and symposium online, offering English-ISL interpretetation as well as International Sign interpretation to reach audiences outside Ireland). When activities targetted staff, they

were available to *all* staff, including academic, administrative, and service staff such as security and catering, full-time and part-time. Also, when scheduling activities for staff we were cognizant of the mixed schedules university personnel might have and tried to broaden our audience ready by offering varied engagement options such as weekly courses, 1-day intensive courses, and personalized one-to-one courses for those in senior management with very limited time (e.g. the President of the University). Over the course of the pilot programme, 260 members of staff and 404 students (undergraduate and postgraduate) took part in ISL classes across Dublin City University. We had a further 419 attendees at the deaf education seminars and symposium. This part of the pilot was evaluated through anonymous surveys distributed after a capacity building event took place.

Staff and students alike were very positive about the experiences in ISL classes. Benefits highlighted by those participating included improved ISL skills (91% of partipants reporting this) and increased awareness of the Deaf community and Deaf culture (108 references across the data). Qualitative statements from the survey highlighted the benfits of running the classes on campus:

> "It has opened me up the wanting to really learn more of ISL, I really want to learn more of ISL, a language I never thought too much about if I am honest." (Staff, ISL course).
>
> "It was a sort of a "lightning bolt" moment, where I wondered, why isn't everyone learning this in school? Seems utterly ridiculous not to be - there are nothing but advantages to knowing it." (Staff, ISL course).

Deaf awareness training was mainly attended by staff, in particular those who were preparing to include deaf students in their lectures. Like the ISL classes, attendees were extremely positive about the opportunity it afforded them to learn from deaf presenters and many highlighted the practical nature of the training:

> "Practical and grounded in experience." (Academic staff, Deaf Awareness Training).

Furthermore, they saw the event as part of a necessary move to improve accessibility in higher education:

> "Personal and professional insight into an extremely important area which higher education institutes should be doing a great deal to support." (Academic Staff, Deaf Awareness Training).

Some participants also noted the limitations of this kind of training and highlighted larger, sometimes systemic issues with the roll out of new initiatives:

> "The recognition by DCU staff at higher levels of valuable time and resources required of lecturers to deliver a meaningful experience...Time should be officially built in and recognised on workload model." (Academic Staff, Deaf Awareness Training).

Some wanted further opportunity to talk about the direct implications of including deaf students in their work:

> " [There was] not enough time to talk through implications for and practicalities of our local situation" (Academic Staff, Deaf Awareness Training)

Capacity building at the community level through seminars and the symposium was met with extremely positive feedback, to an unanticipated level. Comments from participants revealed that professional development in the area of deaf education is desired, not just in Ireland, but overseas, with participants tuning in from as far away as Australia:

> "Great to get an update of language assessment within the field. I am in Australia so appreciated having the opportunity to watch the recorded seminar, 2:30 am was a bit too early for me". (Participant, Seminar 1)

Constructive criticism of the seminars and symposium tended to focus on issues relating to technology (the participant's connectivity issues or the size of the interpreters on screen), desire for content on a congruent topic (e.g. more applicable to primary or postprimary, depending on the sector of the participant), and in a few cases that the seminar did not deliver what they were hoping for. Overall, however, the feedback across the four seminars and symposiums was extremely positive:

> "As a teacher of the Deaf and ISL interpreter I am always wanting to broaden my knowledge and learn more about the Deaf community, its language and Deaf Education and this symposium and the other seminars DCU have provided are a fantastic way of doing this." (Participant, Symposium).

A second major advantage brought by a congregated cohort of students was that ISL interpreters could be contracted within the university. Ordinarily in Ireland, sign language interpretation for individual students is provided through an agency external to the university. While the agency will often try to ensure continuity of interpreters, there is no guarantee of that. Interpreters will not be employees of the university. For the Bachelor of Education ISL pathway, a team of three full time equivalent interpreters was contracted to work with the students over the course of each academic year. Care was taken to allow for timetabling of preparation hours and team meetings for the interpreters to allow them to build a strong cohesive team for supporting students. For interpreters, being contracted to work in the university was a considerable departure from the usual mechanism used to provide interpreters within higher education whereby they are paid as self-employed suppliers. Our approach brought a number of

advantages. Especially, they felt like they were a member of the staff in DCU, rather than being ancillary staff who come in, but were not members of, the university community:

> "I felt like an established member of the professional team. And so yes, there was the whole thing – a member of the DCU community." (ISL interpreter 2, focus group)

A third major advantage was that the concentration of funding allowed for the development of specific modules for the cohort of deaf students that would be relevant to their careers as teachers of deaf students. In total, 11 dedicated modules were delivered across the four years. These covered topics such as audiology, working with other professionals, sign language linguistics, assessment of deaf children, and others. This allows for graduates to apply for recognition as teachers of the deaf in jurisdictions where a minimum mandatory qualification is required (e.g. in the UK).

Finally, the congregation of students had considerable social benefits from both the perspective of staff and students alike. First, it brought increased visibility of the cohort to the lecturing staff:

> "I possibly did spend more time with them but not to the detriment of others. I was very conscious of everybody else, but I became more conscious that I needed to ensure that they [the deaf students] understood." (Academic staff, interview).

Furthermore, it created a safe deaf space for students, which ultimately aided their integration with their hearing peers. Speaking about their *past* experiences in other higher educational establishments where they had been the only deaf student in their programme, two of the students recounted:

> "I was a loner before in college, I was lonely, I used to eat by myself. My class? Forget them!" (Deaf B.Ed ISL student 3, focus group)

> "The interpreter was my best friend there you know. I talked to my interpreter more than I did to other people." (Deaf B.Ed ISL student 1, focus group)

Pointing to the benefits of the deaf peer group, the B.Ed ISL student cohort noted that their interactions with hearing peers improved after they started to socialize with them as a group, but that they would not have had the confidence to do this without the support of their deaf peers. Thus, while having a congregated group of deaf peers may be perceived as a threat to integration with hearing peers, in the case of this cohort of students, it facilitated their ultimate integration with the main hearing cohort.

4. Conclusion

Deaf students have typically experienced poorer rates of access to and progression through higher education. One initiative designed to tackle this was the creation of a dedicated pathway

into initial teacher education for primary teaching in Dublin City University, Ireland. Creating a dedicated pathway allowed for a concentration of funding which in turn provided for a range of benefits such as improved capacity building (sign language classes, deaf awareness training, seminars and a symposium), development of novel modules for a deaf education specialism, and improved inclusion of the cohort of deaf students through increased visibility for their lecturers and the creation of a secure peer group from which they could embark on social engagements with their hearing peers. This is an example of an adaptive response to recruitment of underrepresented students into teacher education. Rather than focusing on deficits of marginalised students and creating activities to change the students themselves (as reflected in reactive or strategic responses), an adaptive response is when "[institutions] realize that participation and graduation goals cannot be attained in a system in which students are expected to do all the changing" (Richardson and Skinner *in* Keane et al., 2022, p.6). The learnings from this pilot would suggest that higher education institutes should give consideration to the development of congregated pathways for other at risk or underrepresented students and use this as an opportunity for university-wide systemic change.

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Alternative gamification approaches in engineering education

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Abstract

Motivating students eases their learning process. In this line, gamified activities are presented as an effective strategy but dependent on the context and students' profile. The procedure to gamify several activities of a master course in engineering is detailed: preliminary analysis, justification of the selection of alternative gamifying strategies, definition of the indicators, including the proposal of a novel mood self-assessment strategy, and discussion of the obtained academic results. The main conclusion is that gamification improve students' mood. In addition, time trial activities motive students but are detrimental to their marks, whereas the importance of choosing a suitable activity type and placing it in the correct calendar date is essential to its effectiveness.

Keywords: *Gamification; Engineering; Motivation; Mood; Self-assessment.*

1. Introduction

The motivation of the students is a key point to impulse their learning process. With this aim, different gamified experiences were introduced in *Concrete Structures* course of Structures and Construction specialization of the Master in Industrial Engineering at ESEIAAT-Polytechnic University of Catalonia (UPC). The specific objectives were: to increase the class attendance up to 90%, to reduce the theoretical lectures to a maximum on 20 continue minutes and to include at least one gamified activity per session. It was also intended to test different types of gamified activities to asses which were the more suitable ones.

To implement these activities a previous analysis of the context, a comparative discussion of the alternatives and the preparation of the required resources was carried out. During the application of the gamified activities, mood surveys were answered by the students and objectives and subjective indicators were acquired. Finally, the academic results are analyzed in comparison with previous courses to conclude about the pros and cons of the proposed activities, being possible to distinguish the most efficient changes.

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2. Theoretical background

First uses of gamification in learning environments date back to 1980's. However, scientific research on its relationship with motivational aspects is more recent and critical references appear just 10 years ago. A literature review on gamification for undergraduate students performed by Bodnar et al. (Bodnar et al., 2016) pointed out the general result of improving the attitude and learning performance. However, the same authors indicated that more evidence-supported research was necessary. In this line, some researchers presented their corresponding studies on educational and professional field (Indriasari et al., 2020), highlighted its usefulness for simulating work life (Alanne, 2016) or the importance in developing decision-making competences (Legaki et al., 2021). Particular empirical applications were performed together with other active-learning methods (Rodríguez et al., 2018), to improve laboratory practice also reporting students' perspective (Kim et al., 2018) or using it continuously along a semester being gamification volunteer (Díaz-Ramírez, 2020). Nevertheless, some researchers pointed out that there may be also negative effects related with wrong gamification design (Toda et al., 2018). A review study (Hamari et al., 2014) pointed out that gamification effectiveness highly depended on the context and the profile of students, or that technical resources are required (Dicheva et al., 2015). In addition, it seems that results are also variable, improving global marks but reducing the proficiency in written activities or face-to-face participation (Domínguez et al., 2013).

For all these reasons, the current research is based on analyzing different gamification approaches in a well-defined group-context, to provide additional data to the literature.

3. Research context and previous learning evidence

The specific characteristics of the students is highly related with the performance of gamified activities in the learning process. To objectively characterize the group, the first research task was to submit a brief questionnaire about the students' profile to the people who took the course in the three previous editions and the last course the gamified activities were applied in. The participation was 85% and the results showed that the average age was 24, all of them worked apart from studying with an average job dedication of 25h/week, most of them (76%) came from Engineering in Industrial Technologies Bachelor indicating little (70%) previous knowledge on the matter (in a scale of no-little-intermediate-high previous knowledge).

To assess the starting control situation, SEEQ questionnaires, firstly defined by (Marsh & Roche, 1994), of previous editions of the course were analyzed from five particular questions regarding motivation: (A) I have found the course intellectually challenging and stimulating (4.75/5); (B) My interest in the subject has increased as a consequence of this course (4.50/5); (C) Instructor enhanced presentations with the use of humor (4.88/5); (D) Instructor's style of

presentation held my interest during class (4.75/5); and (E) Course difficulty, relative to other courses, was (1)Very easy, (2)Easy, (3)Average, (4)Difficult, (5)Very Difficult (3.63/5).

Finally, the academic results of the previous editions of the course were analyzed. The selected concepts had to had been continuously assessed with activities or exam questions in the past three editions (2020-2022); it was gamified in the studied edition. The following table summarizes the results through numeric marks out of 10.

Table 1. Previous academic results.

Concept	2020	2021	2022	Avg.	2023
To calculate the mechanical properties of concrete	10.0	10.0	8.8	9.6	8.1
To name concrete	10.0	10.0	10.0	10.0	7.2
Durability	8.5	5.8	5.7	6.7	8.9
To calculation of flexural strength	5.3	4.2	6.2	5.2	5.0
To calculate deflection	6.8	6.2	5.4	6.1	7.0
Pouring and curing procedure	9.8	10.0	7.5	9.1	9.6
Strengthening of concrete structures	5.0	5.3	6.9	5.7	7.5

4. Methods

4.1. Previous analysis

4.1.1. Objectives definition

Two potential objectives are set to justify the application of gamified activities. The first one aims to increase the motivation of the students. A motivational issue can be detected if SEEQ questions (A)-(D) in section 3 show marking below 4/5. The second potential objective would be to easy hard-learning concepts. This need can be observed if the question (E) in section 3 obtains a punctuation higher than 4/5. It is important to highlight that adopting a gamification strategy is not the only way to deal with the previous two challenges, but it is the studied one in the current research. Regarding the particular application case, the results of previous SEEQ questionnaires did not indicate the need of modifying the course. Nevertheless, it was decided to apply the gamification to easy the hard-learning process.

4.1.2. Group characteristics

The size of the group will determine which activities are preferable for operating limitations. The age of the students together with the job occupation are considered to indirectly assess the daily contact with game playing. Hence, older people or people with greater job responsibilities are supposed to have little time to play, thus gamification may be effective at providing a stress release, helping students to be in positive mood when dealing with complex concepts. Finally, the class attendance may be used as an additional indirect measurement of students' motivation.

Regarding the case study, most of this data is provided in section 3. The group size was little (4 students in the 2023 edition) and the class attendance of previous editions was 85%.

4.1.3. Content type

Complex transversal concepts are commonly included in the first years of engineering bachelors at UPC. These more abstract ideas can benefit from gamification but it would be recommended to introduce the changes at a slower rhythm than in technological higher courses that are more oriented to practical applications. This later situation is the current case study and introducing a wide range of possible gamified activities was possible.

4.1.4. Calendar limitations

Analyzing the calendar allows to cross the information about the more stressful dates for students (exams, delivery of course projects) and the gamified activities that require more time out of the classroom to avoid their coincidence. In the case study, the more time-consuming activities were placed out of the stressed periods (early November and last December) and the short activities to be developed in the classroom are moved to these periods, except for one control activity.

4.1.5. Available resources

Having access to the time, human and material resources is necessary to introduce any teaching innovation in a course. The case study benefited from the support of a teaching team committed with the innovation, six months' time to implement the changes and the material resources and support of the laboratories from CATMech research group.

4.2. Alternative gamified activities and selection

Six types of activities are considered in the research to be used as part of the gamification process. Others are possible but not considered. A brief description of each activity type is provided with no aim of in-depth analysis. The prize to the student/group winning each activity was the direct addition of 0.1 to 0.5 points, depending on the complexity, in the final course mark.

Debate/role playing consisted in randomly assign roles to the students that had to convince a volunteer person that acts as a jury/referee with technical arguments (e.g. constructor vs client representative discussion about particular construction techniques). Experiments were typical laboratory practices that used recorded data to calculate some parameters (e.g. flexural test of reinforced beams). Peer tests were short questions asked by students to students in anonymized way (e.g. defining durability requirements based on peer's definition of the construction). Peer problems followed the same idea but involved solving more complex calculation problems (e.g. first student set a calculation problem about deformation and the socend solves it). Environment

exploration consisted in getting pictures of particular elements or processes analyzed in the classroom in time trial (e.g. searching for concrete joint types). Assisted calculation activity refers to a common computer assisted calculation of structures practice (e.g. Finite Element Analysis of a reinforced beam). Combining the data from the previous study and the characteristics of the combined activities, the following generic selection table was set.

Table 2. Selection table for gamified activities.

Activity	Objective	Group	Content	Calendar	Resources
Debate/Role playing	Motivation	Small-Medium size Adult age	Complex cases	Stressed	Little
Experiments	Motivation Ease learning	Small size Young age	Complex concepts	Stressed	High economic
Peer tests	Motivation	Medium-Big size Adult age	Simple concepts	Stressed	Little
Peer problems	Motivation	Medium-Big size Young age	Complex problems	Non-stressed	Little
Environment exploration	Motivation	Any size Young age	Descriptive concepts	Non-stressed	Little
Assisted calculation	Ease learning	Small-Medium size Any age	Complex problems	Non-stressed	High economic

Specific characteristics of the course would justify implementing debate/role playing, experiments and environment exploration. However, with the aim of assessing the performance of different alternatives at improving students' mood, all six types were considered. The previous table was used to assign the concepts of the course to the different type of activities. Debate/Role playing was used to deal with concrete pouring/curing and strengthening of structures. Experiments were introduced to focus concrete production, concrete characterization, flexural calculation of reinforced concrete and truss-tie models. Peer tests were used to learn about concrete and cement labeling and advanced concrete types. Peer problems were used in durability analysis and calculation of deflection of reinforced concrete. Environment exploration was incorporated at explaining concrete structural elements and types of joints. Finally, computer assisted was applied in non-linear calculation. Calendar limitations were also researched by including experiments, computer assisted calculation, peer tests and debate/role play in stressed dates, being assisted calculation the time-demanding activity to be used as control item. In total, 12 gamified activities were prepared.

4.3. Preparation of activities

Before implementing activities, the corresponding activity card was prepared including title, topic, objectives, duration, materials, tools, equipment, previous preparations tasks,

development tasks, gamification strategy and marking. For the debate/role playing activities the specific stories and databases were prepared. Specimens and tooling for experimental activities and digital files for computer assisted calculation activities were also prepared in advance.

4.4. Setting the follow up strategy

Two types of evidence were gathered. First, objective evidence like class attendance, results of activities and exams and SEEQ questionnaires were collected to compare with data from previous editions. Second, subjective evidence from students' opinion gathered through open questions in SEEQ and face to face discussion. The students' mood was also asked through anonymous graphical assessment (see Figure 1) at two different times in all sessions. These two asking times were set to analyze the mood before and after the gamified activities. However, in some cases these were placed to analyze the effect of a longer theoretical explanation or to analyze the mood evolution from the ending of a gamified experience to the end of the session.



Figure 1.Graphical students' subjective mood assessment.

5. Results and discussion

The first result is that class attendance increased from 85% to 92%, indirectly indicating a motivation improvement. Regarding the marks (see the last two columns of Table 1) it was observed that including time trial activities caused more mistakes that resulted in 15% lower marks for the calculation of the mechanical properties of concrete, the calculation of the flexural strength or the concrete labelling. However, it has mentioned that all students choose these topics to answer open-selection questions in the exam getting an average mark of 7.5/10. In contrast, with no time restriction (durability, deflection calculation and strengthening of concrete) the marks clearly increase (over 15%). Assisted calculation, which was placed in the wrong calendar time, got the worst results with any student completing the activity even though it had the highest reward. Moving to SEEQ questionnaire, the four questions presented in section 3 related to motivation obtained the maximum mark, whereas the question about the difficulty of the course improved to "average".

Graphical mood assessment showed that the mood self-assessment increased 0.9/5 points comparing the states before and after gamified activities. The two more effective activities in this line were debate/roleplaying and experiments. In the control cases, comparing the mood

state before and after a theoretical session, 1.3/5 points were reduced, whereas from the finishing of the gamified activity to the end of the session the mood reduced 0.25/5 points.

Subjective students' opinion indicated that the preferred activities were the ones conducted out of the classroom, followed by debates. They also explained that solving calculations in time trial was also motivating. Surprisingly, this was the opinion of the student who got less additional mark in this type of activities. Long peer problems were the ones that liked less. From the teacher point of view, experimental activities involve far more preparation but help students at understanding, whereas debate activities are the most effective ones. Peer tests contribute to change the rhythm of the session and increase motivation at a lower cost in time.

6. Conclusions and practical implications

Different gamified activities were introduced in a Concrete Structures master course together with a mood self-assessment strategy to identify the types of activities that are more effective at motivating students. Academic results and SEEQ questionnaires results are also considered and compared with previous editions to conclude that:

- Gamified activities improve students' mood during sessions.
- Time trial activities caused calculation mistakes but settled down students' knowledge that selected these activities in an open-exam.
- Debate/Role playing activities improve academic results of students and are assessed as the preferred ones, together with experimental activities, by the students.
- Gamified activities have improved the SEEQ questionnaire results on students' perception of the quality of the course in relation to motivational aspects.
- Setting the suitable activity types in the correct calendar dates is essential to bring positive results.

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Challenge-Based Learning in Higher Education: Master's Degree in Logistics and Productive Operations Management from Mondragón University

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Abstract

Since 2022, Mondragon University has implemented Challenge-Based Learning (CBL) in the teaching and learning process of the Master's in Logistics and Productive Operations Management (MUDOLP) program. This article describes the application of CBL in four companies from different industrial sectors during the second semester of the 2022–2023 academic year. The challenges focused on reducing the variability of industrial processes through the implementation of a continuous improvement process and analysis following the Lean Six Sigma methodology in an environment of operational excellence. The results show that having a partner with experience in the CBL industry is important in increasing the complexity and uncertainty of the task, while also providing students with significant exposure to professional issues that need to be addressed.

Keywords: *challenge-based learning, higher education, Lean Six Sigma, operational excellence*

1. Introduction

In the new context of economic productivity, fresh paradigms prevail related to achieving maximum efficiency of productive resources in a sustainable way through the incorporation of new information and communication technologies (ICT). These developing conditions demand that organisations and industrial companies transform to be competitive, satisfy customer demands and remain in the marketplace. They also require that companies have personnel trained and prepared in the field of management with excellent advanced logistical and

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productive operations skills who can guide their companies towards the transformations required by the new prevailing paradigms (Mangla et al., 2020). To prepare master's program students with the skills needed to work in the increasingly complex and diverse environments of higher-level industrial organisations, it is necessary to adopt appropriate pedagogical approaches (Helker et al., 2024). One strategy that may be relevant to this approach is Challenge-Based Learning (CBL) (Christersson et al., 2022). Since 2022, Mondragón University (MU) has implemented CBL in the teaching and learning process in the Master's program in Logistics and Productive Operations Management (MUDOLP). This paper examines its application during the second semester of the 2022–2023 academic year. In the aforementioned case, the students immersed themselves in challenges in four companies from different industrial sectors, focusing on the problem of reducing the variability of industrial processes. In each case, this was achieved through the implementation of a continuous improvement process following the Lean Six Sigma methodology in an environment of operational experience. These challenges were designed and agreed upon by the company staff and MU professors. In the experimental setup, the learning modules and contents were aligned with the objectives of both the company and the university. The challenges raised topics related to industrial operational excellence, such as the variability of industrial processes, lean production, continuous improvement models, sustainable production and people-centred production. Transversal skills, such as teamwork and communication, were also addressed. Teachers continuously monitor this process, focusing on analyzing students resilience to failure, problem solving, and how each student acquires content knowledge. The main difference between a problem controlled by a school and a completely uncertain problem created in an industrial plant is the degree of uncertainty about the solution to that problem (Chapel et al., 2021). Many factors were evident in our study. For example, cross-disciplinary skills such as teamwork, critical thinking, ethics, problem solving, planning ahead, and resilience have been observed (Chapel et al., 2021). Our results show that having an industry partner for CBL experience is important in increasing task complexity and uncertainty, and also helps significantly in helping students are exposed to real-world professional problems that need to be solved (Chapel et al., 2021). Consequently, skill development is consistently greater than learning delivered through traditional methods, as a theoretical teaching classes.

2. Challenge-Based Learning

CBL is an innovative learning strategy specifically designed by Apple's education team to develop and refine the skills engineering students need to succeed in today's world by collaborating with colleagues, professors, and experts in their fields to solve real-world problems (Apple Inc., 2012). Engineering educators encourage this active learning style as an appropriate way to develop critical thinking skills in engineering students (Membrillo-Hernández et al., 2021). As Helker et al. (2024) mentioned, CBL has become increasingly

popular in higher education as it aims to stimulate students to take initiative in their own learning, acquire and apply relevant knowledge to respond to the challenge. The CBL process begins with selecting a core idea and goes through the following steps to identify and solve the problem associated with that idea: physical problem; competition; instructional questions, activities, and resources; definition/solution article; action to implement the decision; result of evaluation; and sharing information with the world (e.g. publishing results) (Apple Inc., 2012; Mas et al., 2017).

3. Learning Experience

The following stages describe a learning experience in which CBL was used as an instructional strategy for the second semester of the 2022–2023 academic year of the MU master's degree program in logistical and productive operations (MUDOLP). This was based on the steps of the CBL strategy developed by Apple and takes into account that the reference topic of the second semester in the master's program is the design and application of continuous improvement strategies in the field of operational excellence. During this semester, the phases defined in our methodological process were supported with an improvement methodology based on the Six Sigma DMAIC (Define, Measure, Analyse, Improve and Control) (Thomas et al., 2017), which we call DMAIC-7P (Eguren, 2012) (Unzueta & Eguren, 2021). Templates in the form of a diary were developed to guide the teams through the different stages of the challenge to be addressed. The work route that appears in Figure 1 lays out the schedule, the different phases of the CBL and the phases of the reference process, which were interspersed throughout the semester that corresponded to the application of the Six Sigma methodology.

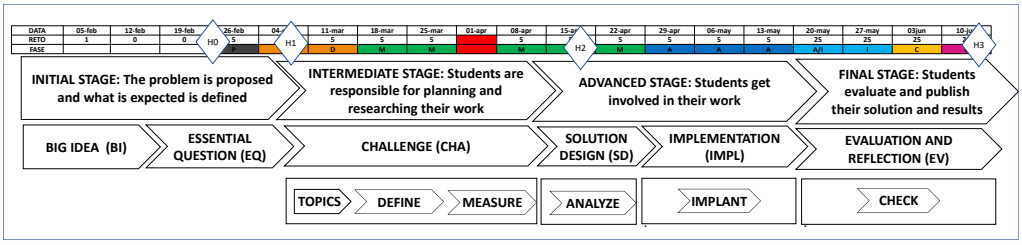


Figure 1: CBL methodology use

3.1. Team Formation

A total of 17 people enrolled in the MUDOLP master's program, of which four groups of four to five people were generated to address the challenge. The topic addressed in the session corresponds to how operational excellence can be achieved through the development of continuous improvement activities under the Lean Six Sigma philosophy in a real environment. To do this, each group tackled its challenge in a real company where internships were being carried out in alternation. Previously, the managers of the selected companies were contacted to

show them the work that would be addressed in the challenge and to get their agreement. Table1 shows the challenges identified by each group in their corresponding companies.

Table 1: Challenges identified for each group

	Team 1	**Team 3**	**Team 3**	**Team 4**
Type of company	Capital goods company	Automotive sector company	Capital goods company	Automotive sector company
Activity	Manufacturing of filtering installations	Rubber processing company	Sprayer manufacturing company	Carburetor manufacturing company
Challenge to address	Operational excellence in the painting area	Operational excellence of the injection machine tuning process	Operational excellence in the component storage area	Operational excellence in waste management

Each group was assigned a tutor to guide them in the process of addressing the challenge. Who has previously received training in the field of CBL and the Six Sigma methodology at the black belt level. The role of the expert tutor was to be a learning collaborator and to seek new knowledge together with the students, while at the same time molding habits and new ways of thinking. To do this, they were organised by monitoring through weekly meetings, where the activities to be carried out, the visits to be made to the companies and the evolution of the work carried out at all times were planned and monitored.

3.2. Initial Stage

At this stage, the problem to be addressed has been proposed, and what is expected has been defined. A general idea of solving the problem of operational excellence in industrial processes was introduced and the problem of reducing the variability of industrial processes was addressed using improvement models. Focus on operational excellence in each established area. After identifying the challenge to be addressed, the teams began to analyse the challenge topic and explore the questions that guided the formulation of a concrete and feasible strategy to solve the challenge (Apple Inc., 2012). The essential questions were related to the theoretical knowledge developed in parallel with the challenge that was being developed (van den Beemt et al., 2023). These correspond to the following thematic blocks and the questions below. Table 2 shows some guiding questions generated by the teams, as well as the blocks of developed content. As the challenges are developed in a real industrial environment, the complexity of the tasks addressed are significantly more complex and have greater uncertainty.

Table 2: Guiding generated by the teams for each topic

Topic	Essential questions
Analysis of Process Variability	How can I reduce the variability of an industrial process using Lean Six Sigma techniques?
CI Models	What elements and factors have an influence when approaching a CI project?
Sustainable Production	What aspects of the sustainability of industrial processes must be taken into account for operational excellence?
People-Centred Company	How are people managed and organised?
Lean Production	What tools or techniques can I use to eliminate or reduce production waste?

3.3. Intermedial Stage

In this first stage, the challenge to be addressed has been specified, starting from the guiding questions identified in the previous phase, and the necessary activities and resources have been used and developed for each thematic block to describe the problem to be addressed. The steps of the DMAIC-7F (Eguren, 2012) methodology have been used as guiding support. In this section, the define and measure phases will be addressed, in which all the contents addressed by each thematic block included in the challenge will be incorporated.

3.4. Advanced Stage

This stage corresponds to the design and implementation of the solution. To do this, first, we have designed a thoughtful, concrete and clearly articulated solution that can be implemented in the local community. As support, the analysis phase of the DMAIC-7F methodology will be addressed. Next, we proceeded to address the solution implementation phase. For this purpose, an implementation plan was designed and addressed, depending on time and resources. Table 3 shows the improvements identified by each group.

Table 3: Improvements identified by each group

Team 1	Team 2	Team 3	Team 4
Implementation of the 5S tool	Reduce injection machine change time	Redefine component reference locations	Improved waste cart locations
Design of a procedure for changing the paint reference	Reduction of Lead Time of references that go through the oiling process	Incorporate solar panels	Cart dump lift system
Change in the Paint Layout	Defect reduction	Use recycled material in plastic packaging	Collaborative transportation robot
Design and implementation of a Kanban board		Calculate company's carbon footprint	Reduction of non-returnable referrals
		Carry out the Lay-Out study to minimise movements	Indicator of number of people in waste management
		Get people to be an active part of improvement teams	Logistics train

3.5. Final Stage

At this stage, the students evaluated and published the results of the challenge addressed by each team. To do this, they have developed a technical report that includes the process followed and its results and have made a presentation to their colleagues and the managers of the companies where they have carried out the challenge. In the aforementioned presentations, the students reported progress, problems and achievements during the process. Overall, the students admitted that the project required a lot of work, but even more so, they appreciated the bonds that developed between teammates during this intense work. They also noted that they learned how to communicate better with each other to move things forward (Apple Inc., 2012). This experience with CBL not only provided team members with knowledge on a topic relevant to their careers but also gave them a method to rationally approach a problem and helped them develop interpersonal skills to successfully work on a team (Apple Inc., 2012). Also, at this stage, the final evaluation of the challenge was carried out. It should be noted that the evaluation has developed progressively through the milestones defined in the challenge process. An evaluation system was developed in which the results of the formal and informal evaluations were evaluated. In the aforementioned system, the developed learning was collected and analysed, and the decision-making process was followed as the challenge progressed. Four follow-up sessions were carried out based on the milestones. In these four sessions, the different groups made presentations of the progress of the challenge based on established planning (van den Beemt et al., 2023) .The final evaluation was carried out taking into account the aspects included in Table 4.

Table 4. Final evaluation structure

Assessment Category	Assessment Subcategory	Description
Technical assessment (60%)	Technical memory (45%)	Definition and description of the technical solutions developed to address the challenge
	Defending (45%)	Individual questionnaire for each of the technical aspects of challenges
	Sales results (10%)	Sales capacity of the solutions proposed in the challenge
Transversal assessment (40%)	Cross memory (50%)	Level of writing and structuring of the memory
	Final presentation (50%)	Evaluation of the final presentation of the challenge

4. Conclusions

These educational and teaching activities demonstrated that CBL as a pedagogical method can be applied to logistics and operations management education and can effectively promote independence in learning, positivity and cooperation among students. This gives MUDOLP students the opportunity to explore the challenge with an experiential learning model, focused

on solving a real-world problem and proposing creative solutions. It has also offered students a dynamic of participation and confidence that has increased as the challenge progresses. All of this generates a positive expectation on the part of students and instructors towards the applied model (Lara-Prieto et al., 2023). In addition, it has been found that CBL provides MUDOLP students with a foundation for developing project management, communication and coordination skills (Woschank et al., 2022), as well as skills related to industrial process variability analysis, continuous improvement modeling, sustainable manufacturing, people-centered manufacturing and Lean Six Sigma methods, as a basis for developing the differential problem solving task described in Table 1. These are all important characteristics that company operations managers must possess to achieve operational excellence. In summary, the CBL is a learning strategy that can help MUDOLP students to have the necessary 21st century skills to solve the problems they face in the complex manufacturing environment in order to achieve excellence in industrial processes.

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Problem-based, research-led learning for our times: The case of Vertically Integrated Projects in higher education

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Abstract

Vertically Integrated Projects (VIPs) are a novel method to embed problem-based research education in the curriculum in higher education. Students become part of student and staff research teams working on long-term research projects led by University Principal Investigators. The aim of this paper is to provide a description of how VIPs have been developed at the University of Galway and to explore student experiences of participation. Two semi-structured focus groups were conducted with nineteen undergraduate students who had completed their first VIP module. Interviews were transcribed verbatim and analyzed to identify key themes. Four key themes were developed: Increased understanding and awareness of research skills, approaches and resources; enhanced communication skills; improved organizational and project management skills; and becoming more "work ready". This study demonstrates the value of VIP in enhancing research knowledge and skills and supporting students to develop broader skills that are transferrable to their future careers.

Keywords: *Vertically Integrated Projects; Self-efficacy; Innovative Undergraduate Learning; Research Skills; Experiential Learning.*

1. Introduction

According to Kloeg (2023) "problem-based learning is not quite in its young years anymore: as an innovative approach to education, it stands to reason that it should continue to develop in response to our ever-changing world and the challenges that come with it" (p.93). An innovative project within the University of Galway has been working to introduce a new problem-based learning initiative, called Vertically Integrated Projects (VIPs), as part of its undergraduate

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provision. The VIP approach was developed at Purdue University in 2001 within the Engineering Department. VIPs have a number of key components (Coyle et al, 2006; Sonnenberg Klein et al., 2017, Strachen et al., 2019). These are that the projects are based in active research projects currently ongoing by university staff, that the projects are running over a number of years, that they involve a reasonably large team of staff, that the teams are multi-disciplinary and that students work together in teams regardless of their year in college. Students also receive credit within their curriculum for their work. Finally, students can take part over a number of semesters in different roles so that they get a full, rounded experience The term "Vertically Integrated" refers to VIP team compositions, which can include undergraduate, postgraduate (taught) and research students in addition to university staff.

The opportunity to implement the VIP initiative in the University was made possible through the awarding of national funding for five years, (2020-2025), through the Human Capital Initiative (Higher Education Authority, 2020). The VIP programme has been developed to enhance the employability of university graduates by offering additional practical and creative teaching, learning and skills development alongside traditional degree studies.

VIPs in Galway are credit-bearing modules where students work in teams with academic researchers on multidisciplinary, longitudinal research projects to address grand challenges. This project represents the first time the VIP teaching approach has been deployed in an Irish context. As part of the implementation process, the University has become a member of the international VIP Consortium led by Georgia Institute of Technology, USA[1]. This paper provides an overview of the key features of how the VIP programme is being implemented at present at the University of Galway. This paper also aims to explore student experiences of participating in the introductory VIP module during the first year of VIP implementation at the University. Our findings will then be contextualized within relevant teaching and learning literature.

2. Methods

2.1. Description of the VIP Programme at the University of Galway

The VIP programme at the University of Galway has initially been set up to target 2nd and 3rd year undergraduate students. Two 5ECTs modules are available to students. VIP 1 is the introductory module where students join VIP for the first time. Students have the option then of completing a further VIP module which is focused on developing students' research leadership skills. Within this paper, we are describing students' experiences of participating in our VIP1

[1] For more information , see VIP Consortium Website

module in the first two semesters that we ran this module. The learning outcomes of the VIP 1 module are as follows:

On successful completion of this module the learner will be able to:

1. Describe the VIP programme and its relevance to your development.
2. Plan workload in order to deliver research tasks on time and within budget.
3. Interact with others to understand their research-related requirements.
4. Record work in a way that meets professional research standards.
5. Present research in a variety of forms to a professional standard.

In VIP1, students had three sets of regular commitments to make up the contact hours for this course. Each week, a one-hour lecture on research methods and approaches is delivered by the VIP coordinator. Secondly, students arrange up to six hours contact time with the Principal Investigator (PI) of their assigned research project. Thirdly, the group of students working together on the VIP project arrange separate times to meet up and progress assigned group work. The assessment requirements has three aspects. Students have to develop a group presentation based on their work, (10%); each research team have to complete a 1200-word research report on their project, (40%) and each individual student is asked to complete an individual personal reflection documenting the skills and dispositions they developed during VIP1, (50%). A number of core topics are taught in weekly classes including VIP module orientation, introduction to research design, preparation for teamwork, presentation skills, academic and literature reviewing. Specific topics were also introduced where there was a need to support particular work that project teams were doing.

2.2 Overview of VIP Projects

A recruitment campaign was undertaken to identify academic research projects within the university who would like to engage in this VIP initiative. The VIP coordinator circulated an all-staff e-mail, provided newsletter and website updates and set up individual meetings with potential PIs. The outcome of this process was the setting up of 13 VIP projects which are available to view on the University of Galway Designing Futures VIP website. During the first two semesters of VIP1 we allocated students to seven of these projects. The projects ranged from those focused-on data and artificial intelligence, cardiovascular health, perceptions of environmental sounds, mathematical education in the community, neuropsychology, medical device development and enhancing sustainability in small to medium enterprises. These projects also entail collaboration with the wider community, business, and enterprise. Prior to module commencement, students filled in an expression of interest form to match them to a project that suited their interests best. Student teams ranged in size from three to six students.

2.3 Evaluation method

We invited all students who participated in the two introductory VIP modules in 2023 to take part in semi-structured focus groups at the end of each semester to share their experiences of participating in the module. Focus groups were conducted by a postdoctoral researcher who was independent of the VIP teaching team. Focus groups were transcribed verbatim and analyzed using a thematic approach by two researchers who were independent of the students' teaching team (Bruan and Clarke, 2022). The data was analysed thematically in line with the focus group questions which captured student feedback in relation to their experiences whilst participating in the module, what they learned, what they enjoyed and suggestions for improvements. Ethical approval for this study was gained from the University of Galway Research Ethics Committee (Reference Number - 22.08.015). Pseudonyms were used and participants volunteered freely and were reassured that their feedback would be anonymized.

3. Results

19 out of the 34 invited students took part in the end-of-semester focus groups (56% response rate). This included seven males and 12 females. Five of the students were registered on courses in the College of Science and Engineering, 12 were registered on courses with the College of Arts Social Science & Celtic Studies and one was registered on a course with the College of Business, Public Policy and Law. 15 students were in the third year of their degree and four were in the second year of their course. Overall, the students reported that participating in the module was a very positive experience, that it was significantly different from other modules that they had experience of in college and that they would recommend the module to other students. Student feedback is summarised under four key thematic areas below with supporting quotes.

3.1 Increased understanding and awareness of research skills, approaches and resources

A core learning outcome for students was their increased understanding and awareness of research skills, approaches and resources. The students reported that this module did actually increase their skill level in this area as opposed to other more classroom-based modules involving research topics. Some students noted in particular specific skills they practiced such as interviewing skills, online researching, visiting research laboratories. They felt informed and knowledgeable about research resources that would be very useful to them in their future college and work careers. Aisha in recommending VIPs to other students highlights the research skills she has acquired from her participation.

"I would definitely recommend it as one of the better courses into research, writing and learning all that just because like there is no specific course to actually teach you how to do that. Some courses … say they're teaching you how to reference and research and they actually don't. Yeah,

so now I have a nice list of stuff that I can use now for like researching and compared to what I've heard from other courses. In terms of advice for other students, I'd say just go for it". (Aisha)

3.2 Enhanced communication skills

Students reported that participation in the VIP also provided them with many opportunities to improve their communication skills, whether through interacting with team members, researchers, in delivering presentations or in working with external community members. Across the feedback there was a recognition that this module enhanced student confidence and skills in working with people from different backgrounds and perspectives. Tara explains how she found having to speak in public 'daunting' yet it turned out to be a good experience and 'surprised' herself;

"I think for like speaking publicly like for example with the brain week, that we did that was something that I never thought that I could do. For me that was really daunting but it ended up being a really good experience. So far people like me, they like saw that as something that they were going to do that they shouldn't think that. Oh, I can't do that because you actually have surprised yourself. Like you learn new things in that way". (Tara)

3.3. Improved organizational and project management skills

A benefit of the cross disciplinary approach was the requirement that students develop their organisation and project management skills in order to complete group tasks and meet deadlines. As such, improved project management skills were identified by students as an outcome of their participation in the VIP. Jason explains how this was his first group work experience in university was challenging but rewarding

"I really enjoyed this well the group work aspect of the project. The fact that you know for three or four years, whatever you're working on your own, everything all the time and you get into an environment, we're spending the whole semester trying to work through challenges that come with that. It's sort of like a job environment to an extent, you know. So, I think it's really good just to experience on that side of things". (Jason)

3.4 Becoming more "work ready"

Finally, students reported that this module required them to develop their "work ready" skills, such as business etiquette, time management, being prepared for meetings, etc. The nature of the project work where students had to represent their work to external stakeholders required them to be aware of presenting as a "worker" rather than in a student role. These opportunities for learning which would benefit them as they transitioned into the workplace after college included practical tasks such as setting a meeting agenda, taking minutes so everyone know

what they are doing and the importance of turning up on time for meetings as Paddy and Surya explain;

"Set the agenda for every meeting. Oftentimes, when you meet the person, things can derail. It's better to set an agenda beforehand and make sure everyone knows in advance". (Paddy)

"Write up a plan or like make sure you take notes during the meeting so that you know who's doing what task and you're not confused as to what to do so". (Surya)

4. Discussion

This paper aimed to provide an overview of the initial implementation of VIP at the University of Galway, provide context for those wishing to adopt similar approaches in their universities. It also aimed to provide an insight into student experiences of participating in our introductory VIP module. Students reported that participation supported them in four key ways – by increasing their understanding and awareness of research skills, approaches and resources, enhancing their communication skills, improving their organisational and project management skills and supporting them to become more "work ready". These findings will be discussed now in relation to relevant teaching and learning literature.

The VIP model resonates well with the central tenets of adult learning. According to Knowles (1980), the adult learner has: increasing desires to be self-directed; significant life experiences which shapes their learning and may attach more meaning to experiential learning; are more likely to be motivated to learn when they can see how learning applies to their own life context; and are more inclined to be performance-orientated in their learning. On the VIP programme self-directedness is encouraged from the outset. Prior to starting the module, students fill in an expression of interest form to indicate their VIP project preferences. This element of choice supports self-determination. Students are encouraged in their expression of interest forms to indicate what skills/experience they bring to the projects, affirming their previous life experiences and supporting them to recognise how they can add value to the project teams. To keep learning as relevant as possible, students are asked on their expression of interest form to note any skills/topics they would like to develop in weekly classroom sessions and the class topic list through conversations and anonymous class surveys.

It is clear from the focus group analysis that students highly value the experiential, practical or problem-based approach to learning which facilitated them to deepen their understanding of research skills, approaches and resources. In the design of student assessments on the VIP programme, we have also tried to provide an opportunity for students not only to demonstrate the research-related work they have competed (in the team project report) but to reflect on what skills and dispositions they have developed and how this learning will support them in future (in their individual reflection assignment). Therefore, throughout the module, students are

encouraged to think about their adult experiences and the skills that will be relevant to their future lives and development. Their ability to reflect on the skills and dispositions they have developed is particularly evident in the themes in our analysis focused on how students felt they developed communication skills, project management and organisational skills and recognized how the module had helped prepare them for their future professional careers.

VIP modules resonate quite strongly with Barnett and Coate's (2005) conceptualisation of the three core components of curriculum: 'knowing', 'acting' and 'being'. Students are supported to gain knowledge on how research works with their VIP lecturer and PI's, to act as a researcher themselves in a research team; and to reflect on how their experience would support their 'being' in their future lives/careers through the skills and dispositions they have developed. O'Neil and McMahon (2005) outline three components of student focused learning – promoting interaction, allowing choice and devolving power. In VIP, interaction is promoted in lectures by trying as much as possible to flip the classroom and start with discussions on how teamwork is going and then focusing on any content aspects. Students spend 12 hours of the semester in team meetings with their student teammates and PI's. Within project teams, PIs are also encouraged to match the team activities to students' interests and previous skills/experiences. This also helps to devolve power and further supports the personalization of the student's learning experience.

5. Conclusion

VIPs provide a valuable pedagogical approach for integrating research and teaching in Higher Education. Coate, Barnett, and Williams (2001) advocate for research-based teaching because of the synergies derived of integrating research and teaching. Engaging students in research can ensure their learning experience remains current and compelling, focusing on important contemporary issues in science and society; while teaching offers an important context for the communication, discussion, and development of research. Furthermore, the composition of the VIPs, where students and faculty work shoulder-to-shoulder on research projects embodies Mann's (2007) reconceptualisation of the lecturer-student dyad, where the relationship becomes one of solidarity, rather than hierarchy. Fung's (2017) model of the *connected curriculum* advocates for research-based education that engages with key contemporary issues and interacts with the wider community. The innovative VIPs that have been developed at University of Galway are helping to support a whole new approach to student learning, predicated on their interests and engaging them in compelling and dynamic learning about key contemporary issues in science and society.

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Learning Format Innovation - A Conceptual Framework

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Abstract

This study engages in the identified research gap of a conceptual framework to systematically develop learning format innovation projects. The so-called "Learning Format Innovation" (short: LFI) approach provides a structured five-phase model that serves as a conceptual guide for the development of any type of new learning format.

LFI starts with the analysis of the enacted learning approach followed by the conceptualisation of the intended new learning format. Then the intended format becomes translated into concrete touch point experiences along the main constituents. In phase four the materialization into the new learning format takes place. During the final phase the effectiveness and resonance of the evolving new format is evaluated and necessary adaptations are identified. A case study of the transition of an established "semi-active" learning approach into a new "blended immersive AI supported" learning format is prototypically used to illustrate the application of the designed approach.

Keywords: *learning format innovation, enacted and intended learning format, touch-point experiences, materialization, blended immersive AI supported learning.*

1. Introduction

Although a great number of studies show the benefits of active learning over the conventional ways, traditional teaching methods still dominate the classroom. The overall outcome of the traditional approach is that only a small percentage of students have all the attributes needed to learn effectively and successfully in this lecture format. In contrast the active approach engages more students in the learning process and is more effective in constructing and synthesizing concepts (Kovarik, Robinson, and Wenzel, 2022).

For almost two decades, educators have been advocating for transformative innovation (Karyne, Afzal, and Crawford, 2021; Sasson et al. 2021) in higher education that incorporate new versions

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of active learning, today and in the future appropriately supported by artificial intelligence approaches (Holmes & Tuomi, 2022).

Still a systematic approach which guides instructors from a thorough analysis of the strengths and weaknesses of the established, often more "instructor-led " learning approaches towards highly active 'student-centered' AI integrating learning formats, seems missing.

The current research aims at filling that gap by designing and testing a conceptual framework that helps instructors together with other relevant system partners to identify and translate an intended learning format into multiple coherent touch-point experiences in order to generate effective learning results and positive resonance among affected learners and recruiting responsibles (Botschen and Muelbacher, 2019; Court, Elzinga, and Mulder, S., 2009).

The development of the LFI framework applies the design science research approach proposed by Hevner et al. (2004), whereby an innovative, purposeful artifact for a special problem domain is created. The authors test the usefulness of the framework in an innovative project whereby a rather semi-active learning approach of two courses in retail management becomes transferred into a blended immersive learning format supported by AI tools.

The following section outlines some theoretical principles that ground our conceptual framework based on relevant literature in the field of organizational brand identity development and touch-point experiences. In section 3 the authors develop the conceptual framework followed by its application in an innovative learning case in section 4. The paper finishes in section 5 and section 6 with a discussion of theoretical and educational implications of the research, limitations and summarizing conclusions.

2. Learning Format and Touchpoint Experiences

In order to more precisely clarify the rather vague term of a learning approach the authors introduce the construct of the learning format. The latter is derived from the retailing discipline, where a retail format is the offline or online "store package" that the retailer presents to the shopper and where the vendor interacts along pre-determined touch-points with the customer (Enders, and Tawfik, 2000). Beside its look and layout, it includes elements of the retail mix such as assortment, pricing, promotion and so forth (Drexel,1981; Messinger and Chakravarthi, 1997; Levy and Weitz, 2008). In general, a retail format is a combination of different levels of retail services such as information, accessibility, assortment, ambience, and delivery speed (Gauri et al., 2021; Botschen and Wegerer, 2017). Hence, the authors specify a learning format as the offline or online "learning package" along their main constituents that instructors present to students and where instructors interact at pre-determined touch-points with the learners (Enders, and Tawfik, 2000). Beside the particular learning space, touch point experiences (Brakus, Schmitt, and Zarantonello, 2009) include methods of lecturing, assignments, guest-

speakers, excursions, application of AI tools, project work, feedback mechanisms, celebrations etc.

3. The conceptual LFI framework

Figure 1 shows the conceptual framework "Learning Format Innovation" (LFI) as a continuous circular process consisting of five phases derived from our retail format innovation approach (Botschen & Wegerer, 2017).

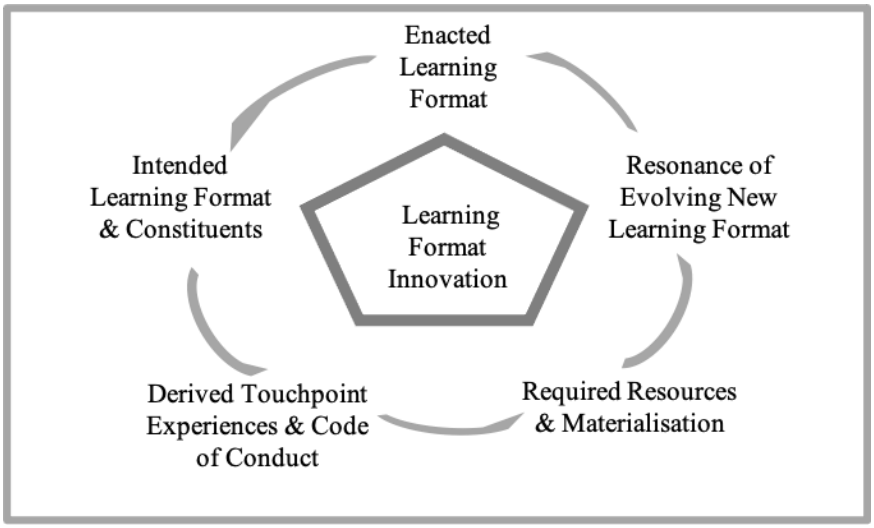


Figure 1. Conceptual Framework of LFI

The five phases of the LFI framework are defined as:

a) *Enacted Learning Format* – Identification of positive and negative patterns of resonance behind the established learning format, expressed from the perspectives of affected students and alumnis, involved lecturers, potential recruiters and entrepreneurs plus studies concerning the same or similar learning approaches.
b) *Intended Learning Format, Constituents & Principles* – Development of the guiding strategic frame for the new intended learning format consisting of the driving core competence and attracting value fields, expressed in active learning dimensions, derived constituents and their guiding core principles.
c) *Touchpoint experiences* - The transformation of the intended learning format and their main constituents into the most effective learning touchpoint experiences for students

and instructors which shape and determine all elements, typically content and style, assignments and applications.

d) *Code of Conduct and Materialisation* - Aligning insructor's, employee's and student's behaviors, organizational processes and structures in order to materialize the intended touchpoint experiences of the new learning format.

e) *Effectiveness and Resonance of Evolving New Learning Format* – The learning results and resonance of affected participants are continuously monitored and the degree of achievement of specified touchpoint experiences is controlled. Necessary modifications and improvements become constantly implemented.

How these five basic elements interconnect in detail and what processes are at work, is described along our prototypical case "From a Semi-active Learning Approach to a Blended Immersive-AI supported Learning Format".

4. Prototypical Case Study – From a semi-active learning towards a blended immersive learning AI supported format

4.1. Phase 1: Analyzing the status quo of the enacted learning approach

The Covid driven 2020/2021 digital online-move inspired us to question and redesign our established teaching and learning approach of two retail management courses in the third year of the bachelor of science study. Hence, we decided to perform an analysis of the main drivers of positive and negative resonance from the perspective of different stakeholders, namely affected students and alumnis, involved lecturers, potential recruiters and entrepreneurs. Therefor we conducted focus groups and in-depth interviews with convenient samples of the five stakeholder segments. For the interviews we applied a semistructured interview guide. Stories and anecdotes of contact point experiences created a deeper understanding of underlying patterns of positive, negative or missing resonance. Table 1 illustrates the main positive (left side of Table 1) and negative (right side of Table 1) resonance drivers across the five target groups for the basic and advanced course.

In summary we observed a deficit of practical applications which all interviewes observed. The lecturing style and exams mode seemed to have little impact on enduring learning effectiveness. A balanced use of online- and offline learning appears to be appropriate.

Table 1: Positive and negative drivers of resonance by target groups

Real live project work with companies	Too little feedback during the phases
Guest-speakers & excursions give deep insights into practical requirements	Separated between the two courses
The BOID Approach, holistically guiding all functions and activities in retail companies	Too little practical application
Presentating and facilitating by student groups	Entrance and final exams, which focus on repetitive instead of applied knowledge
Mixture of on- and offline plus block events	Monoton teaching environment, to much online is demanding and boring as well
Good accessibilty and support of lecturers	Too much frontal lecturing and too little integration of AI tools – smart phone, chat.gpt
	Little personal interaction between all students

4.2. Phase 2: Intended learning format & constituents

Based on the analysis of the enacted learning format, the future learnig format became developed. Our semi-active learning approach in the two courses of retail management was transferred into a blended immersive learning format (Alonso, F., 2005; Thorne, K. 2003; Bersin, J. (2004) supported by AI tools and techniques (Zawacki-Richter et al.,2019). The two courses were integrated concerning guests, excursions and project work. Approximately fifty percent of the two courses will be online and fifty percent presence in class.

4.3. Phase 3: Translating the new learning format into multisensory touchpoint experiences along the main constituents

In this phase the intended blended immersive learning approach became translated into multisensory touchpoint experiences along the main constituents (Reynolds, Howard, Cuthbertson and Hristov, 2007; Botschen, Combe and Thelen, 2014; Botschen et. al, 2016).

Examples of important constituents that embody touchpoint experiences of the new learning format are given below:

Location and schedule – To disrupt the monotony of the lecture hall at the university students experienced different locations during several excursions, presentations at a coffee house of a lecturer, starting and final session at the project ordering company and project coachings online. The integrated two courses were organized into ten block events per semester consisting of an introduction, organisation and briefing session, followed by four block sessions with four guests, four online meetings with four company excursions, and a final block event for presenting project results, and enjoying culinary and celebrations.

Lectures – The rather frontal lectures were transformed into student sessions, where teams had to prepare, present and reflect with their colleagues three prespecified course topics. For one

session every team had to prepare a video clip which was uploaded and accessible on YouTube. The responsible lecturers coached the teams in the preparation phase and added important content after the teams presentations in class. To activate discussions and critical reflections students received for every sensemaking comment a "golden coin".

Project – The semester company project, typically consisting of an analysis phase followed by proposals for solving the identified problema, became processed by team members of both courses. Theoretical approaches and conceptual tools werde directly applied during the project work.

Guest-speakers and excursions - Four guests gave inspiring insights into their company work, strategically and operatively, ideally linked to the sessions particular content. Four companies were explored by all students during excursions.

Assignments - The entrance and final exam were substituted by a learning journal where students had to reflect all sessions, guest talks and excursions, the applied project work and were asked to provide an open ended overall course evaluation.

4.4. Phase 4: Materializing the new learning format

In phase 4 selected intended touch point experiences of the new retail format were materialized through the processes and behavioral principles - the code of conduct - for achieving and reproducing the intended touchpoint experiences. Ideally any modification and optimization of structure, processes or behaviour are driven by the intended touch point results of the particular constituent and not the other way around. In our case the new format was implemented during the summer and winter semester 2023.

4.5. Phase 5: Resonance, learnings and implications

The move from our instructor led semi-active learning approach into a more student driven, blended immersive learning format created strong positive resonance from students, involved lecturers and affected practitcioners. Students particularily appreciated the applied and practice oriented approach, the new assignments where they got the role of lecturers and moderators, as well as joint work of basic and advanced course members for the company projects. The integrative usage of smart phones worked out well, the application of chat.gpt versions needs to be improved in coming courses.

In summary the application of the newly developed LFI approach seems to be worthwile to be tested in other course modifications. Ours is just the first trial and needs to be proved in other contexts.

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Fostering Critical Thinking and Different Perspective Taking in Sustainability Management Education through Role-Play and a Cross-Semester Case Study

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Abstract

In this paper we present a teaching approach offered to sixth-semester students pursuing a Bachelor's degree in Business Administration at a German University of Applied Sciences, who have chosen Environment and Sustainability Management as one of their electives. The sustainable management course is designed to equip future (sustainability) managers with the knowledge, skills, and tools necessary to incorporate ecological and societal considerations into their decision-making, publicly and credibly report on them, and foster positive change within their future careers, organizations and industries. The utilization of role-play and the selection of a relevant and familiar case study, designed as a cross-semester approach, aim to enhance motivation and ownership among students and enable them to critically reflect on and evaluate sustainable impacts of business activities. Our work contributes on how teaching on sustainable management can be designed through role-playing and a real-world case study in higher education.

Keywords: *sustainable management education; sustainability reporting sustainability strategy; cross-semester case study; stakeholder analysis; impact assessment.*

1. Introduction

As we face a global climate crisis and an urgent need for more sustainable practices in all industries, higher education institutions have a critical role to play in shaping the next generation of sustainability leaders (Arnold et al., 2021). Yet, as research has shown, the conventional approach used to date to teach content on sustainable management (Cole & Snider, 2019), and the lack of practical experiences among undergraduates, makes it difficult for them to apply management concepts to real-world situations and to transition from theory to practice (Felder & Brent, 2005). To overcome this challenge, we decided to adapt our teaching concept from scratch. Given the complexity and ambiguity of sustainable management, which involves

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tackling challenges often labeled as wicked problems (van Tulder, 2018), we have developed a cross-semester teaching approach that incorporates both role-play and a case study. The primary objective of our sustainable management course is to empower students from diverse business administration disciplines with the skills to analyze and evaluate business decisions from various perspectives regarding their impact on the environment, society, and the economy, while maintaining a critical outlook (Howlett et al., 2016). We opted for a case study that is not only familiar to the students, providing them with a personal connection to it, but also aims to address a real-world need: The students will assume the role of sustainability managers of their university, tasked with developing a raodmap concerning its future sustainability strategy and reporting. Currently, the university has only laid the groundwork for its sustainable management, and there is a need for a structured development of a sustainability strategy along with approaches for reporting.

In this paper, we present our teaching approach, including relevant literature, and show our experiences in how sustainability education can be designed through role-playing and a case study with a cross-semester attempt. Our work contributes on how teaching on sustainable management can be designed through role-playing and a real-world case study in higher education, with the potential to cultivate an active and transformative learning experience.

2. Implementing a case study and role-play

The sustainable management course is intended for 6th-semester students of a 7-semester (210 ECTS) Bachelor's program in Business Administration conducted in German. It is structured with 5 ECTS and 180-minute classes per week. The course underwent a fundemantal redesign for the winter semester of 2022/2023 and is being implemented for the fourth time in the summer semester of 2024, adopting a cross-semester case study approach.

When designing the course, we were able to build upon two prerequsites regarding the auditorium: Firstly, we assumed that students enrolled in our course show inherent motivation to the topic, given that they are required to select two electives from nine distinct business administration disciplines, such as Marketing, Production and Logistics, Entrepreneurship, Taxes, Finance, or – which would be the relevant for our course – Environmental and Sustainability Management. Typically, students undertake their bachelor thesis within one of these chosen disciplines. Due to this semi-voluntary choice, it is anticipated that students bring intrinsic motivation to their selected elective, willingly immersing themselves in learning about the topic (Felder & Brent, 2005). Secondly, there was the capacity to leverage existing knowledge in the field of sustainable management (Vatalis, 2017). Before participating in our course, students engage in foundational courses covering key topics in sustainable management. These courses discuss fundamental sustainability aspects such as definitional basics, planetary boundaries, stakeholder theory, and sustainability reporting. The successful completion of the

elective's foundational courses is a mandatory prerequisite for undertaking the exam in the here described 6th-semester course. Moreover, most of the students acquire practical experience through mandatory internships, with some opting to complete them in the sustainability department of a company. Thereby, in our course, students can build upon foundational knowledge in sustainable management, incorporating theoretical and practical insights from the previous semesters. However, it is important to note that students may not always adhere strictly to the planned and recommended curriculum. As a result, students from various semesters may be present in the course which had to be considered when conceptualizing the course. When formulating our sustainability course, we encountered various challenges we chose to approach as targeted opportunities. They can be grouped into three dimensions:

1) The course aims to consolidate the complex and multidimensional field of sustainable management through a holistic and interdisciplinary approach (Howlett et al., 2016).

2) The course aims to equip students with the skills essential for sustainability managers to enhance their employability (Dacre Pool & Sewell, 2007).

3) The course aims to promote interpersonal competencies and social cohesion among students, which has been particularly challenging during the years of the COVID-19 pandemic and the associated remote lectures (Wildman et al., 2021).

The first challenge led us to focus on two topics of sustainable management, that consolidate the complex field of sustainable management holisticly: strategy and reporting (Lozano et al., 2016). While fundamental concepts of sustainable management are regularly revisited and reinforced in the course, particularly the development of sustainability strategies and how to report on an organization's sustainable management are explored in greater depth. The decisive advantage lies in the interdisciplinary nature of these two aspects of sustainable management. Aiming to consolidate the knowledge the students have gained so far, they can leverage their previously acquired foundational and, where applicable, practical knowledge to apply it in a more nuanced and context-specific manner. In addition, we had to structure the course in a way that would captivate students from various Business Administration disciplines with diverse focuses. Our goal was to ensure that all students recognized the relevance of sustainability thinking in every aspect of a company and across all those disciplines (Howlett et al., 2016). Embracing the opportunity to unite a spectrum of perspectives in the course, we consistently sought to proactively engage and integrate interdisciplinary insights from other electives of the Bachelor's program throughout the sessions. This approach was designed not only to enhance student motivation, but also to bolster their ability to cultivate a holistic understanding of the impacts of business decisions across different departments (Lozano et al., 2016).

The second challenge led us to incorporate role-play and a case study to enhance the employability of students in the realm of sustainability education (Gordon & Thomas, 2018). Research has shown that role-play has the potential to foster an experience-based learning

environment that supports sustainable development and can result in heightened sustainability awareness and actions among students (Vatalis, 2017; Oliver, 2016). Substantiating the contribution of role-play and case studies in educating, we designed the course to include numerous discussions and group activities. Not only did we aim to encourage personal exchanges and connections among the students (Haller et al., 2000), but also to allow students to develop the skills of engaging in constructive exchanges and critically reflecting from diverse perspectives (Howlett et al., 2016; Vatalis, 2017).

The third challenge led us to choose the students' university as the case study as well as to a cross-semester approach. The purpose was to go beyond discipline-specific and operational skills, but to foster interdisciplinary and interpersonal competencies. The choice of a case study focusing on their own university, with relations to personal experiences (Warburton, 2003), aimed to strengthen the feeling of community among the students, which had been compromised by the COVID-19 pandemic and the predominantly remote learning situation for the current enrolled students (Wildman et al., 2021). We also intended to reinforce the idea that students could gain a better understanding of their institution and explore the opportunities available for active participation. It was during this process that we observed a surprising lack of prior knowledge among the students about their own university. The choice of the case study also centered on the university due to an identified real need for development. While students engage playfully in the role of sustainability managers at the university, they are actively working on the non-existent or highly expandable sustainability strategy of the institution. The methods, tools and reporting standards they apply and analyze are not only precisely relevant in practice and visible on the desk of every sustainability manager, but also align with tasks the university is concurrently addressing. To give even more weight to the role-play and case study, and positively impact student motivation, the university's sustainability management team actively participates in specific course sessions. This involvement takes place through guest lectures by university representatives during lectures or by having them attend student final presentations, actively asking questions. We see this as a powerful motivational lever for students, resembling a real-world business meeting with their own superiors.

Furthermore, the course is designed to pass on students' work to their fellow students in the following academic semester, allowing them to build upon the knowledge and results obtained. This should also further strengthen the students' interpersonal relations, aiming to forster motivation and personal employability when building on the work of your peers (Warburton, 2003; Dacre Pool & Sewell, 2007). The first academic semesters also show that it can motivate students to compare their own results with the results of previous semesters and to interpret the reasons for differences. However, the success of the cross-semester approach is dependent on the quality of the students' results and their documentation. For that it is important for us as the lecturer to convey to the students that their work is not solely for getting a good grade, but it has the potential to make a real impact in practice (Felder & Brent, 2005).

3. Adapting a deep approach to learning

Acknowledging that orchestrating a role-play and a case study might be viewed as resource-intensive and necessitates thorough planning, the argument remains that the learning outcomes achieved by students are worthwhile (Gordon & Thomas, 2018). To enhance effectiveness of our efforts and to achieve the learning objectives, we aimed to motivate a deep approach to learning (Felder & Brent, 2005), when conceptualizing the course. Warburton (2003) has identified deep learning as particularly relevant to the field of sustainability education, especially when it promotes principles such as self-directed learning, connection to personal experiences, the use of cooperative and active learning, and students' critical self-reflection, all while recognizing that sustainable development is an ongoing process rather than a fixed set of solutions. We focused on incorporating five aspects to achieve a deep learning approach: 1) Learning in context; 2) Interpreting information rather than repeating; 3) Active learning; 4) Cooperative learning; 5) Alignment. The adaption of the five elemenents during the course are described in the following.

Instead of only repeating acquired knowledge and reproducing it in an exam, in our course students are encouraged to apply theoretical knowledge to the case study, specifically in the context of their university (Element 1), and, as a result, interpret their learnings specific to the context (Element 2) (Felder & Brent, 2005). We not only emphasize and encourage students repeatedly to actively participate and ask questions, but also consistently conduct small group work during sessions (Element 3) (ebd.). This facilitates discussions and interpretation of the material learned, enabling students to apply their understanding to various scenarios and corporate contexts, extending beyond the university's scope. This approach is aimed to activate students to deepen their learning actively, collaboratively solve questions with other students, and ultimately prepare students to actively participate in effective teamwork in their future careers (Haller et al., 2000). Additionally, throughout the academic semester, various collaborative work phases are implemented during lessons (Element 4). For instance, students collaboratively develop a stakeholder analysis and a materiality analysis, with the supervision and support of the lecturer. Further, the final course assessment includes a group component, emphasizing the importance of collaborative effort to ensure each team member is responsible for meeting the learning objectives linked to the assignment (Felder & Brent, 2005; Haller et al., 2000). Crucial for adopting a deep approach to learning, topics related to the case study are not only regularly explored, but there is also continuous reference to the requirements of the assessment throughout the semester (Element 5). This involves not only reviewing what students have learned and its implications for the case study but also providing a perspective on where the journey is heading and how the acquired theoretical knowledge could influence the students’ upcoming assessments. It is constantly emphasized that the results of the collaborative work phases during the semester and the outcomes of the students' assessments are relevant to the real world, in our case to the university’s leadership.

Additionally, the course assignment aims to strongly emphasis on conceptual understanding while minimizing rote memorization (Felder & Brent, 2005). The students have two exam components, each weighted equally at 50 points, contributing to the overall grade of the students: An individual written exam covering on one hand the theoretical inputs, where we assess key fundamentals of sustainable management, particularly focusing on the topics strategy and reporting; And on the other hand covering questions related to the conducted collaborative working phases, requiring students to critically reflect on jointly developed outcomes and approaches during these working phases. This is designed to support memorization to some extent but also to reward those who were present and actively engaged during the sessions. The other 50-points-component involves a collaborative group presentation where each group concentrates on a chosen reporting standard, along with a corresponding status quo and gap-analysis of the university's sustainable management. As a group of four to six students, they select from five reporting standards and frameworks predefined by the lecturers (GRI, DNK, SDGs, UNGC, ESRS). Throughout the semester, students consistently apply their acquired theoretical knowledge to their chosen standard or framework, always considering the question: What does this mean for the case study, namely, the university? These standards and frameworks not only cover aspects of sustainability comprehensively, proving highly relevant to practice, but also provide additional support to students in understanding the essence of sustainable management, the skills required for a sustainability manager, and the goals that must be set and achieved by an organization. Students face the challenge of collectively managing the sheer complexity of the standards and frameworks, while critically reflecting on what goals and measures for an organization, specifically their university, might be appropriate and how they can be prioritized and implemented effectively.

4. Conclusion

Upon reviewing our teaching approach, we understand it as an effective model for educating and preparing future managers in sustainable business practices. It could be replicated in other universities and educational institutions to foster sustainability practices within the business community. After completion of an academic semester, we gather oral feedback from the students and reflect on what worked well and what aspects of the course concept could be enhanced. Based on this feedback, we incorporated more active group work and included review sessions throughout the semester to keep students engaged and provide moments for reflection. We also identified needs to further adjust our approach in refining our expectations and allocating more class time for the student groups to collaborate on their assignments.

For the upcoming semesters of our course, we aim to further amplify the role-play concept. We recognize that the students have difficulties to fully immerse themselves in the scenario as sustainability managers where the university entrusted them with a specific task to solve within a designated timeframe. For instance, we plan to involve university members more often

throughout the semester, e.g. at its very beginning by having them deliver the assignment in the lecture instead of us as lecturers, and interim to reflect on first results and discussing questions with university officials to provide students with reassurance regarding their assignments.

We also recognize the need to intensify the cross-semester approach. We plan for an in-depth validation of the previous iterations and results to integrate them comprehensively and from an overarching perspective, including reflecting on them for practice relevance with university officials. While this will require resources and capacities, we perceive added value in the cross-semester approach for both the learning objectives and the practical application within the university, aiming for closer collaboration and synergies with the university.

With a practical outlook, we aim to integrate software solutions into the lecture and potentially incorporate them into the group assignments. Proficiency in software solutions is highly relevant in practice, and it can help simplify the complexity that students may face when engaging with the reporting standards and frameworks. We are considering tools such as AI-supported tools or metric data collection.

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Impact of Reflection on Individual and Team Performance in Student Team Projects

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Abstract

Higher education is increasingly adopting project-based courses to prepare students for dynamic work environments, yet this approach may overwhelm students and impact motivation and group success. To address this, two undergraduate courses, an undergraduate IT project-based course and an undergraduate material science course, introduced mandatory reflective practices, focusing on self-reflection aligned with Kolb's Learning Cycle. The study aimed to assess if these reflections led to changes in cooperation methods and communication skills, benefiting learning outcomes. Despite initial resistance, students recognized the positive impact on communication and task clarification. While no direct correlation was found between reflection and individual project assessments, a slight connection emerged between improved group time management and higher grades. Additionally, first-year engineering students tended to be overly confident in self-assessment, prompting the need for instructor awareness of student variations for better outcomes in group projects.

Keywords: *inverted classroom, flipped classroom, online teaching, unprepared students.*

1. Introduction

Project-based learning is an educational approach that emphasizes student-centered learning, collaboration, and problem-solving in real-world contexts: Sjølie, Espenes, Buø (2022). It is known for igniting students' intrinsic motivation and promoting profound learning outcomes: Cuseo (1992; Siegeris and Pfennig (2023). Additionally, it enhances interpersonal and interaction skills: Muller (1989) and aligns with the shift towards competency-based education.

As project-based learning gains traction in higher education, there's a need to reevaluate student assessment methods. Self-reflection is suggested as a potential assessment criterion: Bohd, (2015); Goel (2017).

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In project-based learning, group processing is crucial for collaborative learning, with team members engaging in critical discussions and self-organized teams: Sjølie, Espenes, Buø (2022); Johnson & Johnson (2009). They continually evaluate their work through team reflection: Kneisel (2020), adjust and improve their workflow, and anticipate adverse consequences: Sjølie, Espenes, Buø (2022; Edmondson (1999). Team reflection is also valuable in online project work, supporting adaptability to online environments: Sjølie, Espenes, Buø, (2022).

High-achieving students use self-reflection for formative and summative purposes, improving their ability to meet teachers' expectations: (Bohd, 2015). Training in reflective strategies has been shown to enhance test performance: (Schneider, 1986). In engineering courses, combining team effort and portfolio assessment provides deeper insights into students' learning (Cress and Cress, 1995). Reflective practices in arts education and reading curricula contribute to individual learning and professional development: (Carpe, 2019). Self-reflection offers detailed feedback but may require additional effort: (Coertjens, 2021).

Despite the potential benefits of self-reflective practices, empirical studies on their impact on academic achievement are limited, especially in project-based group courses. The role of self-reflection in individual student performance needs further research as educators sometimes overlook the student's central role in the learning process.

2. Linking reflection to learning

The levels of reflection encompass a range of depth, with various reflective models, as outlined by Moon (2004) and elaborated by Dowling (2019). It's essential to note that a comprehensive reflection often incorporates elements from these levels. However, to attain a truly "insightful" reflection, it's imperative that the depth of reflection reaches an "analytical" or "concluding" level, as emphasized by Dowling (2019). Kolb's Learning Cycle, as discussed earlier: Siegeris and Pfennig (2023) connects reflective practice to the learning process, where reflection serves as one of the four stages: concrete experience, reflective observation, abstract conceptualization and active experimentation (figure 1).

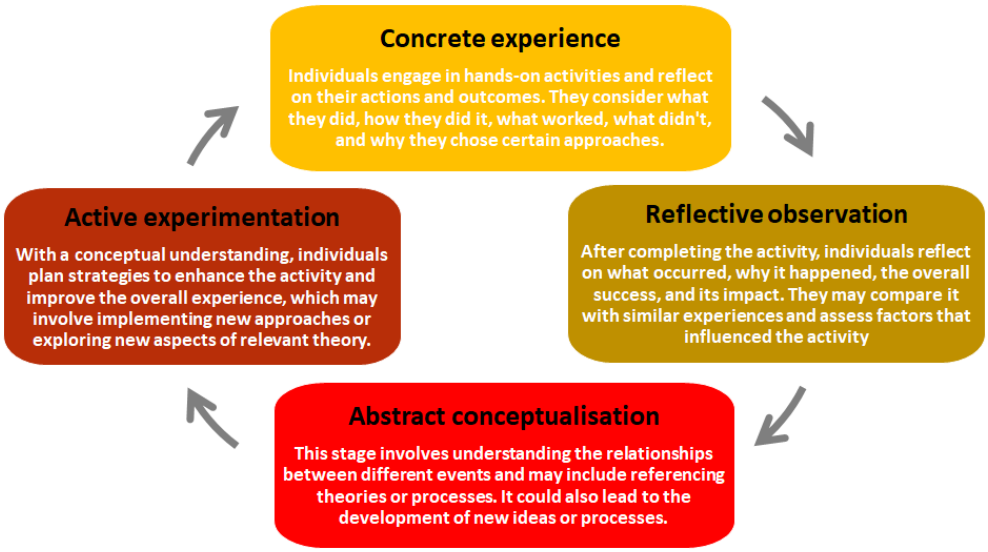


Figure 1: Kolb's Learning Cycle demonstrates four stages in the learning process: A concrete experience is followed by a reflective observation what occurred. After trying to understand what occurred and why, the final step tests the understanding in experimentation. Source: Adapted from Kolb (1984 p. 42) in: Dowling (2019).

In this practical course, the authors investigated whether self-reflection has a positive impact on group performance and the individual learning progress in a project-based course: Siegeris and Pfennig (2023) and will now focus on the impact of reflection on individual student assessment. The authors are specifically focused on Step 4 of the Kolb Reflective Learning Cycle encouraging an ongoing process repeating the 4 steps throughout the project.

3. Reflection as means of improving group performance and individual grades

The reflection cycle is applied in two distinct courses at HTW Berlin: an IT project course and introductory course-level Materials Science course. Both conceptual set-ups and the reflection process have been described earlier: Siegeris and Pfennig (2023). The main difference in learning outcomes are that in the IT project course, the primary objective is to enable students to undertake self-organized projects within teams comprising five to eight students. In the Mechanical Engineering course, students research, develop, write, design, and create educational materials on a topic of their choice within the field covered in an introductory material science course. Groups in this course typically consist of 2 to 3 students. In summary, both courses utilize the reflection cycle, but they differ in their objectives and project structures. The IT project course focuses on practical, real-world applications, while the Materials Science course emphasizes the creation of educational materials within a peer-to-peer learning framework.

Both project courses are demanding and rely on the motivation of individual students and their ability to work effectively in groups. While students have the freedom to choose their projects, fostering successful teamwork in a university context can be challenging. The authors propose a hypothesis: introducing a reflection process that focuses on cooperation, teamwork, and the final product could lead to improvements. Students are required to submit written reflections as part of their project work, with specific prompts provided. This approach aims to enhance collaboration in subsequent phases of teamwork, solve conflicts within the group and improve the project outcome.

1. **Concrete experience:** What is the current cooperation framework, and are there any conflicts?
2. **Reflective observation:** Evaluate your own contributions to the ongoing cooperation.
3. **Abstract conceptualization:** How well does the framework work for you and the team? Reflect on the setting and own contributions to the ongoing cooperation. Reflect on the impact of rules set by the team, cooperation, communication, individual and group performance, the individual micro task as well as individual and group time management
4. **Active experimentation:** Consider possible reactions and suggestions for improvement. What would you do differently next time?

Students submitted their reflections to an impartial person who assured confidentiality. Grading was based on the outcome of the project work, extra credit was given for the reflection. However, a drawback of this method is that the content could not be directly used by supervisors to address conflicts. Instead, students were encouraged to apply their insights to resolve issues.

4. Evaluation

A critical analysis of the method revealed that students faced challenges with the reflection task. They struggled to engage honestly, reflect on their own contributions critically, and encountered difficulties with the writing process. Evaluating the written reflections and their evolution over time, four observations emerged:

1. Problem Description Accuracy: Students often provided vague problem descriptions, using phrases like "communication does not work" or "I just can`t get focussed."
2. Own Contribution: Some students merely listed their tasks without delving into their contribution to the problematic situation or conflict. Most of the engineering students were proud and confident upon their individual performance (Figure 1).
3. Analysis of Conflict Situation: only over time students became more critical of their own contributions. Especially engineering students reported their weaknesses which were mostly related to poor time management and missing reporting to their team member(s).

4. Proposed Solutions: Improving communication, updating task statuses, or starting work on specific tasks from the beginning, assigning micro milestones and meet more often to discuss work in progress were found to be the most desirable learning actions considering group performance.

In both projects in summer semester of 2023, it became apparent that most problems could be traced back to communication challenges. Students found the reflections mostly time consuming and most of them did not directly rate these as beneficial for the project outcome. Later (2nd and 3rd reflection cycle), they recognized its positive impact on communication and task clarification. Due to the nature of the different course settings the project results of the IT course could not be related to any of the reflective statements as too many stakeholders are involved. For the more homogeneous setting of the Materials Science course the main issues addressed in the students` reflections were carefully outlined by lecturers after the course (grading was accomplished) and appointed to weighted numbers (0 (poor) to 10 (outstanding)) based on wording, emotional involvement and rational statements.

First year engineering students tend to be overconfident with their situation in general and their contribution to the team work as they reflect mostly very content on each of the specific promts in their reflection sheets (see above) that have been transferred to the main issues that were illustrated infigure 2. It seems that first year students` evaluation of their overall performance, team behaviour and communications skills strongly deviate from the actual learning outcome. Possible reasons for this overconfidence include limited project work experience, potentially receiving unrealistic praise during high school, or having a generally positive attitude towards scientific teamwork. Lecturers need to be aware that personality and course performance may deviate strongly and students need guidance towards satisfying results in project group work.

Regarding rules, micro tasks, communication, cooperation, and scientific performance as well as individual time management there is no correlation to the individual project assessment (figure 2).

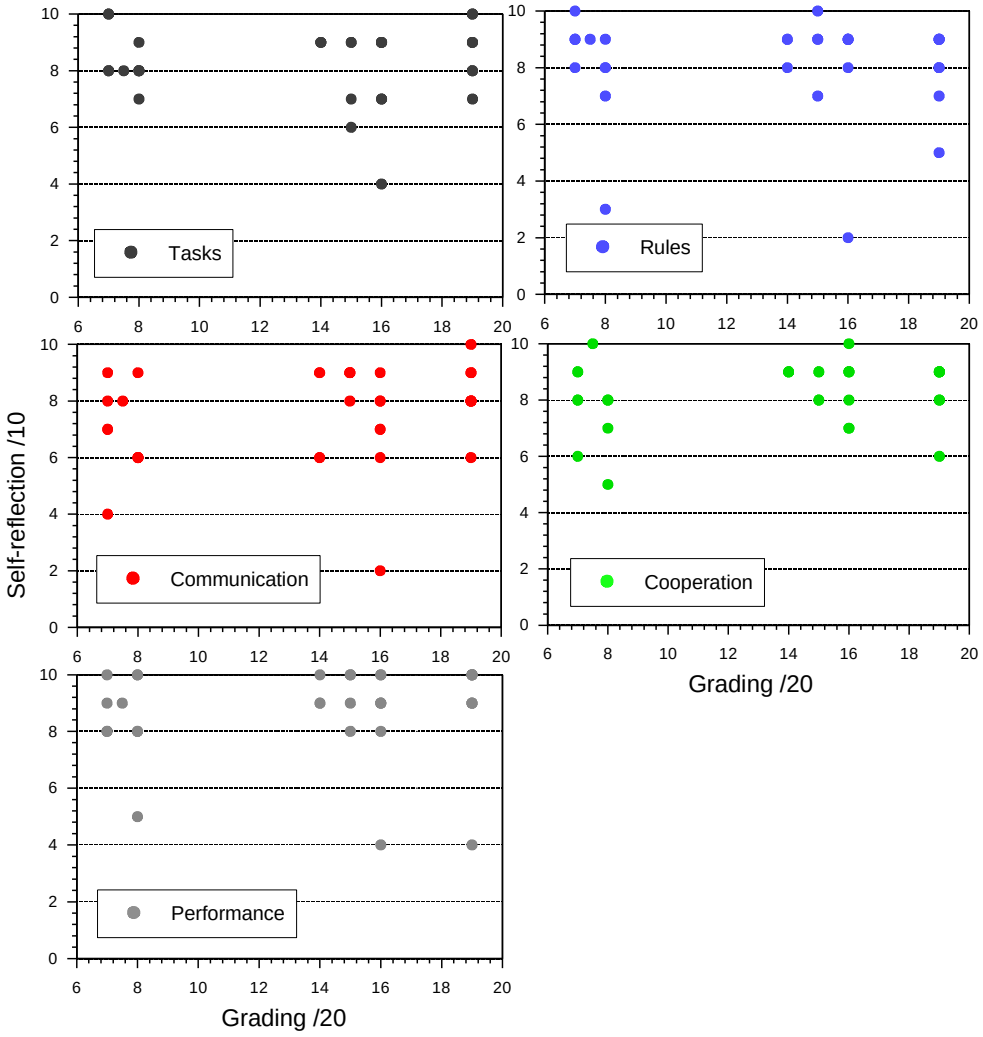


Figure 2. Influence of the individual reflection of students upon tasks, rules, communication, cooperation and individual performance on the project outcome. (0 poor, 10 outstanding)

There is a slight dependence of enhanced group and time management on improved grades (figure 3). Student groups with better time management (deadlines, milestones, informal meetings, etc.) score higher than groups with poor time management. An interesting observation is that even students who believe they are good at time management rate group time management less satisfactorily, leading to the question of why they can't improve group time management despite their individual skills.

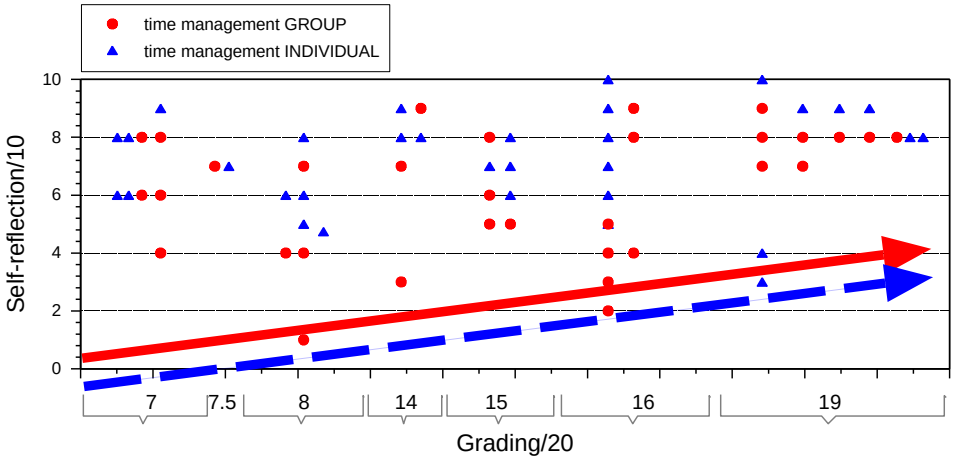


Figure 3. Influence of the individual reflection upon individual and group time management on the project outcome. Students with better group time management scored higher.

5. Conclusion

In two different courses, an undergraduate project-based IT course and an undergraduate first year material science course, reflection cycles were introduced to improve group performance and individual learning. Students' reflections were given extra credit based on critical thinking and self-reflection rather than content or course success. The evaluations were conducted anonymously by the cooperating lecturer. The aim was to understand the impact of reflections on cooperation methods, project outcomes, and whether students found them beneficial for learning. Although students initially viewed the process as extra work, they recognized its positive impact on communication and task clarification. There is no clear correlation between reflection and individual project assessments but a slight link between improved group time management and higher grades, with groups exhibiting better time management skills generally scoring higher.

First-year engineering students tend to be overconfident when assessing their performance and contributions to teamwork, which may not align with their actual learning outcomes. Instructors who gained insights into students' challenges through reflections need to recognize that students' personalities and course performance may vary, and they should consider guiding students to achieve better results in project group work. More management skills and in-person communication will be encouraged in future projects.

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Teaching Medical Humanities to medical students: implementing an integrated approach

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Abstract

Medical Humanities is a rapidly expanding field of medical education. However, in Italy, only a few humanities are included in the curricula of medical schools. Other humanities are provided in the form of elective courses, with great heterogeneity among the various medical schools. The objective of this paper is to present an optional course in Medical Humanities, based on an integrated approach, aiming at fostering the human and professional growth of medical students. In addition, the paper presents the research project associated with the integrated course, aimed at evaluating the effects of the course program on students' personal and professional skills and psychological well-being.

Keywords: *Medical Humanities; Medical education; Visual Thinking Strategies; Narrative Medicine; Reflective Practice*

1. Introduction

"Medical Humanities" (MH) is a term used to define an interdisciplinary field that includes humanities, social sciences and arts and their application to medical education and practice (Kirklin, 2003). The MH movement began to spread in the United States in the late 1960s, under the leadership of physician and philosopher Edmund Pellegrino (Sulmasi, 2014). Pellegrino and other health professionals proposed a rediscovery of the human dimension of care, driven by the idea of curbing the technical drift that medicine was taking in those years (Sulmasi, 2014). Since then, MH has spread all over the world, enriched by the contributions of various humanistic disciplines (e.g. philosophy, history, literature, art). Still today, the purpose of MH

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is to facilitate the understanding of the "human condition of health and illness to create knowledgeable and sensitive healthcare providers, patients, and family caregivers" (Klugman, 2017). MH promotes a holistic approach to care, by fostering the development of personal and professional skills in healthcare providers. Previous studies have shown that MH helps medical and not medical students to develop fundamental skills, such as empathy, and communication, observation and reasoning abilities (Ferrara et al., 2022; Krishna et al., 2022). The development of these skills is often hindered in stressful, demanding and competitive educational contexts, such as the medical one (Giusti et al., 2021). Therefore, the inclusion of humanities into medical curricula can have a strong educational value. Consequently, medical schools in multiple countries have been progressively incorporating humanities into their curricula (Howick et al., 2022; Qian et al., 2018; Smydra et al., 2022). Also in Italy, humanities are included among the curricular subjects of the medical degree courses. However, the space reserved for MH is mainly occupied by courses in Bioethics or History of medicine (Patuzzo & Ciliberti, 2018). This is because, in Italy, the curricula of degree courses must comply with criteria defined by the Ministry of University (MUR), which means that universities are left with little autonomy in the choice of subjects. For this reason, some universities have chosen to include humanities as optional subjects (i.e. extra-curricular courses).

Some years now, the teaching of Medical Humanities has landed at the University of L'Aquila (central region of Italy), where a course in Medical Humanities has been structured for medical students from the 3rd year onwards. The purpose of this article is to present the structure and curriculum of the *Integrated Course in Medical Humanities* (ICoMH) and its associated research project, both of which were activated at the University of L'Aquila last year - for the first time - in their full version.

2. The Integrated Course in Medical Humanities

The Integrated Course in Medical Humanities is the result of a collaboration between the Department of Medicine and the Department of Human Sciences of the University of L'Aquila. It has been promoted by the Italian Society of Medical Pedagogy (Società Italiana di Pedagogia Medica - SIPeM), with the aim to offer to undergraduate medical students the opportunity to broaden their view of the world, in order to enhance their personal and professional growth.

The course is organized in three optional modules reserved for students from the 3rd to the 6th year of the degree course. The structure of each module includes a theoretical part (which introduces the epistemological basis of the methods used) and a practical part, organized in workshop activities that involve students in the educational process. Table 1 summarizes objectives, methods, and target population of each module.

Table 1. The structure of the Integrated Course in Medical Humanities

Module	Course year	Objectives	Methods
Visual Thinking Strategies for the Clinical eye	3rd	Improve observation, communication and reasoning skills	Lectures, VTS workshops
Narrative Medicine for the personalization of care	4th	Develop comprehension and interpretation abilities, and empathic approach	Lectures, IDS workshops
Reflective Practices for Self-care	5th-6th	Develop awareness of the future profession	Lectures, maieutics workshops, close reading, Reflective Practice workshops

The three modules have been designed considering the curriculum of each year of the Italian Degree Course in medicine, which lasts 6 years. The course is meant to offer a comprehensive training in the humanities to students who attend all modules. However, there is no obligation to take the entire course and students may choose to take only one or two modules. All the lessons and workshops are taught by experts in Medical Humanities, with different backgrounds.

2.1. Visual Thinking Strategies for the Clinical Eye

During the third year of the Degree Course in Medicine, Italian students deal with the study of clinical methodology, learning the practices of semeiological analysis, aimed at the collection and analysis of clinical data. This prepares them for the internship in wards, which starts from the fourth year of the degree course. For this reason, it is important that students can practice observation and reasoning techniques, during the third year. That is what the first module focuses on.

This module centers on art and uses the Visual Thinking Strategies (VTS) method to promote the development of important cognitive and professional skills, through the active observation of images. VTS has been originally developed by Abigail Housen, a psychologist, and Philip Yenawine, an art educator, to help students develop critical thinking, and communication and observation skills (Housen, 2002) (Yenawine, 2013). Vincenza Ferrara was the first to introduce this method in medical training, in Italy (Ferrara, 2022). The method improves both semeiological skills and empathic sensitivity: it helps to develop the "clinical eye", which is essential to perform a physical examination. Physical examination is the first step in the evaluation of the patient and allows the clinician to complete the information collected during the anamnestic interview. Some specific skills are required to perform a comprehensive physical examination: 1. observing the patient carefully, paying attention to details; 2. reasoning about the information acquired through observation; 3. drawing conclusions based on the information collected. Through critical observation of images and active listening, the VTS method helps

clinicians to expand their perspective, embracing the patient's point of view. Additionally, this method improves communication and relational abilities, through group activities.

The theoretical part illustrates the epistemological fundamentals of medical practice, based on a bio-psycho-socio-cultural paradigm. The practical part includes workshops conducted according to the VTS method. This phase can be carried out directly in a museum or in the classroom, through a digital reproduction of the artwork to be analyzed. Active listening exercises are also proposed, through which students must reproduce an image they cannot see, after listening to a classmate's oral description of the image.

2.2. Narrative Medicine for the personalization of care

In their fourth year, medical students begin to intern on the wards, therefore connecting with patients. At this moment, they experience the transition from theoretical knowledge to clinical reality, often experiencing this change as traumatic. One of the most complicated tasks in the relationship with the patient is to understand the patient's needs, which are not only clinical, but often concern other aspects (emotional, psychological, etc.). At this stage, it is crucial to enhance the empathic skills of the students, enabling them to understand the patient's experience. For this reason, the training module reserved for fourth-year students is dedicated to the use of narrative in medicine, through the Narrative Based Medicine (NBM) paradigm, as defined by the Italian guidelines on the use of Narrative Medicine (Centro Nazionale Malattie Rare [CNMR] – Istituto Superiore di Sanità [ISS], 2015). Narrative Medicine (NM) is an approach to care theorized by Dr. Rita Charon, that uses the patient's narrative to enable the clinician to understand the complexity of the disease and to build, together with the patient, an effective and shared care pathway (Charon et al., 2016). This module also uses Digital Narrative Medicine (DNM), which enables the application of narrative medicine methods through digital techniques, such as the Illness Digital Storymap (IDS) by Cristina Cenci (Cenci & Mecarelli, 2020).

The theoretical part introduces the epistemological basis of the NBM paradigm. It also presents the digital platform through which the patients' stories had been collected, which is used for the second part. The second part of the module includes practical activities, based on the analysis of the stories of patients affected by different pathologies (cancer, heart failure, epilepsy, etc.). The analysis is performed by the students themselves, by using the IDS model. The IDS model provides a map that allows the clinician to navigate the patient's experience of illness. Along this experience, the map identifies five existential dimensions, derived from the socio-anthropological literature: chaos, liminality, normalization, resolution, appropriation. These dimensions summarize “life experiences, needs, the degree of acceptance of illness, emotions, quality of life, helpers, and opposers. […] The dimensions are subdivided into three different phases of the illness pathway: the present phase, the patient/caregiver's expected future, and the therapeutic pathway's target phase. The target phase integrates life experiences and existential

expectations with the clinical variables and the possible therapeutic scenarios" (Cenci & Mecarelli, 2020).

2.3. Reflective Practices for Self-care

Fifth and sixth-year students are already familiar with clinical practice and are preparing for their future profession. At this point in their education, it becomes important to reflect on the experiences they have gained, to better approach the world of work. Therefore, the objective of the third module is to promote the well-being of the students in the last years and to encourage reflections on the challenges they will face in their profession. This module addresses the problem of work-related stress and burnout, which is becoming more and more frequent in health professionals and students (Leombruni et al., 2022). Various reflection techniques are used in the module, borrowed from philosophy (maieutics, reflective practices) or other methods, such as close reading, proposed by Rita Charon as a tool for Narrative Medicine (Charon et al., 2016).

The first part includes an introduction to the risks for the psychophysical well-being of health professionals, followed by a maieutics workshop, aimed at identifying issues that are critical for the students. Workshop activities include reading and analyzing texts, creative writing, discussion, and dialogue. Close reading of written texts or images, and written production on the model of mythobiography are also proposed. These activities encourage students to engage in self-reflection, allowing them to evaluate their expectations for their future profession. Sharing within the community is an essential element in this module.

3. The research project

The ICoMH was activated in its full version in the academic year 2022-2023. A research project was proposed to assess the effects of the ICoMH on medical students and to gather information and feedback that could be used to improve the course. The Project has an estimated duration of 4 years and consists of 3 phases: 1. a survey on the characteristics and the motivations of the students who take one of the ICoMH modules; 2. an investigation of students' satisfaction and feed-back; 3. a pre-post analysis evaluating the effects of the course on students. Table 2 summarizes the steps of the research project.

Table2. Steps of the research project

Phase	Sample	Outcomes	Measurement Instruments	Study type
1st	Students taking the course / Students not taking the course	socio-demographic features	Ad hoc questionnaire	quantitative / qualitative
		motivations	Ad hoc questionnaire	
		anxious tendencies	Self-rating Anxiety Scale (SAS)	
		depressive tendencies	Beck Depression Inventory-II (BDI-II)	
		stress	Perceived Stress Scale-10 items (PSS-10)	
		academic performance	Grade Point Average	
			Number of exams passed	
2nd	Students taking the course	satisfaction, feed-back	Ad hoc questionnaire	qualitative
3rd	Students taking the course / Students not taking the course	socio-demographic features	Ad hoc questionnaire	quantitative
		anxious tendencies	SAS	
		depressive tendencies	BDI-II	
		stress	PSS-10	
		observation, communication and reasoning skills	VTS grid	
		empathy	Interpersonal Reactivity Index	
		coping	Brief-COPE	

The first phase involved the administration of a battery of questionnaires to both students who had chosen to take the course and students who had decided not to. The questionnaires investigated the socio-demographic and psychometric characteristics of the two subgroups, their academic performance, and the motivations that led the students to take the course or not. The first phase has been completed. The second phase involves collecting feedback from students, to reshape the training offer. Every year, all students who have attended a module are given a questionnaire to assess:

- whether the module met their expectations,
- whether they think it was useful for their training,
- which things they found interesting and which they did not,
- whether there is anything they found surprising,
- whether there is anything they would like to learn more about,

- whether they would recommend the Course to their colleagues,
- how they liked it overall.

The third phase involves the collection of data during four academic years, through the administration of questionnaires both to students who have attended one or more modules and to students who have not attended any modules. The objective is to detect and quantify any improvement in specific skills or psychological well-being in students who have attended one, two or all modules, compared to students who have not attended any modules. Skills such as observation, reasoning and communication skills, empathy and coping will be assessed. Psychological well-being will be investigated using the same questionnaires used in the first phase.

4. Conclusions

The progressive shift in medicine towards an evidence-based care paradigm has amplified the scientific dimension of care (caring), at the expense of its human dimension (taking care). Medical Humanities seeks to balance these two trends, creating a space for dialogue between evidence-based and personalized medicine. The Integrated Course in Medical Humanities aims to enrich the curricular training of medical students with the tools and perspectives of the humanistic vision. The structure, content and methods of the course are designed to guide students on a path to personal and professional growth. The research project is essential to identify the strengths and weaknesses of the course, in order to improve it. It also allows us to investigate students' opinions, to tailor the course to their educational needs.

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Themes addressed in undergraduate theses and trends in Human Resources. Implications for last year students of a School of Management

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Abstract

A thesis to obtain a university bachelor's degree reflects students' interests and preferences, as well as specific learnings achieved to enable their future employability. This study analyzes gaps between human resources (HR) topics in undergraduate theses from a management school at a prestigious university in Peru and trends and challenges pointed out by HR consulting firms. The study scope is descriptive, based on content analysis with co-word analysis method, of 119 theses and 35 reports from 5 consulting firms between 2011 and 2022. Findings reveal significant gaps, that raise the urgency of reviewing of undergraduate research objectives and the need to stimulate student interest in developing knowledge, skills and competencies aligned with the expectations and challenges of the job market, such us the external organizational challenges, leadership, and technology's impact on HR management

Keywords: *thesis, skills, competencies, human resources management, human resources trends of consulting*

1. Introduction

Current demographic, social and technological changes and their effects on work environments (WEF, 2022) have an impact on human resources (HR) management and the role of HR professionals, who are expected to have specific capabilities to provide solutions and new approaches to solve the challenges faced by organizations. The magnitude of these transformations determines that HR management becomes more critical (Minbaeva, 2021) and, as Ulrich (2022) points out, expands beyond talent management to include leadership, organizational capabilities and new demands for the HR function itself.

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Both academia and consulting firms study changes on HR management, with the latter becoming specialized sources of strategic information by identifying the most significant trends. Consulting firms set the tone in terms of opportunity by offering solutions and strategies to address these challenges based on their research, as well as successful experiences from other organizations (Claus, 2019).

In this context, the training of young HR professionals is of particular concern. University should foster students' interest in studying subjects that align with the demands of the job market, with employers' needs, but above all, with trends in the HR field. In the case of undergraduate students, they need to leverage their university education and the projects they undertake during this stage to acquire knowledge and develop specific skills that enable them to enter the job market with the necessary capabilities to face the new challenges of organizations. (Abelha et al., 2020).

The objective of this paper is to study the alignment between the HR topics addressed in the theses of graduates from the School of Management at the Pontificia Universidad Católica del Perú (PUCP), and the HR trends reported by a sample of important specialized consulting firms in the period 2011-2023. The study is based on the understanding that the greater the alignment between the topics developed in the theses and the key trends in the HR field, the better the knowledge and skills of the graduates and the better the opportunities for their insertion in the job market. The scope of the work is descriptive, based on the content analysis of a sample of theses and reports published by 5 specialized consulting firms during the period 2011 and 2022, using the co-word analysis technique.

The analytical framework used corresponds to the human capabilities approach (Ellehave and Ulrich, 2021), which integrates individual (human) and organizational (capabilities) elements through four dimensions to understand the value contribution of HR to organizations. These dimensions include talent, organization, leadership, and the HR function itself. These dimensions serve as the basis for comparing the two groups of documents, which allow for identifying the degree of alignment and, at the same time, the gaps between student interests and job market trends. Based on the findings, this study proposes recommendations related to the development of specific knowledge and competencies, the adjustment of the training curriculum, as well as the need for better guidance on thesis by faculty advisors.

2. Analysis framework

Analysis and projections regarding HR trends have paid, and still pay, special attention to roles, area functions and the consequences of technology on processes and management (Kapoor and Kabra, 2014; Minbaeva, 2021). However, they leave room for other perspectives based on structural changes, evolutionary paths and a broader and more dynamic understanding of HR management in organizations, focused primarily on people and their capabilities.

For the purposes of this study, the approach called the human capabilities framework is taken as a basis. Ellehave and Ulrich (2021), integrate individual and organizational elements (organizational capabilities), considering Ulrich´s (2022) talent perspective, organization, leadership and HR function to redefine its value contribution. These are the four dimensions that frame the analysis.

Talent dimension involves not only attracting and placing the right people in the right positions at the right time, but also planning their competencies and alignment in traditional and new work ecosystems, as well as generating a value proposition that generates contribution and commitment. In this line Mercer (2023) points out that, in the current situation, it is key to generate experiences that consider the employee and his or her life in an integral way. In this field Ulrich (2022) includes Diversity, Equity and Inclusion (DEI) as a strategy for managing talent in its diversity.

Organization dimension involves aspects such as the workplace, culture and processes, that evolves with new post-pandemic era. HR professionals should provide the framework for people to develop their capabilities and contribute effectively to the mission and purpose of the organization; an organization that evolves with new structures based on agile teams and market-oriented systems (Ulrich, 2022). Culture is constituted as the unifying element that provides identity to employees and outsiders, orienting the organization and providing it with an identity to be proactive to market demands.

Leadership dimension proposes an understanding of the leader's role as a developer of current talent and future human capital, with strategist skills and, at the same time, an executor. Leaders drive talent and shape organizational capabilities through their preferences or styles (Ellehave and Ulrich, 2021). HR should focus on the challenge of developing leaders capable of adding value to stakeholders, with cross-functional capabilities applicable to all types of organizations, a strategic and short-term vision, and a focus on people and the organization, according to the new leadership code coined by Ulrich (2022).

Regarding the role of HR, it evolves from being responsible for administrative tasks to being a business partner, from functional efficiency to a strategic role. Its function scales, impacting not only employees and internal leaders but also other stakeholders such as clients, suppliers, and communities in general, as Deloitte (2021) points out through the practices of an "exponential HR". Ulrich (2022) also highlights the contribution of HR to evidence-based decision making through the use and exploitation of information, predictive and prescriptive analytics, as well as the use of AI and machine learning.

This analytical framework allows ordering and classifying these four dimensions and their derived topics (descriptors), facilitating the comparison between the topics addressed in graduation theses and the trends impacting HR management according to the reports of consulting firms.

3. Methodology

This study has a descriptive scope, supported by the technique of content analysis of official documents, understood as publications not produced exclusively for research purposes (Bryman, 2012). This technique allows inferences to be made through the systematic identification of specific topics and terms contained in the documents to be analyzed (Bryman, 2012). The co-word analysis was applied to the theses and reports published, based on the descriptors corresponding to each dimension identified in the analysis framework, in order to identify thematic gaps between the two document categories. This analytical approach enables the observation of connections and interactions between topics, areas, and the co-occurrences established among them. Thus, it facilitates the identification of emerging trends within a single document sample or through the comparison of more than one sample. The open-source software VosViewer version 1.6.18 was used. To avoid interpretation biases, the double reviewer process was applied.

The period of analysis was from 2011 to 2022. In the case of theses, 119 theses published in the institutional repository that addressed HR topics were selected. As for the trend reports, 35 reports published by specialized HR consulting firms (Deloitte, Mercer, The Josh Bersin Co.) were selected, as well as Price Waterhouse Cooper PWC, all of which are prominent in different rankings, and additionally the special reports of the World Economic Forum (WEF).

4. Findings

The main findings, based on co-word analysis and organized by nodes corresponding to each dimension of the analytical framework, are as follows:

The talent node (Figure 1) is the most developed in students' theses, with a greater diversity of perspectives. In the documents analyzed, the descriptors referring to the attraction and retention of young talent (i.e. Millennials and Generation Z) through employer branding and employee experience strategies, as well as the development of competencies and employability in these generational groups predominate. There is also an interest in issues related to diversity management, engagement and sustainability. On the other hand, the trends reported by the consulting firms, related to talent, focus on its relationship with organizational changes, technological development and new labor relations.

As for the organization node, it ranks third among thesis topics, after HR management and talent. The students' research focuses on culture descriptors and their relationship with job satisfaction and readiness for change and innovation; they also include organizational behavior (resilience and communication) from an internal perspective. The analysis of the consulting firms gives the organization a second place of relevance in the HR trends of the 21st century, due to the impact of the economic, social and technological transformations mentioned above.

For consulting firms, the development of capabilities, the redesign of organizational structures, as well as the review of the purpose and relationship with society becomes a priority, while the theses still pay little attention to these dimensions, focusing on relationships into the organization.

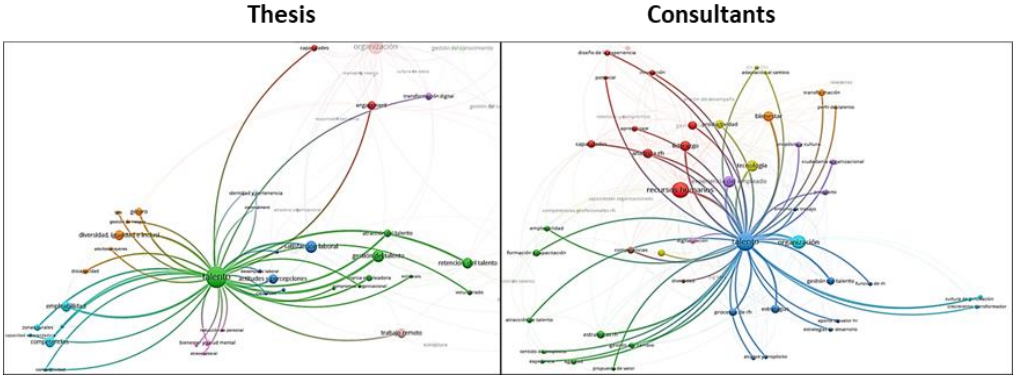


Figure 1: Talent node

The understanding of leadership in contexts of uncertainty and turbulence is still very little explored in the theses of final year students, focusing basically on leadership styles and their relationship with culture, satisfaction and employee engagement. In the case of consulting firm reports, leadership is treated in a transversal manner, highlighting challenges related to organizational transformations, talent and new work relationships.

The HR node (Figure 2) is where the theses and consultant reports coincide in the relevance but not in the contents. It is in the descriptors where more differences were found. The students' theses show greater concern for administrative efficiency, i.e. in practices and process performance. For example, improvements in training processes, compensation and career line management, processes necessary for the implementation of teleworking, as well as work climate management. On the other hand, there is a growing interest in attraction and recruitment processes. But in the case of the consulting firms' reports, the topics are closely linked to different strategies, among which, well-being and technology stand out.

Finally, the analysis of the consulting firms reports show special relevance to the effects of technology on organizational capabilities, coinciding with what Ulrich (2022) points out as "the dominant agenda" now and in the future. Technological innovations, among which machine learning and artificial intelligence stand out, are means that, according to Ulrich (2022), will enable better decision-making processes and contribute to the evolution of HR functions. As well as HR analytics, which is necessary for strategic decision making based on evidence. However, this descriptor has been scarcely referred to in the theses of students in the last year of their professional careers (only 5 out of 119).

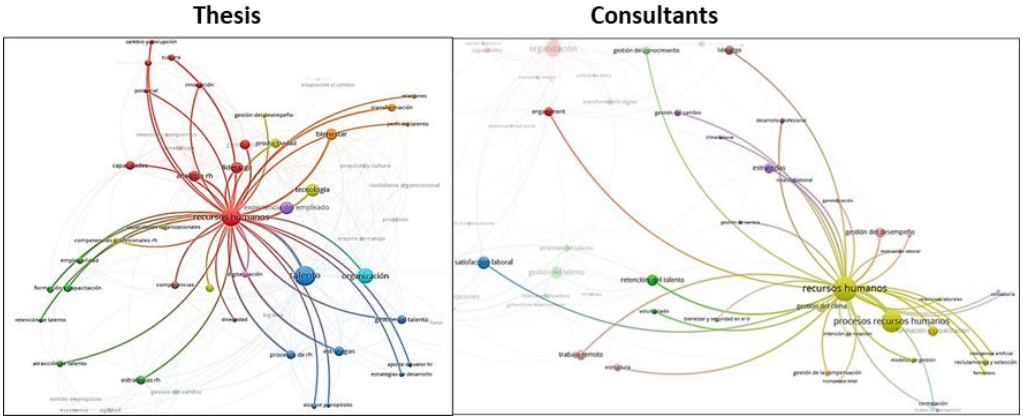


Figure 2: HR node

5. Conclusions and recommendations

The study concludes that the HR dimension is the one with the highest recurrence in the two types of documents; however, the descriptors occurrence in this node differ significantly between the consulting firm reports and the theses. While the reports of the consulting firms emphasize that the HR agenda moves from internal efficiency to value generation, both inside and outside the organization, the theses show a focus on the internal efficiency of HR processes, with emphasis on retention strategies and satisfaction measurement.

In the organizational aspect, the differences found between the reports of the consulting firms and the topics addressed in the theses lie in the priority that the latter give to culture and behaviors within the organization. In contrast, the reports emphasize the need to adapt to the external environment. In relation to this, it is necessary to reinforce the training of students, the analysis of cases of transformations and their implications in organizations, in order to stimulate the development of skills and competencies that enable them to be alert and prepared in new work scenarios.

Regarding the talent dimension, it was observed that students were concerned and interested in the strategies and processes that attract, retain and generate greater commitment in the generations to which they belong, as well as the conditions that foster their employability. In this sense, it is necessary to broaden their vision regarding the challenges that consulting firms point out, with respect to structural changes in organizations, technological development and new labor relations.

In relation to leadership, it was observed that it is a dimension that is less observed in the sample of reports and theses. The theses focused on the study of leadership styles, basically exploring their relationship with organizational culture, employee satisfaction and engagement. While the

sample of reports highlighted the need to developed disruptive leadership in the face of technological developments, a key role in the changes in formal hierarchies to move to "networked" leadership, the promotion of human capital development and rebuilding trust.

The reported findings suggest the need for continuous review of the curriculum orientation, allowing for the incorporation of a new vision of HR, that includes leadership skills demanded by current transformations that students need to develop. It also suggests incorporating new technologies and their applications in industries, organizational settings, and new contractual modalities into training content and methodologies.

Finally, the analysis of the theses of graduates who are about to enter the job market allows us to observe that formative research at the undergraduate level is important as it demands a significant dedication of student and faculty advisors in time and effort. The development of these theses must constitute a motivational space to address issues and challenges of HR. It is necessary to guide students to study the trends in HR management identified by leading consulting firms in the field. The review of trend reports in thesis courses can facilitate a better selection of study topics, and stimulate the development of undergrad projects that address new HR management models, the changes in skills and capabilities required by digital transformation and, in particular, the effect of analytics for decision-making in HR, which will contribute to improving employability in this area.

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A review of Financial Education Implementation in Higher Education

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Abstract

While undeniably enriching, the academic odyssey sometimes leaves a void where financial education should reside. Graduates should have optimal knowledge of financial matters to maximise their financial planning. Recognising this gap, higher education institutions have implemented financial education to bridge the gap for students before they enter the workforce. This paper reviews existing studies where higher education has implemented financial education and its outcomes, including program length, format, platform, and voluntariness. The findings reveal a diverse landscape of financial education initiatives in higher education, with varying degrees of success in achieving desired outcomes. The study will benefit higher education and policymakers considering implementing financial education. The review highlights the importance of ongoing evaluation and refinement of financial education initiatives to meet students' needs better and maximise their long-term financial well-being.

Keywords: *Higher education; Financial literacy; Financial education; Students.*

1. Background

Students would gain from obtaining financial knowledge early in life (Lusardi & Mitchell, 2014). Equipping students with financial knowledge before they commence their careers can profoundly impact their ability to navigate the complexities of personal finance, leading to enhanced financial well-being (Lusardi & Mitchell, 2007). The problem is that university students invest several years in completing specific qualifications yet frequently lack crucial skills such as financial literacy (FL). A significant concern for higher education (HE) students is student debt and credit cards. Norvilitis et al. (2006) found that higher debt translates into greater stress, impacting the students' financial well-being, where students need holistic financial education (FE). Furthermore, some students are at increased financial risk due to their extended training programs (Barrett et al., 2023). FE and counselling often occur when it is too late, and individuals are already in debt (Moore, 2004).

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Across the globe, students consistently exhibit low to average FL scores. In Malaysia, studies observed low FL for students from eleven public and private colleges (Sabri et al., 2010), four HE institutions (Yew et al., 2017) and first-year university students from private and public universities (Wee & Goy, 2022). A cross-country study found that Indonesian students achieved higher FL scores than Malaysian students' average FL scores (Khalisharani et al., 2022). Low to moderate financial knowledge was observed for students in India (Kanduri, 2021), Turkey (Akben-Selcuk & Altiok-Yilmaz, 2014), South Africa (Antoni et al., 2020; Van Deventer, 2020), and public universities in the US (Artavanis & Karra, 2020). Medium or moderate FL levels were found among students from eight European countries (Ergün, 2018).

Many authors see FE as the bridge that connects individuals to FL (Lusardi, 2019; Wee & Goy, 2022). FE has been introduced at HE institutions to address low levels of FL among students. It is the foundation for improving knowledge associated with improved behaviour and FL, ensuring the next generation of workers and consumers has financial knowledge (Lusardi, 2019). Education on its own may not be sufficient, but it is a necessary element for behaviour change (Arlinghause & Johnston, 2018) and prior knowledge (Brady et al., 2021; Fürstenau & Hommel, 2019; Xiao et al., 2014). Studies highlighted the benefit of prior learning, where informal learning is ineffective without previous knowledge (Fürstenau & Hommel, 2019) and loan literacy before accumulating debt may serve as a mastery experience for students, enhancing financial self-efficacy when student loan repayments begin (Brady et al., 2021). FE positively influences financial well-being later in life (Xiao et al., 2014). Therefore, this paper sheds light on the implementation of FE in HE, offering invaluable insights into that program's direct outcomes and relevance.

2. Method

A literature search of articles on Scopus was performed. The combination of search terms included (financial literacy AND financial education AND students) and delivered 240 articles. The keyword 'higher education' was not included in the search words as it limited the search results; many studies referred to colleges and universities without reference to HE. Therefore, the search included many more results (especially on schools), but by reviewing them, schools and other organisations that are not HE were excluded. The researcher worked through the articles to identify studies reporting on specific FE implemented at HE. It is pivotal to distinguish between studies evaluating the role of a particular FE program and those assessing general financial educational exposure lacking specifics on quality, depth, or duration.

3. Financial Education

The role of FE programs has been debated, with scholars presenting contrasting views on its effectiveness. Goyal and Kumar (2020) reviewed 502 FL articles over ten years. They observed

the delineation of two aspects of FL among young individuals: parental socialisation during adolescence and continuous financial learning within educational institutions or workplaces. Fernandes et al. (2014) performed a meta-analysis examining the correlation between FL, FE, and financial behaviours across 168 papers, encompassing findings from 201 previous studies. They discovered that efforts to enhance FL account for only 0.1% of the differences observed in the financial behaviours under examination, mainly showing less impact in samples from low-income backgrounds. In contrast, a national study by Wagner (2019) found a correlation between FE and FL, where individuals who received FE were less inclined to exhibit lower FL scores and more likely to demonstrate high FL scores. These studies have largely overlooked the heterogeneity of FE programs and did not consider the specific type, duration, or intensity of instruction. While previous research has overlooked the specific components of FE programs, this paper addresses this gap by focusing on articles that examine the implementation of tailored FE initiatives within HE institutions.

4. Specific financial education

In America, four studies of FE implemented at different HE institutions are included here: a) an outside institution developed FE consisting of one presentation that took an hour and a half (on average) on credit, budgeting, and investing. It was presented in a co-curricular module for business students at a university. The study noted the benefits of outside organisations offering FE at HE as well as increased basic financial knowledge, communication and technical skills (DeLaune et al., 2010);

b) FE was offered by appointing a financial and educational specialist who presented financial content as part of the curriculum in all four years of study, gave workshops, and offered one-on-one student advice for veterinary students. Relevant topics were identified, ensuring information was pertinent to their current circumstances (Jones et al., 2019);

c) librarians offered FE during first-year workshops as part of one-credit-hour courses. The content included savings, interest, budgeting, loans, debt, insurance, tax, and research skills. Positive changes were observed from before to after the course; however, the most positive changes were in improved research skills (Li, 2012);

d) libraries introduced many FL initiatives, where most of the support included FL collection development, collaborations with different partners on campus, events, workshops and online resources (Reiter & Ford, 2019);

e) an elective one-session, three-credit undergraduate course (saving, budgeting and debt) presented by business librarians on how advertising impacts spending behaviour. The course offered an opportunity to engage students in discussions about financial behaviour. Although

students had mixed responses about the topic, most agreed it is a valuable inclusion in the personal finance course (Vaaler & Wilhelm 2020).

In China, a voluntary FL programme (face-to-face and online) was introduced to college students, measuring the driving forces behind the decision-making to attend the programme and how it impacted their FL. The study adopted an endogenous switching regression model focusing on how students decide to attend or not to attend (Tan et al., 2022). The face-to-face offering includes 36 hours of structured sessions. Participating students significantly increased FL, especially regarding their knowledge, behaviour and attitude. Students with a higher self-perceived level of FL did not prefer attending FE. In another Chinese HE institution, FE offered to finance students focused on using an internet-integrated programme provided over 18 weeks (90 hours in total), which found that education provided through the internet is cost and admin-effective and avoids real-life pitfalls in learning (Liu & Lin, 2021). The study found that FE has the potential to boost individuals' financial knowledge, instruct them in assessing personal financial health, and instil a lifelong interest in the study of money.

In New Zealand, FE was structured according to insights from literature reviews. This approach emphasised translating financial knowledge into actionable steps, involving consultations to reflect on spending pressures, follow-up appointments to track progress, identification of teachable life experiences, and simplifying technical and financial information for better understanding (Subactagin-Matto & Goncalves-Rorke, 2010). The knowledge gained positively affected the students' experience, retention and completion of studies. In Australia, a study examined the effects of FE on undergraduate students three years after completing a semester-long elective FE course, equivalent to other major options in their qualification. The study discovered that students retained substantial effects of both objective and subjective FL, although there was a slight decrease over time. The evidence for behavioural change did not demonstrate consistency over time (Gerrans, 2021).

In Singapore, FE is offered as an elective to undergraduate students, which covers various aspects of assets and finance management (investments, budgeting, debt, taxes, etc). Students receive a fixed amount to bid on courses. The study included students who bid for FL courses and divided them between those who bid and enrolled for the module and those who did not bid enough and could not register for the programme. The study found that students who attended FE had an 11% increase in financial knowledge and 16% in financial planning (Barua et al., 2018). In Malaysia, a study found that FE for undergraduate students from different higher institutions does not significantly impact personal management performance and is ineffective. The study did not refer to the FE offered or if all students attended FE (Bakar & Bakar, 2020).

In Italy, an introductory financial course of 20 minutes included interest rates, the time value of money, inflation, and risk. Students were invited to participate in the study (standard randomised trial treatment), which included the presentation to the treated group. It found a significant

impact on FL and an even greater effect on the self-assessment of FL (Brugiavini et al., 2020). Another university in Italy offers free online FE to the public and teaches basic FL concepts. An experiment was conducted to compare the effectiveness of the online vs. on-campus offering. A portion of the FE content was offered over three hours, focusing on investments, bonds and interest rates. No statistically significant distinction is observed between attending the program in a lecture room or online, suggesting a causal effect estimation (Agasisti et al., 2023). In Croatia, a randomised field experiment introduced FE to a training group four times for 90 minutes, where FE positively impacted knowledge (Torma et al., 2023).

In Chile, FE was piloted for the Pedagogy of History and Geography students as an elective course for 16 weeks (32 hours) with the aim of targeted education on economics and finance, fostering practical skills development and cultivating positive attitudes (Alí et al., 2021),

5. Conclusion

Many initiatives worldwide incorporate and initiate FE; however, the slow movement to improve FL levels sheds light on the fact that not all approaches work for everyone and should be custom-designed for a specific audience. This review provides a comprehensive overview of the implementation of FE in HE, highlighting the diverse approaches taken across different institutions. The literature reveals variations in the length, format, platform, and voluntariness of FE programs, underscoring the need for flexibility and adaptability to cater to the diverse needs of students. Despite these differences, the review sheds light on the importance of FE and its perceived value among students, guiding HE and policymakers on the diverse options available to introduce FE. Thus, while FE at HE may not yield immediate transformations, it is a foundational element conducive to gradual development. The paper guides policymakers and higher educational institutions on how FE has been implemented. Limitations of this study include FE implemented but not reported in research papers, research papers from other databases, and business- or finance-related academic programmes with financial knowledge as part of the educational curriculum. Furthermore, the findings should be interpreted with caution as they may not reflect what every country experiences in delivering FE. Future research should focus on comparing different implementation strategies, voluntary vs compulsory offerings, technology in the offering and the impact of finance-related academic curriculum content.

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Unleashing the Power of Social Entrepreneurship Education in Cultivating Spiritual Capital: Insights from the SEnSE Program in Hong Kong

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Abstract

This research study aims to explore the potential of Social entrepreneurship education in cultivating spiritual capital as a catalyst for empowering teenagers towards personal and societal transformation. It delves into the process through which young individuals establish meaningful connections with the transformative journey and investigates the key factors that contribute to their transformative experiences. Employing a case study approach, the "Social Entrepreneurship and School Education Program" (SEnSE Program) implemented in Hong Kong from 2014 to 2020 serves as the primary case under investigation. By utilizing literature analysis, observation methods, focus groups, and in-depth interviews with participants of the SEnSE Program, this study examines the life transformation experiences of the fifth generation of youth in Hong Kong (born between 1992 and 2006), ultimately identifying the crucial factors that facilitate their transformative growth. The findings of this research contribute to the development of a transformative framework that seamlessly integrates the realms of spirituality and entrepreneurship education, offering valuable insights for shaping future educational practices.

Keywords: *Spiritual capital; Entrepreneurship education; Transformation; Experiential learning; Service-learning; Youth empowerment*

1. Introduction

According to sociologists such as Max Weber, Herbert Marcuse, and Peter Berger, modernization and rationalization have brought about not liberation, but rather a dehumanized way of life, limiting human beings within the realms of the world and history, gradually eroding their imagination and ability to transcend (Berger, 1977). The fifth generation of youth in Hong Kong (born between 1992 and 2006) find themselves living in a society characterized by

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material abundance and robust economic development. It is expected that they should strive for higher levels of personal growth and change. However, Hong Kong's emphasis on an education-driven society, where educational credentials hold significant sway, has led to an overemphasis on academic achievement during their formative years, neglecting the cultivation of spirituality by parents, schools, and society. As a result, youth become confined by the expectations of others, losing their sense of imagination and vitality towards life, and experiencing high levels of stress[1]. Therefore, how to educate the next generation of young individuals to explore their self-identity, respond to society, care for others, and seek meaning in life has become a pressing concern for both the education sector and society as a whole.

The key lies in the elevation of spirituality, specifically the accumulation of spiritual capital. As Sandra Schneiders has pointed out, spirituality involves the transcendence of the self, providing integration and meaning to life, and offering individuals a pathway for growth and transformation within an ultimate perspective. However, what does spirituality encompass? In simple terms, spirituality can be understood as the establishment of harmonious relationships between individuals and the divine, others, nature, and oneself. Yet, the most significant aspect of spirituality lies in its practice and transformation. For a long time, spirituality has been conceptualized as a pursuit of personal goodness and wholehearted commitment to life (Schneiders, 1986). However, John Cottingham argues that spirituality is a lived experience, emphasizing action rather than mere ideas (Cottingham, 2005). Spirituality reflects what Paul Tillich referred to as "participating knowledge", emphasizing self-transformation through the active engagement of knowledge, with the ultimate goal being life transformation (Tillich, 1984).

Therefore, we have chosen the "Social Entrepreneurship and School Education Program" (SEnSE Program) as our primary case study. Co-organized by the Department of Cultural and Religious Studies at The Chinese University of Hong Kong and the Fullness Social Enterprises Society. This program utilizes social entrepreneurship as a medium to provide life and spiritual education to young individuals. Through this program, we aim to explore its transformative impact on youth and propose a referential framework for transformation.

[1] According to a questionnaire survey titled "The Relationship between Stress and Family Functioning among Secondary School Students," conducted by Mr. Sun Yuk Kit, a lecturer at the Hong Kong Mental Health Association and the School of Continuing and Professional Education, City University of Hong Kong, from September to November 2013, nearly 1,500 students from ten secondary schools in the Kowloon area, ranging from Form 1 to Form 6, were interviewed. The survey aimed to analyze students' perceived stress, family functioning, and mental health using different scales.The findings of the survey revealed that, on the subjective stress scale, with a maximum score of seven, approximately 16% of students had stress levels ranging from six to seven, indicating a high level of perceived stress. Among these students, academic-related factors were the primary source of stress, with over 56% of them expressing feeling "somewhat troubled" or "very troubled" in their studies. Exam stress and dissatisfaction with grades and rankings were the most significant sources of distress.

2. Methodology and The Suggested Program

Through this research, we aim to understand the role of social entrepreneurship education in transforming the fifth generation of youth and the impact, hierarchy, and importance of different elements on youth. The reasons for selecting the SEnSE Program as the research case study are as follows:

I. Focuses on Hong Kong's fifth generation of youth, specifically secondary school and tertiary students aged 15 to 24.
II. Utilizes the four elements of transformational leadership in its design, and this research aims to evaluate their significance in facilitating transformation. These elements are as follows:
    A. Idealized influence: Inspired by the concept of "shared destiny" (caring for others is caring for oneself), the program encourages young people to participate in social entrepreneurship and care for marginalized communities. Knowledgeable volunteers and staff serve as role models for idealized influence.
    B. Inspirational motivation: Through playful design and practical social entrepreneurship, the program enhances the emotional and psychological states of young people, motivating them to learn.
    C. Intellectual stimulation: By introducing the concept of social entrepreneurship and combining different business tools with transformational learning, participants are challenged to think beyond their existing frameworks and emphasize creative problem-solving. They learn how successful social entrepreneurs creatively respond to the diverse needs of Hong Kong.
    D. Individualized consideration: University students and social entrepreneurship ambassadors not only provide personal care and motivation during the program but also continue to support aspiring entrepreneurs in a friendship capacity, including their personal growth in areas such as academics, grades, and family.
III. Moreover, a substantial number of program participants have observed noteworthy transformations in their relationships with family, friends, as well as their future outlook and social engagement. These observations offer compelling evidence of the program's transformative impact on youth.
IV. From 2014 to 2018, the program reached over 20,000 local students from 200 schools, reducing the impact of variables such as background, class, grades, gender, and religion. Data shows that students exhibited a strong willingness to care for disadvantaged groups (91%, n=15,010) and believe in young people's ability to solve social problems (95.9%, n=7033). The program attracted over 100 tertiary studies student be the peer mentor , and deep-trained 850 secondary school students, and completed 90 social entrepreneurship

project. Many participants are eager to return as ambassador, highlighting the program's transformative impact on youth.

Based on the aforementioned discussion, it is evident that the SEnSE Program effectively integrates theoretical principles with practical applications to cater to the specific requirements of Hong Kong's fifth generation of youth. To comprehensively examine the program and its impact, a case study methodology was adopted. This approach involved the utilization of diverse sources of data, including focus group discussions, interviews, and program documents, to ensure an extensive and holistic understanding of the subject matter. The primary objective of this research endeavor was to identify the crucial factors that contribute to the transformative experiences of the fifth generation of youth. To achieve this goal, the sample collection process for this study was divided into five distinct stages, which are as follows:

1. Stage 1: Review existing data over the past five years, including documents, participant feedback, staff and teacher input, and the researcher's observations.
2. Stage 2: Conducting a pilot test. Randomly selected 5 participants from the 70 student entrepreneurs and social ambassadors of the SEnSE Program for focus group discussions as a pilot test to gather suggestions for improving the interview question design.
3. Stage 3: Organizing formal focus group discussions. 16 participants (6 Male 10 Female) were randomly selected from the remaining student entrepreneurs and social ambassadors of the SEnSE Program to participate in formal focus group discussions.
4. Stage 4: Conduct in-depth interviews. 8 participants who demonstrated significant life transformation during the focus group discussions (including pilot test) were selected for individual in-depth interviews.
5. Stage 5: Cross-validate findings by analyzing data from 100 randomly selected past participants (32 Male 68 Female).

Limition : Choosing the "SEnSE Program" as a research case study has limitations. Participant subjectivity and the author's involvement may introduce biases. To address this, participants with diverse backgrounds were selected, and the author's involvement was acknowledged. The study leverages the author's past observations and relationships with participants to enhance the effectiveness of the focus group interviews. The findings may not be directly applicable to other programs, but the SEnSE Program can serve as a model for other youth programs. Future research can explore similar cases in different youth development programs.

3. Results and Discussion

Growing up is not a one-time event but a process of continuous practice, experience, and painful reflection. The transformation steps for adults involve being in a displaced situation, which leads to a change in previously held beliefs and making new choices in dilemmas, as well as a process

of communication and practice with others (Mezirow, 1985). This study examines the transformation process of the fifth generation of youth differs from that of adults, with an emphasis on peer relationships and the pursuit of happiness. Their transformation begins with playful interactions and relationship-building, which serve as motivation for learning and engagement. The next step involves a platform for practice and participation that offers personalized attention, characterized by close friendships, a forgiving environment, and targeted guidance. These elements, combined with the presence of exemplary figures, contribute to gradual growth and learning. A crucial aspect of their transformation is the development of empathy, leading to a shift in focus from self to others. Paradoxically, the individuals they care for are often reflections of their own past experiences. This shift occurs as they recognize the fleeting nature of personal happiness and redirect their attention towards helping others, thus fulfilling their own past regrets. Through continuous practice and reflection, they transform their past pain into a driving force for assisting others, giving new meaning to their own painful memories.The findings suggest that the "transformation of (the fifth generation) youth" consists of nine stages of personal transformation:

1. Engaging in activities that provide motivation for growth and reflection (55%)
2. Gaining happiness and building relationships through playful learning (83%)
3. Developing the ability to empathize (72%)
4. Breaking free from conventional thinking, focusing on others, challenging oneself, and gaining valuable experiences through practice (83%)
5. Providing a platform for trial and error, deepening the ability to empathize through continuous practice, and having exemplary role models (78%)
6. Shaping oneself through continuous learning and reflection, and learning about "love" (81%)
7. Finding new meaning and healing past pain through helping others (81%)
8. Planning actions, acquiring the necessary skills and knowledge, and truly helping those in need (80%)
9. Continuous self-transformation and helping oneself and others (62%)

From the above, it can be observed that these nine steps represent a process in which young people transition from passive learning to active absorption. Through School Talks/ Lessons and Social Entrepreneurship Workshops, this short-term transformation is more likely to occur in students. In the past, many secondary schools organized service projects for students, such as knitting sweaters for nursing homes or visiting orphanages. In these projects, students were merely givers, and there was a clear distinction between the empowered and the disadvantaged. However, in Social Entrepreneurship Workshops, the students no longer see the disadvantaged as objects of charity, but rather individuals with life stories of overcoming adversity and reclaiming their dignity after being marginalized by the system. Students, in turn, can learn about the dignity of life from these stories and realize that by caring for others, they can also

develop themselves. However, if students only participate in School Talks/ Lessons and Social Entrepreneurship Workshops, the impact may be limited to a change in mindset, without substantial practical actions. Although the interviewees' impressions of their first participation inYoung Social ChangeMaker Camps were somewhat vague (after all, it was three to five years ago), they all agreed that these camps differed from typical recreational camps in that they had a clear message, "This is not just a camp for fun, but a camp with a message and ongoing involvement." Through annual camp activities, specific events, and relationship arrangements, along with a multitude of games, psychological scenarios, and relational configurations, the role of "joy" is cultivated throughout the program. This "joy" not only brings happiness to participants through being cared for, enjoying the excitement of games, or the joy of winning competitions, but more importantly, it allows for a sense of deep connection with others (both team members and disadvantaged groups), experiencing the essential emotional bonds between individuals and reclaiming the sense of happiness in life. This enables them to find "joy" in their own existence. This pursuit of "happiness" is an inner spiritual quest and a universal human longing.Through interactions with peers of the same age, group mentors, and various game activities, participants are encouraged to shift their focus from seeking external happiness to self-appreciation. This leads to a sense of motivation to actively engage in life and envision a promising future. As a result, Participants in camps experience a shift in mindset, seeking their own life values and embracing social responsibility. They no longer feel disconnected from themselves or others and rediscover the importance of happiness in understanding "self" and "others." This transformation leads them to pursue meaningful endeavors and make a positive impact on society.

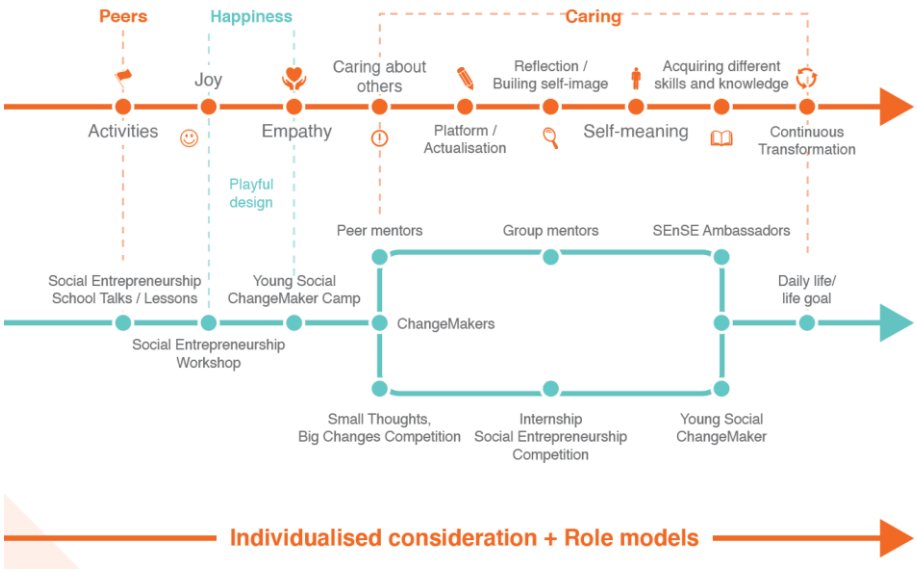


Figure 1: Growth Paradigm 9 Steps

However, the true transformation is not conveyed through words but rather manifested through actions. While the experiences of the participants in the focus groups and in-depth interviews vary, they all genuinely commit to making changes. Despite their different experiences, there is an unexpected commonality among them: the objects of their short-term or long-term concern are related to their personal growth experiences. Through the interviews, the author discovered that the objects of their concern are individuals who have had similar experiences. Their interest in individuals who have been bullied, individuals with emotional needs, individuals contemplating suicide, individuals in need of assistance with special needs, single-parent families, elderly individuals seeking employment, struggling small businesses, and declining craftsmanship, among others, is all connected to their own growth experiences. Most often, it is because they themselves or their closest friends have witnessed others suffering during their own growth journeys, and at that time, they were unable to provide any help. Thus, now that they have the ability, they want to assist them, leading to their continuous learning and transformation. Through constant practice, they transform the 'pain' they have experienced into motivation to help others, giving new meaning to their past painful memories. History and memories cannot be changed; both happy and unhappy moments become unchangeable past events. However, humans have the right to change the way they recall and interpret those memories. This group of young people, through their actions, infuse new meaning into past events, which drives them to become youth who continually seek transformation and pursue growth in various aspects, including knowledge. In addition to these nine steps, “happiness”, “peer relationships”, and “caring” are identified as three essential elements that drive the continuous growth and transformation of the fifth generation of youth and shape their inner spirituality. SEnSE program has been implemented in several high schools in Hong Kong since 2020, with the above elements incorporated into the curriculum, and social entrepreneurship has been introduced as a subject to cultivate future leaders. While not every student may become a social entrepreneur, the social entrepreneurship course aims to nurture the qualities of a social entrepreneur and also enhance the inner spiritual capital of the students.

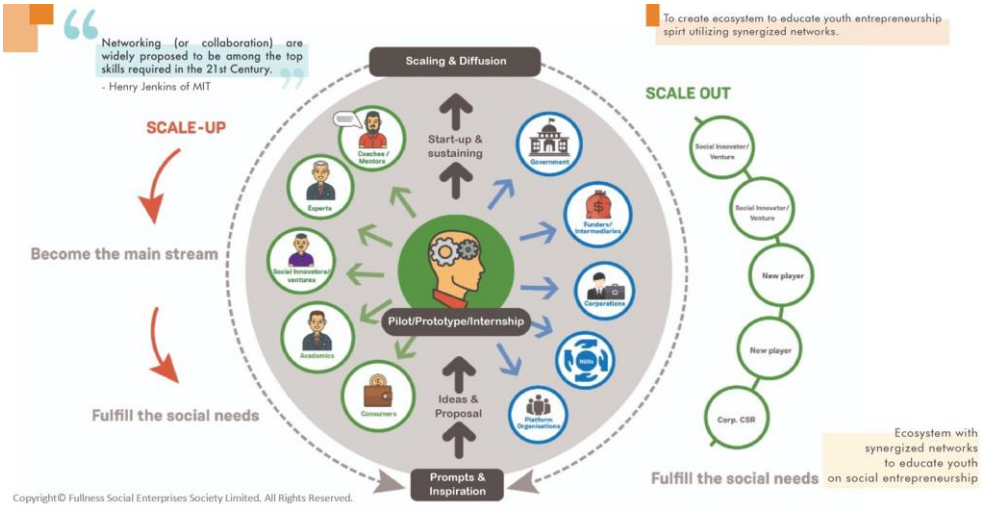


Figure 2: Social entrepreneurship as a method for cultivating future youth leaders

To conclude, the SEnSE Program in Hong Kong serves as a successful example of transforming the fifth generation of youth through educational experiences. By providing activities that inspire growth and reflection, fostering happiness and relationship-building through playful learning, and developing empathy, the program enables young individuals to break free from conventional thinking, challenge themselves, and gain invaluable experiences. It offers a platform for trial and error, encouraging the deepening of empathetic abilities through continuous practice and providing exemplary role models. Through their actions of helping others, these young people find new meaning and heal past pain, ultimately becoming capable of making a true difference in the lives of those in need, leading to ongoing self-transformation. It is important to note that while the SEnSE Program provides valuable platforms for contemplation and reflection on life choices, these educational approaches are not panaceas. However, they do address the spiritual needs of the fifth generation of youth by allowing them to explore the educational value of such experiences extends beyond just the SEnSE Program, as they represent a broader type of learning practice that can be adopted and adapted in various educational settings. By fostering self-discovery, empathy, and a commitment to making a positive impact, these programs can empower young people to become agents of change, not just in their local communities, but across society as a whole.

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Course innovation in business higher education – A case study of a BA Commerce and Marketing course

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Abstract

This paper explores the dynamic landscape of higher education, specifically in the domain of Commerce and Marketing, over the past decade. As higher education faces evolving challenges and changing stakeholder expectations, the study delves into the ongoing debate regarding the alignment of higher education, including business education on a Commerce and Marketing BA course in West-Hungary. The research employs a comprehensive case study methodology spanning ten academic years to showcase the course's development and innovations. The study scrutinizes changes in teaching methodologies, course materials, seminar and project assignments, applied technologies, and assessment methods. Findings from in-depth interviews with business professionals, and student observations reveal the course's adaptation to market needs and challenges encountered during the online transition. The results suggest that, despite disruptions in the academic year 20/21 due to the COVID-19 pandemic, the development of this course in the examined years successfully aligns with market expectations, fostering competencies essential for the business domain, thanks to introducing new methodologies (interactive project-based, seminars), usage of AI assisted applications, and introducing new forms of assessments.

Keywords: *Higher education; business education; course development, course innovation.*

1. Introduction

In recent decades, higher education, like many other fields, has undergone significant change and faced many challenges (Murphy, 2013). The expectations of stakeholders (students, teachers, parents, business) have also changed significantly, but not necessarily in the same direction (Sander et al., 2000; Wardley et al. 2013., Borghi et. al 2016). The extent to which higher education, including economics education, meets the needs of the labour market is a long-standing debate. The needs of the latter, even directly at the local level, indirectly influence

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the expectations of both parents and students towards higher education (Mainardes et. al 2012; Davies, 2002, Remmik et al., 2022). These expectations have to be met, albeit with a time lag, by education and teachers.

2. Course development

The technological, economic, social and political changes of the last decade or two have posed a major challenge to higher education professionals, as these changes have become increasingly rapid and far-reaching (Nurhas et. al, 2022). Technological change, for example, not only affects the methodology of education, but is also transforming the needs and life of society to such an extent that it has an inescapable impact on all aspects of life, and is therefore affecting education from many angles (Ferrel, 2020). These processes can be further accelerated by events such as a pandemic that has increased the pace of the transition to a digital lifestyle and changed its direction and focus (Nurhas et. al, 2022). In higher education, curricula, teaching materials and courses are undergoing significant changes and innovations in response to the changing expectations of both the business sector and students (Guo, 2020). The main driver for the development and evolution of courses is the dynamic change in the world, which affects both expectations and the requirements of practical life (Yulianti, 2020). One of these important changes in the world is the rapid development of technology, which plays a crucial role in the way courses are designed and delivered (Yulianti, 2020), as in many cases traditional course methods no longer meet the needs and expectations of modern learners. As the literature on curricular innovation in higher education highlights, there is a growing recognition that course development is not only about revising course content, but also about paying attention to the way teaching is delivered, to the interaction between students and teachers, and to the design of activities (Bovill, 2020). It is also important to put the learner at the centre of course design and delivery, which includes recognizing the learner as an active and responsible participant in his/her own education (Trinidad, 2020). Another important aspect has recently become collaboration and interdisciplinary approaches. In higher education, there is an increasing emphasis on interdisciplinary and possibly interdepartmental collaboration in course development. The aim of this interdisciplinary approach is to provide students with a comprehensive education and to tackle complex real-world problems that require multiple perspectives. Continuous innovation and adaptation are required in course design and delivery to keep pace with the rapidly changing educational environment. The main areas for this are the use of new pedagogical techniques in content delivery; new teaching methods (e.g., project-based teaching, task-based teaching) (Guo, 2020), the incorporation of experiential learning opportunities, the incorporation of new technology into teaching (Greenhow, 2020), the incorporation of new assessment methods which may indicate a move away from examinations towards practice-oriented assessment.

3. Case study of a Commerce and Marketing BA course

The aim of the study is to analyze the degree of innovation in a bachelor course of Commerce and Marketing and the degree of involvement and satisfaction of the students at a university in West-Hungary in the last ten years.

3.1. Research methodology

This case study illustrates the introduction of innovations through experimental signals. The methodological approach employed in this research is comprehensive, aiming for an in-depth exploration of the topic. Student observation serves as the primary research tool, with the researcher actively engaging in the learning process to observe students' behavior and reactions in the classroom. The observations span three academic years (2016/2017, 2020/2021, 2023/2024). Criteria for observation vary across phases: during the first phase, encompassing the initial contact hour, key factors include student reactions to requirements, course methodology, activity in the first assignment, and the quantity and quality of comments. The second phase involves observing students during a mid-year seminar, focusing on their activity levels, the quality and quantity of questions, comments, and overall mood. The third phase occurs during the presentation of business plans, with observations centered on students' participation rates, activity levels, and personal reactions following the presentation of their results. Additionally, in-depth interviews (n=16) were conducted with four business professionals every second year to glean insights into company expectations and practices. Throughout the duration of the course, the business professionals were actively engaged as mentors and adjudicators during the end-of-semester presentations and subsequent presentation competitions. At the end of each semester, interviews were administered biennially, conducted in person on an individual basis. The interviews encompassed an assessment of the course methodology and delivery, alongside an evaluation of students' performance, acquisition of knowledge, skills, and competencies.

3.2. The course and its challenges

Due to the strategic importance of continuous innovation in education and responding to the changing expectations of the environment in the university under study, several changes have been introduced in the curriculum of the Commerce and Marketing BA programme of the last decade. The course under study is "Management, Organisation and Leadership of Commercial Enterprises", which is in the penultimate semester of the students' programme (not counting the practical semester) in their sample curriculum. For all but one year of the past decade, the course has been a compulsory subject for undergraduate and postgraduate students. What has not changed is that the course consists of lectures and seminars. Before 2010, the lack of a textbook in Hungarian had been a difficulty, but the continuous updating of the textbook by the author has solved this problem.

Over the past decade, the development of the course has encountered numerous challenges requiring careful consideration. Firstly, there has been a noteworthy shift in the funding structure of economics education, transitioning from public financing to self-sustainability. This change has substantially reduced publicly funded positions in higher education institutions specializing in business and economics. Secondly, alterations in student demographics have ensued, with the disappearance of Hungarian students residing beyond borders, resulting in a student body predominantly sourced from within an eighty-kilometer radius of the university. Thirdly, the ubiquitous integration of new technologies across various aspects of life has elevated expectations from both businesses and students, necessitating competencies in their utilization by the conclusion of their educational journey. Fourthly, evolving labor market expectations now demand graduates to possess practical, project-oriented approaches, interdisciplinary knowledge, and effective teamwork skills. Lastly, reflecting these transformations, student expectations have shifted towards modernized course materials and teaching methodologies. Notably, the rapid acceleration of course development was catalyzed by the challenges posed by the COVID-19 pandemic, leading to the widespread adoption of online teaching in the academic year 20/21, further amplified by the introduction of AI-based programs and applications in the subsequent academic year 23/24.

3.3. Steps of course development

In the realm of educational advancement and innovation, this paper focuses on the systematic evolution of course development over consecutive academic years. The progression is delineated in Table 1, where each column corresponds to a distinct academic year. Notably, the table highlights the incremental introduction of novel methodologies, technologies and assessment used in the class, with each progressive step boldly demarcated. In terms of teaching methodology, the course has undergone major changes over the past decade. It has gradually evolved from frontal teaching to interactive, project-based one, in which students work on a large project (a business plan) during the semester and solve related short tasks in seminars to help them implement it. The course material was supplemented with online materials and videos, and over the years students became more and more involved in the teaching-learning process, taking an active part in the design of the lessons.

As their attention has become less and less engaged, the lessons have become "fragmented", with the processing of the course material being continuously supplemented by illustrative videos, games, interactive digital-based forms of assessment and feedback. In class assignments, longer case studies have been replaced by short, project-based interactive exercises, which are now expected to be carried out using AI-based applications in the 23/24 academic year. The final product of the course, whereas previously a text-based business plan, now requires the submission of a video presenting the business plan and project background materials. Evaluation has also undergone a number of changes, with the initial instructor-led individual evaluation

being replaced by a group-level project evaluation, which takes place in a one-day workshop involving academic and business professionals.

Table 1. Methodological development of course "Management, Organisation and Leadership of Commercial Enterprises" Source: own compilation

Academic year	Educational methodology	Course material	Seminar Assignments	Project assignments	Applied technologies, games, softwares	Assessment
2014/15	frontal teaching	book, lecture slides	calculation	no project task	no applied technology	written exam
2015/16	frontal lectures, **interactive seminars**	book, lecture slides	**case studies with calculation**	**written business plan**	no applied technology	**oral exam**
2016/17	frontal lectures, interactive seminars	book, lecture slides	**simulation**	written business plan and presentations	**jeopardy game on last lecture**	**professional jury**, oral exam
2017/18	frontal lectures, interactive seminars	book, lecture slides, **studies**	simulation	written business plan and presentations	jeopardy game on last lecture	oral exam
2018/19	frontal lectures, interactive seminars	book, lecture slides, studies	short assignments with calculation	written business plan and presentations	jeopardy game and **Kahoot quiz on lectures**	**written exam**
2019/20	frontal lectures, interactive seminars	book, lecture slides, studies	short assignments with calculation	written business plan and presentations	Kahoot quiz on lectures	**presentation for professional jury** written exam
2020/21	**online lectures and seminars (frontal)**	book, lecture slides, studies, videos	online short assignments	**video and a presentation of a business plan**	**online board games** and Kahoot quiz on lectures	**online presentation for professional jury, exam**
2021/22	**interactive lectures and seminars**	book, lecture slides, studies, videos	short assignments	**video and a presentation of a business plan**	**online business plan make**r and Kahoot quiz on lectures	presentation for professional jury, **written midterm and endterm test**
2022/23	interactive lectures and **project-based seminars**	book, lecture slides, studies, videos	project assignments	video and background material	**escape room games** and Kahoot quiz on lectures	**video presentation for professional jury**, written midterm and endterm test
2023/24	interactive lectures and project-based seminars	book, lecture slides, studies, videos	**project assignments using AI, content creating**	**video and background material**	**AI based applications (e.g. Dall-E, ChatGPT)**	video presentation for prof. jury, written mid/ endterm test

3.4. Findings

3.4.1. In-depth interviews with business professionals

In-depth interviews were carried out every two years with the same professional experts after the presentation of the student material. Among other things, it was at his suggestion that new forms of assessment and new methods were introduced to reinforce competences and skills in line with market needs. In principle, he was satisfied with the course during each year, but made additions. He suggested developing students' writing skills and their ability to organise and see things in a systematic way at the beginning, then suggested introducing exercises to develop communication, debating and problemsolving skills and teamwork competencies, and then emphasising creativity and the appropriate use of market applications in order to enhance and develop digital/ICT skills and competences. The 23/24 academic year was the first in which the course structure, the examinations, the technologies used, the curriculum and the students' competences met the market's expectations and the business expert did not make any suggestions regarding competence development.

3.4.2. Student observation

In light of the examination findings, notably influenced by the transition to online observation, the outcomes reveal a pronounced divergence, particularly during the academic year 20/21. Across all phases, a discernible decline in activity is evident, accompanied by elevated levels of student dissatisfaction and increased rates of negative comments. This outcome can be attributed to the challenges posed by the online learning environment, wherein interactive lessons were constrained, relying solely on visual and auditory stimuli while lacking the richness of metacommunication and other non-verbal cues. Consequently, students reported lower satisfaction levels, attributing the difficulty in meeting requirements to the constraints of the online format. Despite adaptations to align with online teaching and learning, the desired outcome was not fully realized. Intriguingly, the subsequent academic year witnessed minimal alterations in the requirements, maintaining continuity with the introduction of two quarterly exams (midterm and endterm test) in lieu of the traditional end-of-semester exam, yet retaining the contentious video component that had been subject to student grievances. The outcomes from the initial phase of observation (first seminar lesson) in the academic year 23/24 closely mirrored those observed in the 16/17 academic year. No discernible distinctions were evident in terms of student engagement, the volume and characteristics of comments provided were nearly identical, and on both occasions, students exhibited a shared sense of disillusionment with the course requirements. During the second phase of observation (midyear seminar lesson), a notable divergence between the two academic years, with a preference for 23/24, became evident. Students in the later academic year exhibited significantly higher levels of activity, demonstrated more substantial advancements in the project assignment compared to previous years, and their inquiries during the seminar indicated a markedly deeper understanding of the

course material compared to the 16/17 academic year. The outcomes in the third phase (final presentations of the course) exhibited a blend of results, as one year excelled in certain aspects while the other surpassed in different facets. Attendance rates during the presentations (partially obligatory for students), were very similar. The more recent year showed slightly heightened activity levels, characterized by increased commentary during the presentations and greater involvement from students in preparation of presentations. Nevertheless, in terms of personal reactions, the preceding academic year, 16/17, was deemed superior, with a greater number of students verbally expressing satisfaction with the course.

4. Conclusion

The assessment indicates that by the academic year 23/24, the course development had attained a level aligning with market expectations, cultivating and reinforcing competencies essential for the business domain. On the whole, students expressed satisfaction with the course, except potentially during the initial year of the COVID-19 pandemic, in the academic year 20/21. The heightened dissatisfaction during this period could likely be attributed to the challenges in effectively translating the course's teaching methodology and requirements into the online environment. Despite this, the lack of a substantial increase in overall student satisfaction does not raise significant concerns, as students consistently reported satisfaction each year, meeting their needs to a satisfactory extent. It is noteworthy that students can only gauge the course within their own academic year, limiting their ability to assess potential deterioration or improvement. This assertion is supported by observational results, revealing consistent student satisfaction and active engagement in the course project assignment after the initial seminars.

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The effect of business students' maladaptive decision-making strategies on entrepreneurial intention

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Abstract

An individual's decision-making strategies are influenced by socially learned patterns. An individual's entrepreneurial behavior can be studied by evaluating learned decision-making patterns. The purpose of this study is to investigate the impact of business students' decision-making strategies on entrepreneurial intentions and to assess the relationship of maladaptive decision-making patterns to business students' intention. Significantly, the results indicate that usiness students who tend to engage in buck passing may be more likely to have entrepreneurial intentions. Buck passing behavior, where responsibility is shifted to others, might be linked to a more independent and proactive entrepreneurial mindset. Individuals who procrastinate are less likely to have entrepreneurial intentions. Procrastination is associated with a lower perceived behavioral control. Individuals who are hypervigilant may experience a sense of reduced control over their actions. Vigilance is linked to greater entrepreneurial intentions, indicating a proactive mindset in monitoring opportunities and risks.

Keywords: *Entrepreneurial intention; decision making; decision making strategies; business education; business students.*

1. Introduction and theoretical background

To obtain a comprehensive understanding of entrepreneurial development, it is insufficient to solely assess those who have achieved their goals. The analysis should extend to the pre-decision stage, encompassing factors such as interest, intentions, entrepreneurship as a career choice, and the characteristics of potential entrepreneurs and employees (Bird, 1988, Gaile et al., 2020). The maturity of an individual's professional choice is characterized by planning skills and "within the individual", rather than being determined by the amount of specific information or content acquired (Sprinthall & Tiedeman, 1966). In today's environment, individuals frequently encounter uncertainty, yet the ability to make a decision is considered a competency that can be

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improved over a lifetime (Saksonova & Papiashvili, 2021). Park has defined decision-making agility based on the interpretation of events, immediately identify opportunities and threats, as well as the development of action plans that lead reconfiguring resources and developing new procedures (Park, 2011). Decision-making, as a multifaceted process, engages various cognitive and emotional faculties (Alsharif et al., 2021). The complexity of these functions correlates with the potential consequences of the decision at hand (Sanfey & Rilling, 2011), sometimes resulting in conflicts during the decision-making process (Certel et al., 2013). Particularly for young individuals, the decision to identify a professional path is often postponed or halted altogether in the face of challenges. Enhancing one's decision-making capabilities involves understanding the necessary steps to select the most suitable option, evaluating the decision-making context, and effectively translating one's thoughts and emotions into actionable outcomes (Appelt et al., 2011). Contemporary research suggests that people often base their decisions not solely on the absolute value of potential outcomes, but rather on the relative magnitude of gains and losses, with losses being perceived more acutely than gains (Seta et al., 2001). Consequently, failure to meet expectations and subsequent feelings of regret can lead to decision conflicts and impact future decision-making processes. Entrepreneurship is highly emotional work, it is often depicted as an "emotional roller coaster" with multiple ups and downs affecting the emotional experience of entrepreneurs (Shepherd & Patzelt, 2018).

According to the scientist Simon, “to develop a comprehensive theory of human rationality, it's imperative to understand the role emotions play within it (Simon, 1972).” Decision-making demands a profound level of awareness, not solely in terms of information, but also emotionally. Emotions wield significant influence, often distorting or even determining the outcomes of many decisions individuals face. Brooks (2011) believes that much of the decision-making is just “emotional business” rather than rational analysis, and that individuals may engage in “talk” that does not reflect their true intentions.

2. Behavioral approaches to overcoming decisional conflict

Scientists Janis and Mann (1977) have outlined behavioral approaches to coping with decisional conflict, distinguishing between adaptive and maladaptive strategies. The adaptive approach aligns with rational decision-making theory, positing that individuals act rationally to maximize expected utility. In contrast, maladaptive strategies are closely linked to emotional factors (Janis & Mann, 1977). However, it is proven that people can use their cognitive resources to influence emotional experience (e.g., Folkman & Moskowitz 2004). Entrepreneurship is inherently characterized by uncertainty, unpredictability and countless variables that are often beyond an individual's control. In such circumstances, decision making is modeled as an iterative process. It involves testing hypotheses, learning from failures and adjusting strategies based on feedback and means that each individual can change his decision by learning the opinions of other individuals.

While individuals strive to act rationally, aiming to achieve their goals through the most effective means, the inherent limitations of human information processing impose constraints on their actions. Despite this, scientists Phillips et al. (2001) have concluded that the pursuit of rational and autonomous decision-making may not always be adaptive or desirable. Human cognitive capacities are limited, suggesting that decisions are not always made with systematic, comprehensive, and rational precision, moreover, emotion or intuition, often considered maladaptive in some decision models, can serve as a valuable source of information in evaluating alternatives (Phillips et al., 2001).

3. Cognitive strategies and entrepreneurial intentions

An individual's decision-making process involves consciously selecting a desired option or course of action from a set of alternatives, impacting numerous aspects of daily life (Avilés-Reyes et al., 2023). This process necessitates the involvement of various cognitive functions to ensure positive outcomes. While this fundamental process appears straightforward, theorists acknowledge significant individual differences in reaching entrepreneurial intentions. Entrepreneurial behavior frequently hinges on an individual's cognitive abilities to adjust strategies and make decisions amidst uncertainty. Coping models of decisional conflict elucidate how individuals navigate uncertainty. The process of viewing and selecting alternatives in a situation can become so intricate that it occasionally "paralyzes" decision-making, as individuals may lack the time and patience to overcome these challenges (Simon, 1972). Uncertainty exerts a significant influence on decision-makers. According to the concept proposed by scientists Janis and Mann (1977), decision-making models may vary depending on the situation, with individuals often gravitating towards certain models of decision conflict management over others. According to theoretical insights from scientists, vigilance emerges as the sole adaptive coping model for decisional conflict. Vigilance is distinguished by systematic information search, thorough consideration of viable alternatives, and deliberate, thoughtful deliberation on the final outcome and decision (Ding et al., 2020). Conversely, individuals employing maladaptive decision conflict coping strategies may exhibit hypervigilance, buck passing, or procrastination (Janis & Mann, 1977). Scientists suggest that maladaptive decision-making strategies stem from emotional pressures that hinder the individual's ability to grasp the full scope of the problem. Awareness of the decision-making pattern can expand an individual's responsiveness, individual resilience, and increase positive experiences in the long term. Therefore, this study will conduct a factor analysis to find out the decision-making strategies of business students and their impact on entrepreneurial intention. Understanding and managing decision-making patterns can help an individual to give structure to the cognitive process in promoting intentions. By integrating these models into their “cognitive repertoire”, young people can improve the efficiency of their decision-making processes.

4. Methods. Research design

The present study aims to explore the influence of decision-making strategies on the entrepreneurial intention of business students and to evaluate the relationship of non-adaptive decision-making models with the intention of business students. The study employed a questionnaire to collect individuals' views. The Entrepreneurial Intention Questionnaire (EIQ) Version 3.1, developed by Liñán, Bradley, Basuki, & Redford (2006), was used for the research. The surveys were translated into Latvian and approved. A total of 158 participants business students took part in the research. 157 questionnaires were considered valid for collecting the research results. Descriptive statistics of constructs are shown in Table 1.

Table 1. Descriptive statistics. Source: Authors' research

	Mean	*Std. Deviation*	N
Entrepreneurial intentions	5,6831	1,05659	157
Attitude toward the behavior	4,3272	,58062	157
Subjective norm	4,1605	,56731	157
Perceived behavioral control	4,1926	,49542	157
Vigilance	1,6889	,25884	157
Hypervigilance	,8099	,37802	157
Buck passing	,6481	,41750	157
Procrastination	1,0790	,32967	157

5. Data collection

Correlations between all main variables were calculated, as shown in Table 2.

Table 2. Descriptive statistics and correlations between variables. Source: Authors' research

		EI	ATB	SN	PBC
Vigilance	Pearson Correlation	,209	,037	-,036	,146
	Sig. (2-tailed)	,063	,743	,750	,195
	N	157	157	157	157
Hypervigilance	Pearson Correlation	-0,17	-,201	,039	-,181
	Sig. (2-tailed)	,880	,072	,729	,106
	N	157	157	157	157
Buck passing	Pearson Correlation	,130	,044	-,251*	,118
	Sig. (2-tailed)	,248	,697	,024	,293
	N	157	157	157	157
Procrastination	Pearson Correlation	-,267*	-,215	,110	-,229*
	Sig. (2-tailed)	,016	,054	,330	,040
	N	157	157	157	157

* Correlation is significant at the 0.05 level (2-tailed).
EI - Entrepreneurial Intention; ATB - Attitude toward the behavior; SN - Subjective norm; PBC - Perceived behavioral control

A small but significant correlation (r=0.209; p<0.05) suggests that higher vigilance is linked to greater entrepreneurial intentions, indicating a proactive mindset in monitoring opportunities and risks. The weak positive correlation (r=0.146; p<0.05) suggests that individuals with higher levels of vigilance tend to perceive greater control over their behavior. This implies that vigilance may contribute to a sense of self-efficacy and confidence in managing one's actions. The results indicate that hypervigilance may not be a significant factor influencing entrepreneurial aspirations. The weak negative correlation (r= -0.201; p<0.05) suggests that individuals with higher levels of hypervigilance may have a less favorable attitude toward a specific behavior. Hypervigilance might be associated with a more cautious or skeptical approach to certain actions. Hypervigilance may be associated with sensitivity to social expectations regarding a behavior. The moderate negative correlation (r=-0.181; p<0.05) suggests that higher levels of hypervigilance are associated with a perceived decrease in behavioral control. Individuals who are hypervigilant may experience a sense of reduced control over their actions. Significantly, the results indicatet that individuals who tend to engage in buck passing may be more likely to have entrepreneurial intentions (r=0130; p<0.05). Buck passing behavior, where responsibility is shifted to others, might be linked to a more independent and proactive entrepreneurial mindset. The substantial negative correlation (r=-0.251; p<0.05) implies a strong inverse relationship between buck passing and subjective norm. Individuals who engage in buck passing may be less influenced by social expectations and norms related to a specific behavior. The positive very weak correlation (r=0.118; p<0.05) suggests that individuals who engage in buck passing may still perceive a reasonable level of control over their behavior. This implies that despite the tendency to shift responsibility, these individuals may feel competent in managing their actions. The moderate to strong negative correlation (r=-0.267; p<0.05) suggests that individuals who procrastinate are less likely to have entrepreneurial intentions. Procrastination, characterized by delaying tasks, might hinder the proactive mindset needed for entrepreneurship. The moderate negative correlation (r=-0.215; p<0.05) implies that procrastination is associated with a less positive attitude toward a specific behavior. Individuals who procrastinate may harbor negative sentiments or doubts about engaging in certain activities. The results suggest a slight tendency for individuals who procrastinate to be more influenced by social interactions. Procrastinators may be somewhat sensitive to social expectations related to a particular behavior. The moderate negative correlation (r=-0.229; p<0.05) indicates that procrastination is associated with a lower perceived behavioral control. Individuals who procrastinate may feel less in control of their actions, potentially hindering their ability to initiate and complete tasks.

6. Conclusion and discussion

Understanding decision-making patterns can enhance an individual's responsiveness, resilience, and long-term positive experiences. To explain the potential of realizing entrepreneurial

intentions, the relationship between students' entrepreneurial intentions and decision-making models was clarified. As a result of the study, the behavioral approaches of business students to overcome the decision conflict were evaluated. Information overload, limited time, physical fatigue limit the decision-making process. Changes in personal life, the desire for social comparison, dissatisfaction with the results of the decisions made are the main factors that make young people evaluate or revise their decision-making process (Maheshwari & Rai, 2021). Business students are characterized by both adaptive and maladaptive approaches in solving a decision conflict (Figure 1), however, vigilance and procrastination are dominant. Other studies also show that procrastination as a decision-making pattern for young people is also closely related to students' propensity to postpone academic tasks (Ferrari et al., 1995). This could mean that decision-makers may sometimes struggle with timeliness or face problems in coming to conclusions quickly. Vigilance is considered a key characteristic of rational decision makers. The results of this study and other studies conducted, show that positive professional development results can be related to a rational and intuitive decision-making style (e.g., Li S., Li Y. & Lin, 2023). Vigilant decision makers do not shy away from responsibility and believe there is enough time to find better alternatives.

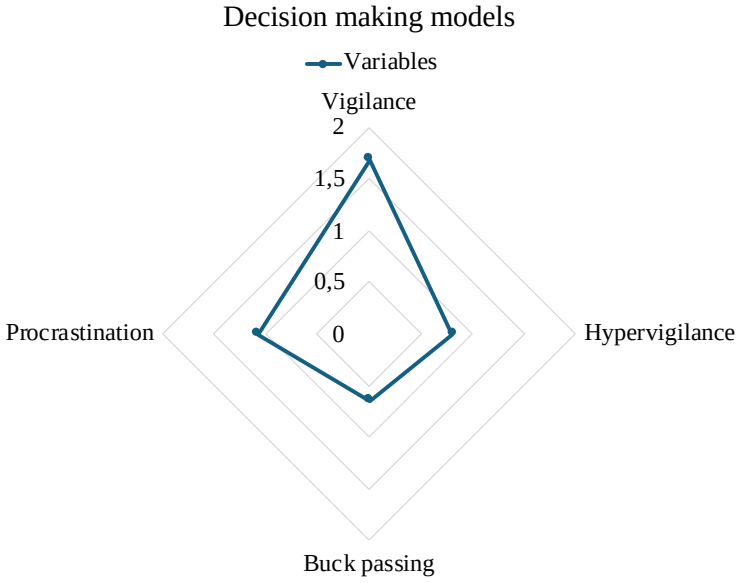


Figure 1. Comparative frequency of decision-making models. Source: Authors' research

The conducted research proved that buck passing can be positively affected by rational decisions, although individuals who make decisions based on other people's opinions may be more often exposed to professional development choices that are not optimal for their goals (Pečjak & Košir, 2007). Avoiding conflict might seem tempting, but decision-making requires

integrity, resilience and facing challenges head-on. Making even the tougher decisions is critical to personal growth, leadership, and fostering accountability and integrity.

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Reimagining Higher Education Post-Pandemic: A Mobile Robotic Telepresence Case Study in the United States

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Abstract

Higher education is facing unprecedented challenges post-pandemic and must provide flexible and accessible learning options to students to remain relevant. This qualitative case study applied social presence theory to explore faculty and student experiences with mobile robotic telepresence (MRT) as tool for offering synchronous hybrid classes. Results indicated co-presence was the strongest element of social presence. Additionally, several key factors were identified for effective MRT implementation.

Keywords: *emerging learning technologies and accessibility, engagement or qualitative research*

1. Introduction

The pandemic had a profound impact on higher education and has forced a reexamination of the system (Kara, 2021). New strategic priorities include the use of emerging technologies to promote access, equity, persistence, interest, and focus (Kara, 2021; Kobysheva et al., 2021; Moshinski et al., 2021) Hybrid learning concepts have become prominent post-pandemic as the face-to-face vs. online binary has been rejected in favor of "convergence," a synthesis of modalities (Brown, 2021, p. 3). One promising approach to integrate physical and remote learning spaces uses mobile robotic telepresence (MRT) to create synchronous hybrid classrooms (Bower et al., 2015).While MRTs have become increasingly accepted in business and healthcare settings, (Fitter et al., 2020; Sheehy & Green, 2011), there is limited research on their use in higher education (Capello, S. et al., 2022; Lei et al., 2019; Leoste et al., 2022). This study explores the use of MRT in a university setting and contributes to the understanding of the potential benefits and challenges of MRT in promoting effective synchronous hybrid learning environments in higher education.

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2. Literature Review

The term telepresence is used to represent a variety of technologies that involve embodied, virtual presence in mediated environments (Hughes-Roberts et al., 2019). Research has shown MRTs to be effective in fostering accessible education, better communication, engagement, and social presence (Capello et al., 2022; Häfner et al., 2023; Kasuk & Virkus, 2024), but they have also presented technical, physical, and emotional challenges (Kasuk & Virkus, 2024). There is a need for additional research on the use of MRT in higher education to better understand its potential for offering effective synchronous hybrid learning environments and to promote positive benefits while mitigating challenges (Capello, S. et al., 2022; Lei et al., 2022; Leoste et al., 2022).

2.1. Social Presence

This study applied social presence theory. Social presence is an important factor in technology mediated communications because it has been associated with positive outcomes such as persuasion, trust and enjoyment, social influence, and attraction toward a physically embodied agent (Oh et al., 2018). However, there is limited consensus on the conceptualization and measurement of social presence (Almeida et al., 2022; Oh et al., 2018; Pimentel & Vinkers, 2021). For the purpose of this study, we characterize social presence across three domains: telepresence, self-presence, and co-presence. Telepresence is the extent to which one feels present in the mediated environment and is no longer aware that their experience is being mediated by technology (Almeida et al., 2022; Oh et al., 2018; Steuer, 1992; Vu et al., 2012). Self-presence is the extent to which the virtual self is experienced as the actual self and how the technology tool feels like and is treated like an extension of the body (Aymerich-Franch, L. et al., 2012; Biocca, 1997; Oh et al., 2018; Ratan & Hasler, 2009). Co-presence is the sense of being in the same place with another human, virtual or otherwise, and the perception of mutual entrainment with another (Almeida et al., 2022; Pimentel & Vinkers, 2021; Zhao, 2003).

3. Methods

The purpose of this qualitative study was to explore student and faculty experiences with an MRT pilot in a synchronous hybrid learning environment. The research question was: What are the experiences and perceptions of students and faculty who use robotic telepresence technology in a synchronous hybrid learning environment?

The study took place at a public university in the northeast region of the United States. The pilot used a four-foot VGo mobile telepresence robot with an integrated camera, microphone, and video display on a lightweight, motorized remote controlled platform. The MTR was made available to 24 faculty teaching across all programs in the satellite location after an initial training on the use of the MTR. In classes where the MTR was used, faculty, remote student

users, and local student users were sent open-ended surveys. Surveys asked for volunteers to participate in semi-structured interviews to gather more detailed information.

The robot was used in four different courses (two doctoral level courses, one masters level course, and one undergraduate course). Four faculty completed the survey and two were interviewed. Eight remote student users completed the survey and six were interviewed. Twenty local student users who interacted with the robot completed the survey and eight were interviewed. Data were analyzed through both inductive and deductive content analysis (Fereday & Muir-Cochrane, 2006). To promote trustworthiness of the data, collaborative coding (Saldaña, 2016) was used in conjunction with member-checking and data triangulation (Mertler, 2020).

4. Results

The feedback regarding the experience of telepresence among remote MRT users was mixed. The likelihood of the remote user experiencing telepresence seemed to be related to their level of expertise with technology, particularly video game usage, as well as the number of times they were able to use the MRT. The majority of participants agreed that MRT was preferable to video-conferencing. While some students experienced telepresence, were so distracted by trying to figure out how to use the robot, it made telepresence impossible.

Self-presence among the MRT users was also mixed with slightly more of the users applying language indicative of self-presence. While some participants experienced self-presence, others continued to refer to the robot as an external agent. More frequent use of the MTR seemed to lead to an increased sense of self-presence.

Co-presence was the strongest element of social presence with most faculty and students perceiving effective one-on-one and small group interactions. Two challenges that arose relative to co-presence were the ability to hear individuals when the whole class was talking and when wi-fi limited the ability to project the user's face on the screen.

Six additional themes related to the use of the MRT emerged in the data. First, the usefulness of the MRT was directly related to the pedagogical approach of the professor. Second, advanced preparation is required for MTR use to be successful. Third, both faculty and students reported the need for and benefit of additional support, such as a teaching assistant, when using MRT. Fourth, the robot was often a distraction, however, this seemed to dissipate with more consistent use. It was recommended that there be a student orientation that included an introduction to MRT and allowed students to practice with the robot. Fifth, maneuverability was a challenge for the remote user, but can be minimized with effective classroom set up and may improve as the robot technology continues to develop and improve. Finally, a strong wi-fi connection was

necessary for effective use of MRT and enhanced co-presence because it permitted the remote user's face to be present on the display.

5. Discussion and Conclusion

Higher education students have varied needs post-pandemic, with some wanting to return to face-to-face instruction, while others prefer the convenience of taking classes from home. To best serve all students, it is incumbent upon higher education institutions to find effective means of offering synchronous hybrid learning environments. This study explored faculty and student experiences with MRT and highlighted both the potential benefits and the inherent challenges associated with deploying telepresence technology in synchronous hybrid learning environments.

The findings of the study underscore the importance of aligning the use of MRTs with specific pedagogical strategies. The effectiveness of the MRTs and students' perceptions of social presence were influenced by the instructional approach adopted by educators. MRT was shown to be most useful when collaborative pedagogical strategies were employed, as opposed to lecture-based teaching, with co-presence being the strongest element of social presence. These findings are consistent with previous studies of MRT in higher education settings (Khadri, 2021; Lei et al., 2022; Leoste et al., 2022). Faculty and students would benefit from substantive training on the use of MRT, opportunities to observe the use of MRT in instructional settings, and the ability to practice with MRT in non-instructional settings before implementation. Faculty need to post class materials online ahead of the class and outcomes were improved with the use of a teaching assistant in synchronous hybrid learning environments. Previous studies have reported similar findings. (Botev & Rodríguez Lera, 2021; Kasuk & Virkus, 2024). A pedagogically sound deployment, pre-class preparations, faculty support, and familiarization with MRT functionalities enhanced student learning experiences.

Technical and operational challenges related to maneuverability and a wi-fi connections negatively impacted the learning experience and the degree to which the users experienced social presence. The MRT demonstrated potential for enhancing the telepresence and self-presence aspects of social presence only when users had sufficient preparation and practice using the MRT and there was sufficient wi-fi to support the technology. It is essential to address these operational and technical challenges through improved design and infrastructure support for the success of MRT applications in higher education.

The study illustrates the nuanced nature of social presence in MRT-mediated environments. While some participants experienced social presence and a sense of agency, consistent with the findings of Capello et al., 2022 and Fitter, 2020, others struggled to achieve similar levels of engagement. Future research should explore how different factors, such as individual technological proficiency and frequency or MRT use, contribute to the sense of social presence.

The mixed outcomes reported in this study suggest that while MRTs hold promise for enhancing hybrid synchronous learning environments, careful consideration must be given to both the technological and human factors involved. Educational institutions should consider the broader implications of MRT integration, including the need for policy and procedure development, infrastructure investment, and continuous evaluation of educational outcomes.

This study is subject to several limitations, including a small sample size, precluding generalizability. Furthermore, the data was collected from one university, which may not reflect broader educational contexts. The focus on the VGo mobile telepresence robot as the specific MRT under investigation could also limit the applicability of the findings to other telepresence technologies or platforms. Despite these limitations, the research offers valuable insights into the use of MTR technology in higher education, enriching the existing body of literature. The study offers potential benefits, or transferrable value, to higher education institutions seeking to increase enrollment and student satisfaction by offering synchronous hybrid learning environments (Mertler, 2020). Moreover, mobile robotic telepresence technologies, such as the VGo robot, offer promising solutions for bridging the gap in classroom access and participation for remote learners.

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Revolutionizing Flipped Learning with ChatGPT: A Strategic Framework for Enhanced Educational Engagement

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Abstract

This paper proposes a novel framework for integrating ChatGPT in flipped learning environments, enhancing both asynchronous and synchronous content delivery. It explores leveraging Large Language Models (LLMs) like ChatGPT to personalize and streamline educational content, utilizing Bloom's Taxonomy and Constructive Alignment for pedagogical design. The paper emphasizes the transformation of the educator's role and the creation of custom assessments using AI. It also outlines practical applications, including case studies, to demonstrate the improved learning outcomes and engagement through ChatGPT's integration. The proposal envisions an optimized educational landscape, rich in quality, diversity, and efficiency.

Keywords: *Personalized Learning, Constructive Alignment, Large Language Models (LLMs), Flipped Learning*

1. Introduction

This paper outlines a framework for using ChatGPT and other Large Language Models (LLMs) to enhance flipped learning environments, highlighting it's ability to mimic human language through complex algorithms. It proposes a pedagogical model that uses ChatGPT as a co-creative agent to improve both asynchronous and synchronous instruction in these settings. The paper aims to propose a novel framework for integrating ChatGPT into flipped learning environments to enhance both asynchronous and synchronous educational content delivery. By integrating educational theories like Bloom's Taxonomy and Constructive Alignment, it presents a methodologically sound instructional design that promotes higher-order thinking, content generation, and custom assessments. The integration of ChatGPT as a co-creative partner is posited to transform flipped learning by enriching engagement and enabling the creation of personalized, adaptive content. The intention is for a shift to improve educational

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resource use, content quality, and relevance. Case studies and evidence will demonstrate the practical benefits of this approach on learning outcomes and student engagement.

This paper is significant for educators as it presents a comprehensive framework for integrating ChatGPT into flipped learning environments, offering a methodological approach to enhance both asynchronous and synchronous learning. By leveraging Large Language Models like ChatGPT, educators can personalize educational content, streamline content delivery, and improve learning outcomes. The paper emphasizes the transformative potential of AI in education, showcasing practical applications and case studies that demonstrate the benefits of ChatGPT for engaging students and fostering deeper cognitive engagement.

2. Flipped Learning Approach

Flipped Learning is the process of reversing the typical learning structure. In the traditional model, a learner attends a lecture for knowledge acquisition and then engages in post-session activities to apply that knowledge (Bergmann & Sams, 2012). In the flipped learning approach, the learner completes knowledge acquisition activities asynchronously before attending a synchronous session to apply that knowledge. A fundamental aspect of flipped learning is transforming the role of educators from mere disseminators of knowledge to facilitators of knowledge application activities (Abeysekera & Dawson, 2015). Another pivotal element is the group-based application sessions, which conventional lecture-based teaching does not easily accommodate (Beichner, 2008). This approach is rooted in Social Constructivist Theory (Vygotsky, 1978) and facilitates higher order thinking activities in a structured environment. Using ChatGPT in this context can enhance the development of flipped activity content.

2.1. Bloom’s Taxonomy

Bloom's Taxonomy categorizes cognitive tasks into a hierarchy of six levels:

- Remembering: Recalling facts or concepts.
- Understanding: Interpreting material's meaning.
- Applying: Using learned information in new situations.
- Analysing: Dissecting material to understand its structure.
- Evaluating: Judging based on set criteria.
- Creating: Synthesizing elements to form a unique whole.

The first three levels represent Lower Order Thinking Skills (LOTS), while the last three signify Higher Order Thinking Skills (HOTS). The goal is for learners to transition from LOTS to HOTS, fostering deeper thinking essential for problem-solving and informed decision-making (Bloom et al., 1956). Bloom's Taxonomy is signitifcant here to ensure that ChatGPT's integration into flipped learning environments methodically enhances the progression from lower to higher-order cognitive skills, essential for effective educational engagement.

2.2. Constructive Alignment

Constructive alignment refers to the intentional integration of learning outcomes, teaching materials, and assessment tasks. The learning outcomes delineate the skills and knowledge that students are expected to acquire in each session. These outcomes provide the criteria against which students' assignments are assessed. Accordingly, the assignments are designed to ensure that they address all specified learning outcomes. Similarly, the teaching and learning materials are purposefully tailored to guide students towards achieving these outcomes (Biggs, 1996). Constructive alignment should be undertaken alongside the ideas outlined by Bloom et al. (1956) when creating materials using ChatGPT.

3. Asynchronous Content Development

Asynchronous learning entails a process where learners engage in guided learning activities without being constrained by a specific time frame or the necessity of an educator's presence" (Hrastinski, 2008). These activities comprise a series of tasks, curated or created by an educator, following a strict pedagogical structure. It is pivotal to differentiate asynchronous learning from independent learning. In the latter, although an educator may provide a general direction for inquiry, students ultimately exert control over the structure and activities they undertake. The generation of asynchronous content creation can be time consuming so using ChatGPT as a co-creator of these materials can save time and have additional benefits as laid out in the following process.

At the start of any module, key terminology will need to be introduced. A glossary of terms or a bank of words may already exist which explains these terms when they arise organically. Using ChatGPT to outline all the common key pieces of terminology within a specific topic can be beneficial for learners. Even subject-specific specialists could have potential blind spots; ChatGPT can highlight the possibility of unconscious biases.

> **Example prompts:**
>
> *"What are the key terminologies related to [specific topic or module]?"*
> *"List common terms used in a module about [specific topic or module]?"*
> *"Are there any advanced or less-common terminologies related to [specific topic or module] that might not be widely known?"*
> *"How can biases impact the creation of educational materials on [specific topic or module]?"*
>
> *Applied example: "What are the key terminologies in Macroeconomic theory?"*

3.1. Definitions Overview

Initiating the educational process by presenting simple definitions enables learners to effectively integrate foundational knowledge. It is beneficial to tailor explanations of key terminology to

the context of the broader module being studied. Utilising analogies to convey these definitions in a non-technical and relatable manner enhances learner comprehension. Modifying the formality of the definitions ensures they extend beyond mere dictionary explanations, providing a deeper, more nuanced understanding. Additionally, developing scripts for academic video presentations can transform these definitions into engaging, multimodal educational experiences.

Example prompts:

"Provide a simple definition of [term]"
"Explain [term] in the context of [specific topic/module]"
"Can you provide an analogy to explain [term] in a way that's easy to understand for beginners?"
"How can [term] be defined in an informal or conversational manner?"
"What visuals could be used to explain [term/ concept] in a video presentation?"
"How can [term/ concept] be explained in a way that is engaging for video content?"

Applied example: "How can price elasticity in Economics be explained in a non technical way?

3.2. Introduction Text Summary

Summaries of existing materials containing key terminologies can be created from extensive texts. These summaries prepare learners for the in-depth explanations of terms they will encounter, priming their understanding of the content to follow. Formats for these summaries may vary, ranging from shortened paragraphs to more concise forms such as bullet point sentences or three-word bullet point explanations. Furthermore, the tone of the summary may be tailored to fit the context and audience.

Example prompts:

"Summarize the key concepts and terminologies from the following text: [insert large text, e.g. lengthy textbook]"
"Create a brief overview of [specific term] in a learner-friendly tone"
"Summarize the concept of [term] using only three words per bullet point"
"Provide a summary of [text/term] in a [specific tone, e.g., casual/formal/enthusiastic] tone"

Applied example: "Provide a summary of Economic Policy in the UK since WWII"

3.3. Knowledge Acquisition

Upon the creation of definitions and summaries, educators may transition learners from passive to active participants in their educational journey. ChatGPT can be employed to help create various types of quiz tools within the Virtual Learning Environment, including simple drag-and-drop activities, true/false questions, multiple-choice questions, and more. Questions may be

crafted for students to engage with and respond to actively. These inquiries should be designed to target Lower Order Thinking Skills (LOTS), thereby facilitating differentiated learning that caters to a diverse range of cognitive abilities.

Example prompts:

"Create a drag and drop activity for the key concepts in [topic/module]'].
"Develop a true or false quiz based on the following material: [insert summary/definitions]'].
"Create a set of LOT-based questions for [specific topic] suitable for H5P implementation'].
"Provide examples of recall and understand-level questions related to [specific topic]'].
"Generate questions that require simple identification or recollection related to [specific topic or concept]'].

Applied example: "Create multiple choice questions related to UK Economic history with varying difficulty levels"

4. Synchronous Content Development

Synchronous delivery is learning that is delivered in a specific place, at a specific time, to all students. Synchronous delivery provides students with immediate feedback from their teacher and / or fellow learners (Algonquin College, n.d.). Generative AI can assist with more traditional, teacher-centric models of delivery (Todorovic, 2020). Synchronous content delivery, despite being more traditional in style, can still be enhanced using content produced by ChatGPT. For example, Bagshaw (2022) outlines how ChatGPT can be used to examine a subject area, provide an essay style question, then provide an answer to that question within a set word limit. It is then outlined how that answer can be summarised and shortened

ChatGPT can also be used as a tool for customisation of assessment, to be given alongside synchronous material. Assessment briefs can be adjusted so that each student or group of students has a different version, accounting for a range of criteria including difficulty, language, type of assessment and more. ChatGPT facilitates the possibility of adjusting assessment briefs based solely on material entered or can be enhanced by the existing model used.

Example prompts:

"Generate a case study based on [topic], with a focus on [sub-topic]"

"Examine [previous answer given]. Generate a follow-up question based on this response"
"Adapt this question for [non-native language]"

Applied example: "Generate an essay style question on Game theory"

4.1. Scenario-Based Problem Solving

Generative AI, like ChatGPT, can enhance seminar-based learning by developing case studies, creating relevant scenarios or problems, and offering variations to diversify student tasks. For example, it can generate detailed scenarios based on course content, involving real-life situations that apply specific theories, incorporate current issues, and provide three complexity levels to suit different student understanding levels. Additionally, ChatGPT can facilitate seminars, offering guidance, hints, and real-time feedback, beneficial for online or hybrid learning. It can also serve as a research assistant for both staff and students, manipulating prompts to present information in tailored ways, supporting traditional learning materials.

4.2. Chain of Density

The Chain of Density technique assists in crafting a summary by iteratively refining it through a series of successive attempts. Initially, a sparse summary is created which is gradually refined by adding more important entities from the original content, increasing its density. This iterative process, visualized as a chain, helps in packing substantial information into the summary while managing its length (Eliot, 2023). Figure 1 displays this graphically, outlining how knowledge is developed over time.

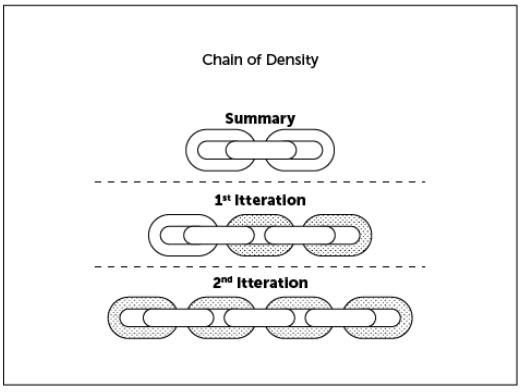


Figure 1. Chain of Density prompting diagram

4.3. Chain of Thought

Chain of Thought prompting encourages Large Language Models (LLMs) to explain their reasoning process by providing few-shot exemplars outlining the reasoning process, which the model then follows when answering a given prompt. This technique improves the model's performance on complex reasoning tasks. This is shown in figure 2, displaying how increased complexity of input enhances output. Moreover, an Automatic Chain-of-Thought (Auto-CoT)

process is introduced to automate the crafting of reasoning chains, thus saving manual effort and potentially improving the model's reasoning abilities further (Mayo, 2023).

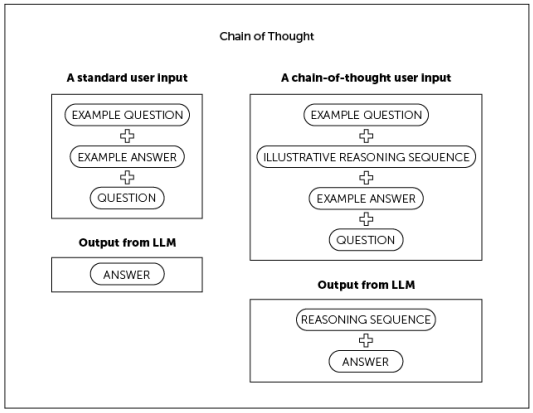


Figure 2. Chain-of-Thought Prompting Elicits Reasoning in Large Language Models

4.4 Perspectives/identity

This approach leverages generative AI's ability to assume varied identities or perspectives, enriching responses and offering nuanced insights. For instance, directing ChatGPT to embody a journalist yields tailored answers, reflecting the profession's unique viewpoint. Gewirtz (2023) outlines how instructing it to simulate the roles of a product manager, caregiver, or journalist while discussing a product like the Amazon Echo demonstrates how perspective-shifting can diversify and deepen the AI's responses. This strategy not only enhances the quality of the output but also broadens the scope of understanding by incorporating diverse professional insights.

5. Discussion

The article presents a framework for integrating ChatGPT into flipped learning environments, highlighting its potential to transform both asynchronous and synchronous content delivery through tailored, dynamic, and interactive pedagogical methods that enhance cognitive engagement and personalize learning. In terms of future research around generative AI, there are numerous directions which could be taken. Longitudinal Studies of ChatGPT Implementation: Investigate the long-term effects of integrating ChatGPT into the curriculum. How does consistent use over time impact student engagement, understanding, and retention? ChatGPT and Teacher Roles: Explore how ChatGPT shifts the educator's role further. What new pedagogical strategies do educators adopt, and how do they manage these alongside traditional teaching methods? Ethical Considerations and Bias Mitigation: Discuss the ethical implications of using AI in educational settings. How can educators ensure that the content generated by ChatGPT remains unbiased, accurate, and respectful of diverse perspectives?

This article implies that ChatGPT can significantly enhance the production of learning materials by individual academics. It achieves this by shifting the academic's role from initially creating content to revising and improving upon what ChatGPT generates. We hope that the systems demonstrated are versatile and straightforward enough to be applied across various subjects and types of content. However, it is predicated on the assumption that all subjects involve some degree of technical knowledge acquisition, and that assessments in every field could be enriched by using worked examples that are tailored to the specific content being taught.

6. Conclusion

The future of AI in education lies in its systematic integration into the classroom, where it supports student learning directly. While some educators are already using AI in an ad hoc and intuitive manner, a structured and consistent approach to its application is not yet widespread. Besides, as outlined by Brynjolfsson (2022), it is not the tasks that humans can do, or the tasks that machines could automate which represent the most potential, it is the new tasks which humans can do with the help of machines which opens an endless frontier of new abilities and opportunities; this holds true for education, both synchronous and asynchronous.

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Postgraduate Supervision in a ChatGPT World: What's Next?

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Abstract

This study explores the considerable challenges for research supervisors of postgraduate students in Higher Education. For experienced academics, the responsibility of assessing theses and dissertations has never been more critical. With the advent of ample search engine opportunities, Generative Artificial Intelligence (GenAI) technology, and adhering to proper academic integrity processes, how can supervisors navigate these complexities, unsupported by solid procedures, due to the rapidly changing nature of AI? If a supervisor is concerned as to the integrity of the presented work during the supervisory process, what options are available to the supervisor to address concerns with the student in an informed and protected way? This work draws from theoretical perspectives, discussions with research supervisors, including early career supervisors, collegial deliberations, and considerations.

This paper will explore what research supervision is and the challenges associated therein. Recommendations for best practice will be presented for discussion during the proceedings.

Keywords: *Research Supervision; Artificial Intelligence (AI); ChatGPT; Higher Education Supervisory Challenges.*

1. Introduction

Acting as a research supervisor in Higher Education (HE) is challenging and complex. Many academics and lecturers avoid it entirely mainly due to the fear of the nature of this type of student engagement. Discussions with colleagues reveal a preference for traditional educational delivery; general lecturer/ student interaction in a lecture hall setting. Many reasons exist for this; first, it is a much more formal process; second; the learning process is mostly at a distance, is pre-prepared; third; personal interaction is limited, fourth, many are comfortable with tried and tested delivery methods. Adding in nouveau complexities of contract cheating, Artificial Intelligence (AI) using ChatGPT; a game changer and disruptor in HE, academic weariness is heightened as many Universities try to better understand AI and ChatGPT. The vastness and

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implications of these AI tools are not clarified for most staff, with few policies or clear strategies in place to work with it, against it, embrace or ban it. Overall, lecturers believe that they are more protected and less exposed in the traditional approaches of delivery. If, however, academics continued only with traditional modes of education, avoiding all forms of research supervision, valuable academic output, or the encouragement of future expert supervisors will not be fostered. Academic outcomes and higher research levels are essential where new contributions are the foundation of progress in each discipline to improve practice and knowledge (Wright, 2020). What guidance/best practices are available for supervisors, however? Government publications in Ireland outline "research excellence is fundamental" to the quality of research activity and "involves an evolving range of research practices that research performers need to embed" (Gov.ie). The HEA's *Principles of Good Practice in Research in Irish Higher Education Institutions* (2019) provide "a clear and consistent framework for HE institutions" (Gov.ie), however, can this keep pace with technology and AI? University recommendations are to create assessments that cannot use AI, however, the very nature of a dissertation is detailed extended text, and the issue with GenAI is it struggles to generate accurate reliable citations, for now. This machine learning tool will learn and evolve, however. Researching for this paper, reading Cotton *et al.* (2023) was interesting. Most of their paper was written using GenAI. It was eye opening, yet hopeful, as there are evident issues with ChatGPT. The paper here presents an overview of the situation faced by research supervisors by examining the practical contributions using the literature review as a method (Snyder, 2019).

2. Approach: Aim, Objectives, Method

The main aim here is to examine the supervisory dynamic for educators in tertiary education. Specific objectives include reviewing and outlining the challenges faced by research supervisors, identifying pertinent issues and best practices, finding opportunities for improvement, development, and training; identifying ways to support lecturers to supervise; reflection on AI but not expecting to find any immediate solutions. To garner a deep appreciation of the concepts and challenges in relation to research supervision, first an extensive review of the relevant literature was undertaken through searches in Science Direct, Scopus, EBSCOHOST, and University Websites, Government and HE websites such as, QQI (Quality & Qualifications Ireland) and the HEA (Higher Education Authority), the Department of Further and Higher Education, and the National Academic Integrity Network (NAIN) to understand the current and situational context for Tertiary education and the impacts on research supervision. Informal discussions with colleagues took place across various disciplines and geographies to understand challenges. From this, current and future research approaches are identified to try to establish the existing fears in this educational context and with a view to identifying the next steps in the process. The aim of the approach is to establish a base line and from here, look for support to produce additional tool kits and training opportunities. Documentation and policies

exist, but they do not include direction for AI specifically. Next steps will include interviewing relevant HE supervisors and identifying future lecturers interested in supervision to gather further information to inform tool kit development. This tool kit will be developed with the support of n-TUTORR[1] which was established for the transformation of learning in the Technological Universities in Ireland. This work is pertinent, relevant, applicable, and transferrable across transnational international HE Institutions.

3. Understanding Research Supervision

Quality high level research supervision is expected in HE where robust quality assurance underpins all supervision especially at doctoral level (HEA.ie). For doctoral education, the core element is the advancement of knowledge, original research, and critical thinking. For supervisors, this is underpinned by academic freedom and innovative thinking (HEA.ie). Considered a nurturer and the most advanced level (Zhao, 2001), research supervision is the highest level of delivery. It requires multitasking with intricate skills, expert field work and knowledge, stakeholder management, navigating funding bodies and sensitive relationship management. Relationship management/dynamics between the parties (student/lecturer) are often complex, however, in many cases little advice is available, particularly, to early career supervisors. Many are fearful of showing weakness in fear of impacting careers (Wright, 2020). It many ways it's a marriage, both parties start out with the best intentions, hopes and aspirations, however, unforeseen circumstances and differing outcomes/outlooks can drastically change the dynamic. Research students start this marriage looking for optimal supervision (Zhao, 2001); supervisors are often looking for outputs, publications, grant writing and reduced timetabling. So, like all marriages it is a shared process. In Ireland, the National Framework for Doctoral Education proposes excellence in all forms of doctoral education while providing a set of principles. It is consistent with European and international standards including the Salzburg principles, the Salzburg II recommendations, and Principles for Innovative Doctoral training (HEA.ie). In the UK, *The Good Supervisory Practice Framework* (Taylor, 2019), acknowledges the highly complex and demanding roles in modern research supervision, however, issues of GenAI are too recent and were unforeseen to be included. When it comes to supervisory approaches, many exist. (Gatfield, 2005; Lee, 2007); and (Lee, 2007; Lucey *et al.,* 2021) advocate mentoring. In contrast, Zhao (2001) uses rigorous research plans with no 'ad hoc' methods. In the new landscape, previous concerns of managing dynamics, quality outputs, gender balance, fade as nothing could have prepared supervisors for ChatGPT.

[1] Transform student experience/ developing staff capabilities (mtu.ie(a)). EU Funded; NextGenerationEU, The Department of Further & HE, Research, Innovation & Science (accountable Department), The Higher Education Authority (accountable agency) for NRRP funded n-TUTORR project. n-TUTORR: co-ordinated through THEA (Technological Higher Education Association) (transforminglearning.ie).

3.1. The Use of Artificial Intelligence (AI) ChatGPT

The use of AI by students is becoming a major concern for Universities, especially with long written assessments. Many tools exist that can be used to generate content, and ChatGPT is most used due to its "user friendly" application (Li *et al.*, 2023). It is an AI chatbot that can understand context, nuance, humour, built on OpenAI's foundational large language models (LLMs) like GPT-4 and its predecessors proving that machines can 'learn' the complexities of human language and interaction (Marr, 2023). OpenAI released an early demo of ChatGPT (November 30, 2022) and this chatbot went viral on social media as users shared its capabilities. GPT-4, the latest most advanced can write and answer anything (Marr, 2023). This rapidly advancing tool has profound impacts on how academics examine, particularly postgraduate work. ChatGPT changes dynamics, roles and trust (Dai *et al.*, 2023) when writing a dissertation/thesis[2]. Currently, HE institutions are challenged to provide guidelines/best practice for supervisors because of advancement in speed of machine learning. By the time a document is written and released to staff, AI has galloped on leaving academics in its wake. To better understand AI, Li *et al.* (2023) examined agreed use of ChatGPT with three of their Ph.D. students' interaction with ChatGPT. Findings uncover benefits like quick reference and effective self-teaching. Li *et al.*, (2023) note some Universities agree to its use with faculty knowledge; but where does plagiarism fit in this debacle?

3.1.1. Plagiarism

Concerns such as the grave issue of plagiarism and resulting disciplinary procedures with ChatGPT exist. Plagiarism, defined as "the action of taking someone else's work, idea and passing it off as one's own; theft [oed.com; mtu.ie(c)]; from the Latin plagiarius, 'kidnapping' (Oxfordreference.com). The University of Oxford goes further providing clarity on AI; "all published and unpublished material, whether in manuscript, printed or electronic form, . . .and material generated wholly or in part through AI (except AI pre-authorized)" (ox.ac.uk). When discussing ChatGPT with colleagues, the first concerns are 'where does this sit with current regulations on plagiarism? Consulting new guidelines (Mtu.ie(b)) finds use of AI "should be viewed as explicit instances of plagiarism". Without any policy of intervention, ChatGPT is here to stay, and employers will want graduates to use these tools. So, how students can take advantage of ChatGPT while embracing integrity is what educators need to consider.

3.2. Discussion

Creative and imaginative ways to use AI to engage students and personalise learning experiences exist (Cotton *et al.*, 2023), still, plagiarism concerns remain within the overall

[2] D*issertation* and *thesis* often used interchangeably; in Ireland, a dissertation is more commonly used at undergraduate/ taught Masters (*minor thesis* is also used), whereas *thesis* is generally associated with PhD's (UCD.ie).

purpose of HE. This gray area could devalue degrees but will depend on each HE Institution's procedures developed and aligned with HE policy. Interestingly, Cotton *et al*. (2023) tested ChatGPT with colleagues and wrote an academic paper on ChatGPT and students using ChatGPT. They found ChatGPT provided cohesive relevant writing, however, the content was repetitive and did not have critique, or analytical capacity. Reading their artificial paper, the researcher finds cohesive very logical writing, lacking creativity, new insights, or learnings. The main findings are that AI tools at this moment generate very similar writings on any one topic; if generated for multiple students, then patterns will arise leading to detection with the correct University tools. Titchener and Greene, (2023) advise that integrity concerns will arise throughout a candidature and resolve these promptly to avoid inappropriate practices that can become deep rooted and carry forward within the future culture of the student when they are supervisors. Dai *et al.,* (2023) explore the impact of ChatGPT on five dimensions of research supervision approaches such as functional, enculturation, critical thinking, emancipation and relationship development through perspectives of 20 postgraduate research students with 4 month's experience of approved use of ChatGPT. They find that ChatGPT "accelerated research progress, enhanced research quality, improved scholarly development and professional skills, enhanced critical thinking, increased student confidence and autonomy and a deeper supervisory relationship" (Dai *et al.,* 2023). Certainly, Dai *et al.,* (2023) provide a different perspective and suggest a change in roles and duties of supervisors and postgraduates; supervisors outline high-level guidance, students move from novices to self-directed researchers using ChatGPT. Cotton *et al.,* (2023) conclude that while the use of AI presents opportunities and challenges, Universities can effectively address concerns by taking a proactive and ethical approach to the use of these tools, while Dai *et al.,* (2023) conclude there will be an evolving model of postgraduate supervision where technology serves as 'epistemological tools' enhancing supervision. Kelly (2023) says we must engage in AI literacy and consider how we assess. From the student perspective, Dai *et al.,* (2023) found that where postgraduates used ChatGPT (with permission), they understood more of the capacities of it, and progressed to tailor it to their needs. However, of concern are issues of authenticity and accuracy in AI outputs (Sikstrom, 2023). Obviously for a dissertation, this is unnerving, so, Dai *et al*. (2023) note students stopped using it and cross-validated sources. This demonstrates students learned from using the tool, and gained an in depth understanding of it, changing their approach when using ChatGPT.

4. Recommendations: Supervisory Responsibilities and Best Practice

Academic supervisors are in pivotal positions to guide practice and must not shy away from challenges (Wright, 2020). Supervisors hold key positions to mentor and ensure students have appropriate robust grounding in conduct (Lucey *et al.,* 2021; Titchener and Greene, 2023). Supervisors must stay current, undertaking professional development, improving practice where possible, (Taylor, 2019) especially now with AI. Many supervisors are not afforded specific

supervision training (Wright, 2020) and for most Tertiary Institutions, no compulsory modules, or training exist. However, all HE institutions must be placed to support supervisors and provide training. Now is the time to further collaborate (Wright, 2020) to see what processes are in place through proven evaluated programmes in an international capacity. Postgraduate students struggle in terms of what is required of them, therefore more formal class work with support will be beneficial (Wright, 2020) with clear roadmaps (Gatfield, 2005). Opportunities are there to empower learners and staff capabilities. Supervisors must abandon 'ad hoc' approaches (Wright, 2020) for postgraduate supervision to more formalized structured approaches with scaffolds. Government funded projects exist to transform HE such as n-TUTORR in Ireland, for HE to progress towards sustainable educational; now is the time to act and embed correct approaches. Universities endeavor to engage in creating AI literacy curricula and protocols for staff and students for responsible use of generative AI tools (Dai *et al.*, 2023). Awdry (2023) believes there is a place for AI once students are supported to work with integrity that deters them from cheating. In an Irish context, QQI established The National Academic Integrity Network (NAIN)[3]. NAIN is framed by the challenges of contract cheating, established under new legislation tackling providers of contract cheating (Kelly, 2023). NAIN draws from national and international guidance to engage with challenges of academic misconduct; embed a culture of academic integrity and develop tools for providers.

4.1. Recommendations & Conclusions

Change will only be affected if emerging good practices are embedded across research disciplines (Gov.ie). The introduction of new HEA legislation[4] for AI clarifies and enhances oversight, governance, and relationships for HE. The Irish Government are committed to ensure Principles of Good Practice are implemented by HE institutions (Gov.ie) and supervisors must be guided here. Future investments, resources and training will be substantial for Governments as they move positively ahead. Future assessment strategies must reflect what is happening with AI (Kelly, 2023) and postgraduate programmes can leverage generative AI tools for AI-enhanced research supervision models (Dai *et al.*, 2023). Start immediately with discussions with colleagues, don't be afraid to outline fears, join communities of practice, look for training, tools, and support. Encourage students to 'own' their work, use robust practices, and be proud of what they produce with no risk of future challenges. What are the differences now in terms of plagiarism? There are none. Concepts are the same, if you copy any content, ideas that are not your own, either human or AI generated, this is plagiarism. It is reminiscent of the initial

[3] NAIN Members = public HE institutions/universities/IOT's independent providers/students/student representatives (qqi.ie).

[4] New legislation for this for the first time in fifty years

debate of Wikipedia use, students were told, if you want to 'google' and consult Wikipedia, do, however, it is not an academic source, not legitimate, cannot be authenticated and therefore cannot be used in HE. Supervisors and postgraduate students, Theses and dissertations need the "construction of nuanced arguments" [MTU.ie (b)], the development of empirical, critical, creative thinking; ChatGPT hasn't 'Learned That Yet'!

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A Novel National Master's in Digital Health Transformation: driving cohesive systemic digital change

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Abstract

To spearhead the digital transformation of the Irish Health system, a National Master's in Digital Health Transformation was co-designed between the Irish Health Service (HSE) and the eight Irish research universities. The Master's was designed around the new Stay Left, Shift Left-10X paradigm which advocates for shifts in focus from illness to wellness, hospital to home and a patient rather than clinician centred health system. A key feature of the Masters is that the main deliverable is a digital change project in the health service instead of the traditional 30,000-word dissertation. The Digital Change project, while an extremely valuable learning process also created a cohesive wave of digital change in an organization and ecosystem known for resistance to change. An additional innovation is the use of a patient jury to guide selection and to score projects. More than one hundred and fifty clinical students delivered over 85 completed projects which brought significant positive benefits across the quadruple aim lens. The education and change initiative achieved a massive return on investment, with some individual projects achieving return on investments significantly greater than the overall cost of the Master's program. In parallel to the National Master's program, other initiatives aligned with the national health strategy Slaintecare, such as the building of a network of primary care centres were carried out. Despite many remaining challenges, Ireland's global health system ranking improved 74 places over the first five-year duration of the Masters. Acknowledging multifactorial reasons for improvement, we can still conclude that education led digital change is highly effective at introducing positive digital change in a complex adaptive systems environment.

Keywords: *Digital health; change; masters; digital transformation; adoption.*

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1. Problem and Opportunity

Over the past two centuries remarkable improvements have been made in health systems, with average life expectancy more than doubling since 1800 (Human Mortality Database, 2019). However, despite this remarkable progress, there is increasing evidence that modern health systems are buckling under the challenges of increasing demand, aging populations and workforce shortages (Figueroa et al., 2019). Digital technologies and data driven innovations offer the promise of transforming national and indeed global healthcare systems.

In Ireland in May 2017, the Committee on the Future of Healthcare (a cross-party parliamentary committee) published its final report, the Sláintecare Report (Shorthall et al., 2017), a ten-year plan to reform the Irish health system. Despite the all-party political agreement and record investment in the Irish Health Services, a 90% increase in the budget over an eight-year period, there was declining performance in most major indicators with waitlists almost doubling in the period since Sláintecare was introduced. Clearly a different approach was needed.

A key question then was 'What to do?' and 'How to do?'. The HSE Digital Transformation team chose to use the 'Open Innovation 2.0' methodology (Curley and Salmelin, 2017) to help drive the system wide change and to develop a new transformation strategy "Stay Left, Shift Left-10X" (Curley, 2018) as the directional lens for focusing all transformation efforts to ensure a coherent, cohesive, and compounding approach to system wide change.

2. Advances in Higher Education Achieved

Beginning the paper, we would like to set forth the five key advances introduced and achieved in the master's program.

1. Academics from all eight Irish Universities rallied around and co-designed a unique national Master's in Digital Health Transformation to address a critical and urgent national problem, that of an increasingly overwhelmed health system. Using the Open Innovation 2.0 methodology (Curley and Salmelin, 2013, 2017), academics worked using an agile collaborative way to deliver disproportionate national shared value.
2. The master's program introduced a significant innovation in requiring students to deliver a digital change project as their major work contribution rather than the more traditional 30,000-word dissertation. This was a pedagogical innovation and over 85 digital change projects were delivered from the first three intakes of one hundred and fifty students, and this had the effect of delivering a tsunami of digital change across the system, and very importantly started to change the culture of the HSE organization.
3. The deep involvement of patients in the design and selection of student projects was critical in having the patient voice heard, creating a portfolio of projects optimized based on patient need and centricity.

4. Accelerated Impact. Because of the applied learning focus of the curriculum, when various crisis such as COVID-19 and a catastrophic cyberattack on the health service occurred, student leaders from the master's program were able to step forward to lead.
5. Unlike the NHS Digital Academy, the master's program was primarily aimed at clinicians rather than technologists, with a goal to produce digital savvy clinicians.

Open Innovation 2.0 which underpins the National Masters is a non-linear change methodology which seeks to establish critical connections, critical capability and critical mass to yield multiplicative results through synthesis, strategy and synergies. At the start of the Digital Transformation Program in 2019 a key goal was to move Ireland from a Laggard to a Leader in Health as measured by Ireland's place in the CEO World Rankings of Healthcare Systems (a leading indicator of health system performance). In 2019 Ireland's global healthcare index ranking was a lowly 80th position (CEO World, 2019) despite above average spending on health per capita (OECD, 2023).

3. Laying the Foundations

In late 2018, the Director General, Mr John Connaghan of Ireland's HSE approved the creation of a new Digital Transformation function at the HSE to be led by Professor Martin Curley. The mission of this function being to lead the digital transformation of the Health Service. As the cornerstone for any transformation is awareness and education, the first strategic action decided was to create a Digital Academy and immediately a master's in Digital Health Transformation. Key National Directors within the HSE were canvassed and agreed to support and fund the new Masters.

Professor Curley approached all the Digital Health professors and senior lecturers in Ireland with the vision of creating a Master's in Digital Health Transformation. These leading academics agreed to collaborate on this unique initiative, participating in an initial co-design workshop at the Innovation Value Institute in Maynooth University in May 2019.

In this workshop an outline syllabus was agreed, with responsible for each module allocated to a university. The original intention was to deliver a Masters that could start in September 2020. Because of the urgency of educating HSE employees/leaders for the digital transformation, a stretch goal of January 2020 was agreed and using a rapid agile development process, the curriculum and module specifications were developed in a series of sprints. The lead accreditation and delivery university was switched to University of Limerick for speed. A HSE Master's Steering Group was established to approve the curriculum and select the clinicians approved for scholarships. A robust and rigorous campaign and selection process was launched in August 2019 and 50 offers were generated with an oversubscription rate of 4X.

Unlike traditional master's programs whereby students are required to write a 30,000-word dissertation, students are instead required to specify, develop and implement a digital change project. This significantly increased the impact of the education experience, delivering real value to the HSE as well as creating a cohort of digital leaders across the organization.

4. Master's Design and a Leapfrog Strategy

The master's program was designed around a new paradigm "Stay Left, Shift Left – 10X" whose objective is to create a new kind of health system which would enable a leapfrog (cf. Figure 1) from a 'paper, presence and physician' centred system to a 'people/patient, proactive and participatory' system.

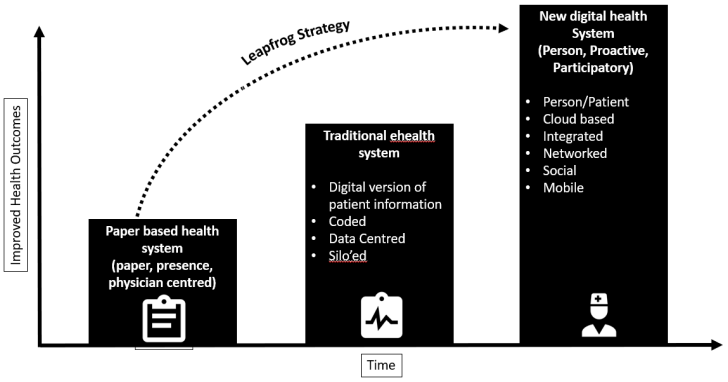


Figure 1 Ireland's Leapfrog Strategy, source Curley inspired by PWC

The goal was to inspire, inform and enable clinicians and other leaders to create digital change projects which when a critical mass was achieved, would create a metamorphosis of Ireland's Health System. When the Digital Transformation and Open Innovation strategy was reviewed and approved by the HSE Board (HSE, 2021) in April 2021 the Board noted that "*this initiative will require a radical rethinking of our organizations culture to fundamentally change and improve the patient and clinician's experience".* Thus a key additional goal of the Masters was to induce culture change by seeding a network of change oriented digital change leaders across the HSE.

4.1. Stay Left, Shift Left – 10X

Stay Left, Shift Left -10X (Curley et al, 2018, 2021) is a strategy which is about first keeping people well and enabling self-care, shared care in the home. **Stay Left** is about first keeping well people, or if a person has a chronic condition or need rehabilitation this person can be best managed from home. **Shift Left** is about moving patients as quickly as possible from an Acute to a Community to a Home setting. A key goal of the strategy was to create a portfolio of

innovations which were coherent and complimentary and hopefully compounding which could create a shift to the left of the entire health system. Embracing Stay Left, Shift Left created a new vision to direct innovation efforts in the same direction.

The National Sláintecare report (Shorthall et al., 2017) specifically identified a need for a strategy like Stay Left, Shift Left stating "*A key cause of Ireland's relatively high spending may well be its emphasis on an expensive model of healthcare delivery". Stay Left, Shift Left hoped to fix that.*

10X is the notion that Digital and Data Technology when applied to healthcare which is essentially an information management discipline and an information intensive industry leads to 10X or tenfold outcomes (10X faster, 10X cheaper, 10X better, 10X higher volume etc). Stay Left, Shift Left – 10X became the core principle underpinning the design and the delivery of the entire Masters. In parallel to the National Master's a network of digital health living labs was established and managed by HSE Digital Transformation and yield evidence of a consistent pattern of digital health solutions yield multiple 10X benefits. This observed phenomenon was coined Curley's law by Insightscare (2022)

4.2. Design Thinking

In designing the Masters, we defined Digital Transformation as coordinated Digital Change effort at scale, throughout all aspects of the organization and ecosystem, and wanted to design a curriculum that would build a network of digital health change leaders.

A design thinking process was used to design the Masters. Design Thinking is a non-linear iterative process used to design solutions to tackle difficult and/or undefined problems. Typically Design Thinking involves five phases: understand/empathize, define, ideate, prototype and test. Before engaging the broader group of national academics, Professor Curley developed a prototype curriculum which was used as a key input to share for the next iteration of the design thinking process when the broader group of academics were brought together. A number of iterations of the curriculum design were led by Annette McElligott. Further details on this program such as Learning Outcomes, Brief Module Descriptions and so forth are available https://www.digitalhealthtransformation.ie

5. Master's Delivery

The program director Annette McElligott was faced with a significant challenge, build a schedule to accommodate the busy rosters of working clinicians across multiple sites within Ireland. She devised a hybrid delivery mechanism which involved students mainly attending modules on Fridays and Saturdays at the various universities. This seemed to work well as attendances typically average over 90% or higher. The program designers felt that

interdisciplinary and inter-site learning would be a critical component of the masters and that face-to-face attendance was strongly encouraged and achieved.

5.1 Participant Numbers

We were able to achieve consistently high demand, and participants each year on the program significantly exceeded our target of 35 students (Year 1: 49 students; Year 2: 50; Year 3: 53 students; Year 4: 44 students; and Year 5: 40 students). Many of the students were sponsored by the HSE which indicated the HSE's commitment to educating clinical leaders in digital transformation.

5.2 Participants' Demographics

The course designers and HSE leadership felt it was critical to have a diverse set of clinicians and others attending the masters to facilitate interdisciplinary learning and to ensure digital clinical leaders were seeded across the health system. In parallel, we felt it was crucial to have attendees from outside the health system and key industry leaders were encouraged to join the program. We had a very broad mix of roles including consultants, doctors, nurses, physiotherapists, pharmacists, dentists, managers, technical leaders, industry executives and other roles.

5.3 Project Topics and Portfolios

We actively solicited a broad set of project topics and these were heavily influenced also by patient needs and inputs through the Patient Dragons' Den process. The portfolio of projects were classified using the World Health Organisation's Digital Health Interventions taxonomy (WHO, 2023).

5.4 Patient Dragons

A core principle of the masters is that the patient or person is the ultimate end customer in aspiring to create a person or patient centric healthcare system. To really 'live' this principle and embed this thinking in the students, we partnered with the Irish Platform for Patient Organizations, Science and Industry (IPPOSI) to make sure the patient voice was influential in project selection and focus. We borrowed the Dragons' Den concept from the world of TV, Venture Capital and Start-ups to establish a Patients' Dragons' Den to review the students' project proposals from a patient perspective. The process produced patient centred projects and when mapped against the WHO Guidelines (WHO, 2023) for digital interventions we achieved a remarkable balance against the four high level impact levels.

6. Master's Impact

We believe the Masters has had a very important non-linear impact on the Irish health system by building people capability, delivering important and critical projects and slowly but surely changing the culture of the Irish Health Service, where we have many outstanding clinicians but pockets of the service who are vehemently opposed to change.

6.1. Systemic Change by Stealth

Eric Topol (2015) has said healthcare is the industry most resistant to change. A very specific but not widely communicated goal was to use the Master's Change Projects as a coordinated mechanism to introduce cohesive systemic digital change into the Irish health system using the Master's learning mechanism as a kind of trojan horse.

In essence, the Master students were setup as Guerilla Innovators, successfully innovating in spite and against a system which deeply resisted innovation. The average failure rates of digital transformation projects can be up to 70%. Bucking this trend 18 of the 21 projects delivered by students from the first intake were viable, being implemented or currently under development and being progressed, thus an 80% success rate.

6.2. Digital Skills Leadership

Developing Digital Leaders was a key goal of the master's program, and we are very pleased to see that about 50% of graduates have been promoted into digital health related roles since graduating. There has been significant role mobility to and from industry.

6.3. Example Successful Projects

Several projects have been extraordinarily successful. A project on remote COVID-19 monitoring by Lorraine Smyth won student project of the year at the National Health Awards but more importantly was pivotal in the HSE's response to COVID-19. The total budget for the master's per year is 0.5 million but on this project alone the return on investment (ROI) was >**24X**

The master's project of Niall Ginnity and Mendinaro Imcha, to create an 'Interactive Infrastructure Map' was absolutely pivotal and essential to the HSE Conti Cyberattack recovery resulting in a 3X faster recovery. The ROI from such an impact is immeasurable – it is impossible to value the lives that were potentially saved and better outcomes for patients that were achieved.

7. Results and Conclusions

To address many overwhelming and concurrent challenges to its ailing health system, a new National Master's in Digital Health Transformation was co-designed and introduced in Ireland by the HSE and all eight Irish research universities, building critical capability, connections, projects and achieving a critical mass to really move the needle in helping the Irish health system transform and shift to the left. Five significant advances were introduced and achieved and the results in terms of patient impact, financial return and project viability were extraordinary, demonstrating the role and value of leader education when trying to introduce radical non-linear change to a system whose defining characteristic is of extreme resistance to change. While much remains to be improved in the Irish Health system, a key success measurement of radically improving Ireland's ranking in the CEO World's Health system ranking was achieved, years in advance, with Ireland improving from 80th place to 6th by 2024.

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Demonstrated Value of Individual Development Plans to Participating Academic Trainees and Their Mentors

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Abstract

An Individual Development Plan (IDP) is a personal action plan. IDPs can be used to set academic goals, explore career opportunities, and develop skills. During the 2022-23 academic year, we implemented IDPs with two groups in university settings: (1) graduate students and post-docs in the NASA-funded ICE-Five-O project; and (2) undergraduate and graduate students at the University of Hawai'i. Twenty-four participants and their mentors rated various aspects of the IDP program on a scale of 1 (negative) to 5 (positive). Results were strongly positive, with means ranging from 4.1 to 4.8 for participants and from 4.2 to 4.6 for mentors. Overall, 92% of participants reported that they would recommend IDPs to their peers, and 94% of mentors reported that they would recommend IDPs as a mentoring tool. Although relatively few people (15%, or 31 of 207 eligible trainees) opted to participate, results of the pilot clearly show that those who created an IDP found the experience valuable. Future efforts will focus on maximizing participation.

Keywords: *Professional Development; Career Exploration; Mentorship.*

1. Introduction

1.1. Individual Development Plans

An Individual Development Plan (IDP) is a personal and professional development planning tool used to convert intentions into action plans. Currently, many variations of IDPs are available, including academic (e.g., Gee et al., 2019; Fuhrmann et al., 2011) and industrial (e.g., Febrian et al, 2023; US Office of Personnel Management, 2024) modalities. In academia, IDPs can be used to set and achieve academic goals, explore career opportunities, and develop a range

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of skill sets aligned with one's degree program and/or intended career pathway. They can serve as a useful advising tool, to help establish expectations regarding milestones and timelines, and to track progress. IDPs can also serve as a framework for holistic mentoring, by providing a structure in which mentors can support students as they overcome obstacles and persist in accomplishing their goals (Hardy et al, 2022). Recently, the U.S. National Academies of Sciences, Engineering and Medicine (2019) highlighted IDPs as a best practice in effective mentoring, which has served to popularize their usage across the U.S.

This project adopts the IDP model developed at the University of Hawaii (UH) School of Ocean and Earth Science and Technology (UH SOEST, 2023). The UH SOEST model centers on six core competencies: Research; Teaching & Mentoring; Oral & Written Communication; Diversity, Equity, and Inclusion (DEI); Leadership; and Career Exploration (Eason et al, 2020). Trainees (students, post-baccalaureates, and post-docs) begin by completing a self-assessment, which includes responding to open-ended prompts and evaluating their skills and abilities in the six areas. This exercise primes them to consider their goals, the skillsets they may need to develop to achieve those goals, as well as their strengths. The trainee then drafts three SMART goals to be achieved within the next six months; SMART refers to Specific, Measurable, Assignable (or Achievable), Realistic and Timely (Doran, 1981). The next step is to discuss the draft goals with their academic or research advisor as well as an external professional development (PD) mentor of their choosing, and to revise as appropriate. The role of the PD mentor is to provide an outside perspective, expand the trainee's mentoring network, and to provide a safe space for candid discussions. The inclusion of career exploration and DEI modules into an IDP also encourages mentor engagement beyond the classroom or research lab.

1.2. UH SOEST

Based in Honolulu, Hawai‘i, USA, UH SOEST is the largest and most research-intensive geoscience program in the Pacific. Its mission is *to understand the subtle and complex interrelationships of the sea, the atmosphere, and Earth in order to learn how to sustainably enhance the quality of our lives and to bring to Hawai‘i an enrichment of intellect and culture along with technological advances well suited to the needs of these islands*. Undergraduates, graduate students, and post-docs pursue research in ocean, earth, atmospheric and planetary science and technology. Fourteen degree programs are offered, in addition to minors and certificates (UH SOEST, 2024).

1.3. ICE-Five-O

Solar System Exploration Research Virtual Institutes (SSERVI) are multi-institutional collaborations, funded by the U.S. National Aeronautics and Space Administration (NASA), to advance research at the intersection of science and exploration (NASA, 2023). Established as a SSERVI in 2019, the Interdisciplinary Consortium for Evaluating Volatile Origins (ICE Five-

O) investigates volatile evolution and how volatiles may enable future human space exploration on airless bodies like the Moon and asteroids. ICE Five-O researchers, who come from a wide range of disciplinary backgrounds (e.g., Earth and planetary science, chemistry, physics, engineering), work together to conduct experiments, analyze materials, construct models, use remote sensing tools and develop methodologies for sample curation. Graduate students and post-docs at institutions across the US, including at UH SOEST, are integral parts of the research team, working alongside senior scientists as they tackle ICE-Five-O's research objectives together. Subsequently, they embark on a wide range of careers, including academia, NASA centers, other government agencies, research non-profits, or industry. To ensure trainees develop the necessary skill sets to succeed in their chosen career pathway, each is encouraged to create an IDP.

2. Data & Methods

2.1. Participant Survey Data

Students and post-docs involved in ICE-Five-O and UH SOEST were invited to participate in the IDP program during the 2022-23 academic year. Participation involved setting three goals, reviewing/revising them with the assistance of their academic/research advisor and an external PD mentor, registering their IDP online via a google form, and completing the goals by a set date (April 30, 2023). Thirty-one trainees (undergraduates through post-docs) accepted, and they were mentored by 24 unique PD mentors (some mentors had multiple mentees). Of the 31 mentees, 27 successfully completed the program. Following program completion, participants were invited to complete an anonymous online survey to provide feedback and 24 did so, for a response rate of 77%. Respondents rated the value of various aspects of the IDP program on a scale of 1 to 5, with 5 being the most positive. The response choices were: 1 (Strongly Disagree); 2 (Disagree); 3 (Neither Agree nor Disagree); 4 (Agree); and 5 (Strongly Agree). For each survey item, Table 1 presents the mean response, along with the % of respondents who agreed or strongly agreed (response choice 4 or 5, respectively).

Respondents were also invited to provide responses to open-ended prompts to share something they liked about creating their IDP and/or something they learned. Table 2 presents a sample of representative responses received. All responses are quoted verbatim. In some cases, topically related responses from two different participants are included in the same cell.

Table 1. Participant Responses to IDP Participant Survey (n=24)

Survey Item on IDP Participant Survey	Mean	% Agree
Creating my Individual Development Plan (IDP) helped me think about and define my long-term career goal(s).	4.4	96%
By creating my IDP, I was able to convert my goals into an action plan.	4.3	100%
Conducting the self-assessment helped me identify my strengths, and identify areas where I could improve.	4.2	94%
My Professional Development Mentor provided valuable guidance and feedback regarding my IDP.	4.8	100%
Conversations with my Professional Development Mentor exposed me to new ideas, opportunities, or perspectives.	4.6	96%
My Research/Academic Advisor provided valuable guidance and feedback regarding my IDP.	4.1	71%
Conversations with my Research/Academic Advisor exposed me to new ideas, opportunities, or perspectives.	4.3	79%
I would recommend creating an IDP to other graduate students or post-docs.	4.4	92%

2.2. Mentor Survey Data

Mentors were also invited to complete a survey, and 16 of 24 did, for a response rate of 67%. Mentor respondents were asked to rate the value of various aspects of the IDP program by stating their agreement on a scale of 1 (strongly disagree) to 5 (strongly agree), as defined above. For each survey item, Table 3 presents the mean response, along with the % of mentor respondents who agreed or strongly agreed (response choice 4 or 5, respectively).

Mentors reported a low time commitment: they met with their mentees for an average of 2-3 hours per semester. Mentors were also given the opportunity to share responses to open-ended prompts, and representative responses are shared in Table 4. All responses are quoted verbatim.

Table 2: Sample participant responses to open-ended prompts on the IDP Participant Survey

Something I liked about creating my IDP	Something I learned from creating my IDP
It forced me to think about the future and form concrete, achievable goals. This was a very useful step in the first year of my graduate program.	I learned that all goals don't have to be focused academically and can be about self improvement. My IDP goals can be personal goals too, unrelated to my research.
The different categories remind you to not be narrow-focused in your goals! Successful professionals are multifaceted and the sections of the IDP remind you to think of additional aspects to a career.	I learned that talking to mentors about career options and preparing in advance for the next steps is super helpful. This prepares me to my next level with a different mindset, knowing what are the options I have and what I need to do to prepare to accomplish my future goals.
I liked the flexibility choosing my own goals gave me. It made this feel less like a cookie-cutter task and more like an individualized approach for improvement.	I switched from thinking all about research and more about career goals over the past couple months. I started thinking about what I want out of my master's and how I can gain skills to achieve those goals.
Created focused, specific, and attainable goals.	Having clear, obtainable goals helps you measure your progress throughout your program.
I am glad that the IDP program pushed me to select a mentor outside of my field of study. Having an external perspective has been grounding and refreshing.	I learned more about career options outside academia through connecting with my PD mentor. That there are government jobs on island that are also a possible future option that still incorporate my research-oriented goals.

Table 3. Mentor Responses to IDP Mentor Survey (n=16)

Survey Item on IDP Mentor Survey	Mean	% Agree
Completing an IDP helped my mentee think about & define their academic & long-term career goals.	4.4	100%
The IDP process helped facilitate communication about my mentee's research goals/timeline, areas for skill development, &/or other expectations.	4.2	88%
I enjoyed serving as a Professional Development mentor.	4.6	100%
I would recommend IDPs as a mentoring tool to other advisors/mentors.	4.4	94%

Table 4: Sample mentor responses to open-ended prompts on the IDP Mentor Survey

What do you think was the most beneficial aspect of IDPs for your mentee?	Do you feel you benefited in any way by serving as a PD mentor? If so, how?
Provides focus and clarity to achieve academic goals.	Yes, I was able to foster collaborations with UH through the work as a mentor.
It helped my mentee prioritize time and effort spent on those activities that are aligned with long-term career development.	Yes, by expanding my professional network. Making connections. Meeting prospective post-docs.
Feeling like a faculty member genuinely cared about them as a person.	Yes, makes me realize I enjoy working with students and want to do that more in my career.
As we revisited her IDP, she came to realize that certain objectives took longer than she had expected and that sometimes it was necessary to re-prioritize her objectives.	Yes - I love helping students share what they want to do when they finish and see them relieved to be in a safe, open, honest environment with their guards down, not having to prove anything to anyone except sharing what they would like to do next.
Carving out time for career development. Interviewing non-academic professionals.	I'm new to the mentor role; this is a nice exercise and framework for future opportunities to help early-career scientists and resource managers in our field!

3. Results & Discussion

Results to this IDP rollout were strongly positive, with participant mean responses ranging from 4.1 (Agree) to 4.8 (Strongly Agree) (Table 1). We note that all survey items were worded such that agreement is a positive response. Participant agreement rates (the percentage of respondents who agreed or strongly agreed with each survey item) ranged from 77% to 100%. Interestingly, the two highest-rated survey items by participants both concerned the PD mentor. Participants reported that their PD mentor provided valuable guidance and feedback (4.8) and that conversations with their PD mentor exposed them to new ideas, opportunities, or perspectives (4.6). These same questions were asked about their research advisors, and the corresponding mean responses were 4.1 and 4.3, respectively. This disparity clearly demonstrates the perceived added value of having an external mentor, which was also supported by participant comments to open-ended prompts. Mentors concur. When asked about the usefulness of the IDP program and their enjoyment in serving as a mentor, mean mentor responses ranged from 4.2 to 4.6 and agreement rates ranged from 88% to 100%. Overall, 92% of participants reported that they would recommend IDPs to their peers and 94% of mentors reported that they would recommend IDPs as a mentoring tool to other mentors.

A common theme in the mentees' open-ended responses was an appreciation for non-research-oriented goals – perhaps because these types of goals may be more likely to be de-prioritized and eventually fall off the radar due to more pressing academic matters. For example, a mentee reflected on their non-academic goal of writing their first science blog post *(Vidwans, 2023)*: "*My mentor served the main purpose of holding me accountable to my goals, and also provided specific guidance for the most ambitious goal of mine – to write my first non-technical science article. This goal was one that I would have otherwise cast aside due to its difficulty, especially because I was in the final stretch of grad school. But I was able to accomplish this goal – and have since written another article – with the help of the IDP program and my mentor."*

Another mentee, who has since graduated and transitioned into becoming a mentor, is excited about their new role: *"I feel prepared to transition from a mentee to a PD mentor because I can reflect on the attributes I admire in my previous PD mentor and implement them to support my current mentee."*

Clearly, those who created an IDP found the experience valuable. However, relatively few people opted to participate. Of 207 students and post-docs who were invited to register an IDP, only 31 (or 15%) did so. There are many possible reasons for this low participation rate, including unfamiliarity with an IDP, limited time, limited awareness of IDP benefits, and lack of willingness to participate in something that is not mandatory. Future efforts will focus on maximizing IDP participation, including exploring options such as making IDP participation mandatory and/or incentivizing the process. One incentive that we are exploring is offering the opportunity to apply for mini-grants, awarded on a competitive basis, to cover any costs associated with IDP activities.

4. Conclusions

Individual Development Plans have recently gained popularity in the U.S. to facilitate goal-oriented mentorship and professional development. An IDP rollout during the 2022-23 academic year resulted in strongly positive evaluation results, with means ranging from 4.1 to 4.8 for participants and from 4.2 to 4.6 for mentors on a scale of 1 (negative) to 5 (positive). Overall, 92% of participants and 94% of mentors reported that they would recommend IDPs. Clearly, those who created an IDP found the experience valuable. However, relatively few people participated, and future efforts will focus on maximizing participation through integration into curricula or use of incentives.

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Interactive videos: its effect on cognitive load and students' preferences across modes

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Abstract

This study aimed to investigate the impact of interactive videos on cognitive load, in specific extraneous load, which plays a crucial role in instructional design. Extraneous load is the cognitive burden imposed by the design and dissemination of educational material, potentially hindering optimal and efficient learning. The study examined the effects of interactive videos by having students complete five formative assessments using both linear (traditional) and interactive videos in a rotational manner. Analytical strategies, including cross-over repeated measures ANOVA and independent samples t-tests, were employed. The results revealed a statistically significant difference in extraneous load scores between the two modes, although this effect diminished over time. Based on the findings, it is recommended that educators provide students with multiple opportunities to acclimate to interactive videos over an extended period. Additionally, student preferences favored interactive videos, and this inclination strengthened with increased exposure.

Keywords: *cognitive load; extraneous load; interactive videos; accounting education; cross over repeated measures;.*

1. Introduction

The use of videos in education has enjoyed popularity as a mode of delivery and the pandemic necessitated the implementation of various digital enhancements to current online offerings. During the pandemic, lecturers explored the use of new software (H5P) and consequently the linear (traditional) video, was replaced by interactive videos (also known as in-video assessments). Interactive videos is a relatively new addition to software available on the learning management systems (for example BlackBoard) and was developed by H5P.com. This software enables educators to convert any linear (traditional) video (self-created or from platforms such as YouTube) to an interactive digital video as a formative assessment tool. Interactive videos use the same video content as the linear video, but instead of answering the questions after

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watching the video, students respond to questions (in the form of questions, quizzes and polls) while watching the video. The video pauses as soon as a question is posed and students need to answer the question before the video proceeds.

Numerous studies have been conducted on the use of interactive videos in a variety of disciplines. Reports include an improvement in academic performance, student motivation and engagement (D'Aquila, Wang & Mattia, 2019), better retention of knowledge and higher level of understanding (Hung & Chen, 2018) and the reported increase of self-directed learning as interactive videos are appealing to students (Bétrancourt & Benetos, 2018). However, the effect, if any, on cognitive load has not been investigated thus far.

Why is understanding cognitive load crucial in an education setting? The goal of learning is essentially the retention of knowledge to attain mastery through the development of schema. Schema construction and automation are processes that take place in the long-term memory of a person. However, before it can reach this stage, it needs to be extracted from working memory. Cognitive load theory focuses on increasing the learning efficiency of complex tasks. This means that the least amount of effort should be expended by a student to optimize working memory and comprehend content (Mostyn, 2012). Therefore, the effect on working memory should be a consideration for all educators who wish to develop learning material (Paas et al., 2003) as the instructional control of cognitive load can influence the learning experience.

Cognitive load represents the load on a human's cognitive system when performing a particular task. Cognitive load includes three different types of cognitive processes during learning: (i) *intrinsic* cognitive load that is influenced by the subject matter (or discipline) and difficulty of the task; (ii) *extraneous* load that is influenced by how well or poorly the material is designed and (iii) *germane* load that is influenced by problem-solving skills, analysis, and interpretation of subject matter (Sweller, van Merrienboer & Paas, 1998). In essence, educators should aim to develop material that will not overextend extraneous load so that sufficient working memory is available to expend on intrinsic and germane load (Kruger & Doherty, 2016).

Although a number of studies were conducted to report on the effect of linear videos on cognitive load (Chen & Wu, 2015; Kruger & Doherty, 2016; Alemdag, 2022), research on the effect of interactive videos on cognitive load of introductory accounting students has not been conducted. Since it was reported that the use of videos to teach complex concepts may increase cognitive load and negatively affect learning outcomes, it is important from an instructional design perspective, to be cognisant of the possible impact of the mode of delivery, especially on novice accounting students. Given the absence of adequate research, the following specific research question is addressed:

RQ1: Is there an effect on cognitive load when interactive videos are used as formative assessments of introductory accounting students?

Regardless of the effect on cognitive load, student motivation and the learning experience might be influenced by the mode of delivery. This study examined the preference of students by posing the following question:

RQ2: Which mode of assessment (linear video vs interactive video) do students prefer?

2. Literature review

2.1. Linear vs interactive videos

The advantages of using videos include accessibility of material, display control, shareability and the benefit of being able to watch the video more than once if needed (Afify, 2020). Interactive videos differ from linear videos as interactive videos include features that demand engagement from students in activities and its content (Shelton, Warren & Archambault, 2016). Characteristics of interactive videos include the segmentation of content; interactivity by means of embedded questions and assurance of completion as the settings allow instructors to decide whether the video can be skipped ahead or not. It also provides an opportunity for immediate feedback after a question was answered and this allows for consistent evaluation of knowledge transfer as the content is delivered.

2.2. Prior literature on the effect of videos on cognitive load

Multimedia instruction (such as the use of educational videos) requires total processing capacity in the form of essential processing, incidental processing and representational holding (Mayer & Morena, 2003). This means that on-screen texts, illustrations, animation, sounds and narrations might all add to cognitive load. Literature on the effect on cognitive load imposed by linear and interactive videos are limited, but available studies reported that the length of the video (measured in minutes) influenced cognitive load (Afify, 2020) – videos less than 6 minutes long imposed the least amount of cognitive load in an extraneous form on students and maximised their germane load. Research in accounting is severely limited with discussions on why the effect on cognitive load should be considered (Mostyn, 2012) as well as mentioning cognitive load, but not reporting on the effect of linear videos on cognitive load of accounting students (D'Aquila, Wang & Mattia, 2019).

3. Research methodology

3.1. Study design

First-year students in introductory accounting are required to complete formative assessments in the form of pre-class activities in preparation of a new topic. The student cohort (n=956) was

randomly divided into two groups (Groups 1 and 2) and students could not migrate between groups. Neither could they choose between linear or interactive videos for a particular test.

The quasi-experiment started with group 1 receiving the treatment (watching the interactive video - IV) and group 2 being the control group who watched the linear video (L) and answering the questions thereafter. The control group and treatment group alternated between receiving the treatment (interactive video) and being the control group (linear video). Therefore, each student were exposed to both modes.

The treatment and the control group watched the same videos and answered the same questions, but the format of the formative assessment was different. Both groups completed a total of five tests over the course of the first eight weeks of the semester.

Table 1. Experimental design (IV = Interactive video and L = Linear video)

	Test 1	**Test 2**	**Test 3**	**Test 4**	**Test 5**
Group 1	IV (n=217)	L (n=156)	IV (n=207)	L (n=161)	IV (n=232)
Group 2	L (n=162)	IV (n=245)	L (n=202)	IV (n=183)	L (n=189)
N	379	401	409	344	421

To measure the effect on cognitive load (CL), students were asked to complete questions on CL using an instrument developed by Leppink, Paas, Van der Vleuten, Van Gog and Van Merriënboer (Leppink et al., 2013).

3.2. Methodology and analysis

A quantitative research design is followed. Initial analyses were conducted using cross over repeated measures ANOVA and independent samples t-tests. Thereafter paired samples t-test were conducted to explore the drivers of significance between the treatments.

To determine the preference of students, students were asked to choose their preferred mode after tests 2 and 5 by choosing "A. Interactive videos / B. Linear videos / C. No preference". The responses were grouped and calculated as a percentage of responses.

3.3. Sample selection

The sample comprised students enrolled for introductory accounting, but not necessarily studying towards a professional qualification in accounting. Participation in the experiment was voluntary (i.e. completion of the CL instrument), although completing the assessments counted for marks as per the usual weighting.

4. Results

4.1. Descriptive statistics

Formative assessments were made available to all students enrolled for the course, but not all students completed every formative assessment. Of the cohort of students, 636 students wrote one or more test, but only 199 students completed all five tests. Of these students, 174 completed all five tests as well as the instrument to measure cognitive load. Of this sample, 65% were female students. Students in the sample ranged between 18 and 21 years of age. No data was collected to depict ethnic heritage or home language. However, since these tests were open to all students in more or less two week intervals, the number of students who participated and completed the instrument varies. Refer to table 1 for the sample size per test.

4.2. Instrument validity

Although a tested instrument was used to evaluate the level of cognitive load (Leppink et al., 2013), factor analysis was conducted and repeated for all five tests. The same result was obtained in each instance: there is a strong internal consistency ($\alpha>0.7$) and confidence that constructs are reliably measured. Factors were 'Intrinsic Load"(IL), "Extraneous Load"(EL) and "Germane load"(GL).

4.3. Cross over repeated measures ANOVA

The purpose of cross over repeated measures ANOVA is to determine the effects of two or more treatments on the same set of students. This analysis is also fit to assess the effect of treatments over time. Table 2 summarises the results and indicates that a significant difference between EL scores for test 2 was observed ($p<0.001$).

Table 2. Results from the cross over repeated measures analysis per construct

	Test 1	**Test 2**	**Test 3**	**Test 4**	**Test 5**
Group 1	IV	L	IV	L	IV
Group 2	L	IV	L	IV	L
IL (Sig.)	.573	.310	.551	. 105	.337
EL (Sig.)	.102	**<.001***	.253	.864	.230
GL (Sig.)	.673	.365	.862	.782	.605

(IL = Instrinsic load; EL = Extraneous load; GL = Germane load)

4.4. Independent samples t-test

An independent samples t-test was conducted to compare the means of two groups in order to determine any significant differences in the means. Table 3 shows the results of cognitive load when comparing groups who wrote the same test. Test 2's results were significant at a 1% confidence interval. None of the other results were signinifantly different between groups.

Table 3. Results from the independent samples t-test

	Test 1	**Test 2**	**Test 3**	**Test 4**	**Test 5**
Group 1	IV	L	IV	L	IV
Group 2	L	IV	L	IV	L
IL (Sig.)	.299	.002	.961	.545	.105
EL (Sig.)	.967	**<.001***	.502	.321	.782
GL (Sig.)	.410	.003	.055	.902	.987

4.5. Paired sample t-test

The paired samples-test was used to determine whether there is a significant difference in means between tests of the same student. After test 2, all students had exposure to the linear videos as well as the interactive videos. Based on results from the previous tests, it was clear that a significant difference exists between test 1 and test 2 for the extraneous load (EL). The question remained: which one of these modes (linear or interactive video) was driving the significance?

Means derived from the paired samples t-test were used to address that question and these are shown in tables 4 and 5.

Table 4. Results from the paired sample t-test

	N	**Correlation**	**Significance (Two sided *p*)**
Pair 1 IL (IV) & IL (L)	174	.294	<.001
Pair 2 EL (IV) & EL (L)	174	.362	<.001
Pair 3 GL (IV) & GL (L)	174	.168	.027

Table 5. Means per cognitive load construct

	Test 1	Test 2	Means IL	Means EL
Group 1	IV	L	IV = 12.34	IV = 11.21
Group 2	L	IV	L = 8.43	L = 6.84

4.6. Students' preferences

Students were asked to choose their preferred mode of educational delivery. Table 6 shows their choices and how it changed from test 2 to test 5.

Table 6. Students' preferences

	Interactive video	Linear video	No preference	No response
After test 2	57%	22%	15%	6%
After test 5	61%	16%	19%	4%

5. Findings

Evidence in support of an initial impact on extraneous load was reported. Following test 2, all students experienced both forms of tests and a significant difference ($p<0.001$) in extraneous load was observed. A means comparison indicated that the interactive videos were driving the significance in cognitive load differences, but that this difference eroded over time.

This initial cognitive overload which erodes over time, is supported by theories underlying the split attention effect (Kalyuga, Chandler & Sweller, 1999). Initially students are unfamiliar with the mode and how it works, but over time, this is mitigated and students experience the same cognitive efforts regardless of the delivery mode.

It is therefore recommended to use interactive videos over an extended period of time so that students can become familiar with it. If these videos are used for formative assessments, it is also recommended that students are offered more than one attempt initially to foster familiarity with the mode.

Student preferences changed slightly over the period to favour interactive videos (see Table 6). Preference influences motivation to learn and improves the learning experience of students. It is important to note that the length of the video might negatively impact the learning experience and enjoyment regardless of the format (linear or interactive), therefore all videos (regardless

of mode) should be 6 minutes or shorter to achieve optimal engagement and academic interaction.

Limitations of this study included the use of only introductory accounting students from one cohort. It is recommened that this study be repeated across various disciplines to determine the effect of interactive videos on cognitive load. Although the more these tests included a mix of difficult and moderately difficulty topics, it is possible that the level of difficulty of a topic might influence cognitive load. It is recommended that future analyses incorporate a control variable to mitigate the effect of understandability of a topic.

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Trying to keep in touch with Nature during the COVID-19 pandemic: an experience from the University of Trento

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Abstract

Italy was one of the Western countries more seriously affected by the COVID-19 pandemic. To counter the outbreak, government resorted to different types of precautionary measures and restrictions. Education, at all levels, from nursery school to university, also suffered the repercussions of the pandemic, with the halt of classroom attendance and the move to distance learning. At the University of Trento, where I teach Ecology, the second semester of the 2019–2020 academic year took place entirely via online teaching, while in the following academic year it was possible to resort to a blended modality. The paper illustrates the initiatives I used to facilitate interaction between students and to set up a mutual dialogue between students and teacher, with the aim of creating a sense of community and of bringing students, isolated and shut up in their homes, into contact with the natural environment.

Keywords: *COVID-19 pandemic; lockdown; distance learning; nature*

1. Introduction

At the beginning of 2020 Coronavirus Disease (COVID-19), first identified in Wuhan, Hubei province, China, rapidly spread all over the world, quickly becoming a global pandemic. To counter the outbreak, national governments resorted to different types of precautionary measures and restrictions, such as social distancing, the use of protective masks, mobility restrictions and the shutting down of main economic and industrial activities with the exception of essential businesses (Atalan, 2020, Wilder-Smith & Freedman, 2020). Education, at all levels, from nursery school to university, also suffered the repercussions of the pandemic, with the halt of classroom attendance and the move to distance learning, in most countries and for long periods of time. Citizens, forced to adopt a "new normal" lifestyle, (Uchiyama & Kohsaka, 2020) were heavily affected, not least psychologically (Davico et al., 2021), with consequences on mental health that are still not exhaustively highlighted even today, especially as regards young people.

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Italy was one of the Western countries more seriously affected by the pandemic, which lasted from February 2020 to February 2021. The first wave, from approximately end February to July 2020 (159 days), was particularly severe, and was followed by a second wave, lasting from August 2020 to end February 2021 (206 days) (De Meo et al., 2022). During the first wave, the lockdown and quarantine measures in place were extended by approximately 50 days, while during the second wave the Italian government, following weekly assessments by the Italian Ministry of Health with the support of Regional Prevention Departments, colour-coded the country's regions according to their risk factor, the colour red representing those regions where the number of positive cases and the virus circulation was particularly high. During the first lockdown in 2020 and in the red regions in 2021, public green areas inside Italian cities were closed due to the restrictive measures imposed by social distancing, forcing people to stay at home. If, in early March 2020, sports activities and walking or cycling in public urban green spaces was allowed, alone or in the company of members of one's household, by the end of March, the rapid increase in COVID-19 positive cases led the government to forbid walking farther than 200 m from home, permitting households to leave their home only for serious and urgent reasons (De Meo et al., 2022).

In such a situation, with schools closed throughout the country during the first lockdown and in the red code regions during the second lockdown, teachers and students had to deal with a truly challenging task. At the University of Trento, where I teach, the second semester of the 2019–2020 academic year took place entirely via online teaching, while in the following academic year it was possible to resort to a blended modality, with around 50% of the students present in the classroom and the remainder connected from home. While distance learning, on the one hand, constituted a precious tool that allowed students and teachers not to interrupt the educational process, on the other, it confined people to their own homes, producing a whole host of new problems with which we had to deal, not least the difficulty encountered by students in interacting with each other and with the teacher. Added to this, in the case of disciplines relating to the forestry–, agricultural–, and environmental sciences, or environmental engineering, there was an aggravating circumstance: the physical distance from the main object of study, that is, the natural environment.

Practical field exercises have always constituted one of the characterizing aspects of the Ecology course that I teach in the third year of the Degree Course in Engineering for the Environment and Territory of the University of Trento. Students ask, already on the first day of term, whether there are fieldtrips planned, and when (Cantiani, 2019). In the 2018–2019 academic year, in particular, a "Summer school on forest management and ecosystem services" had been successfully tested, which created numerous expectations in the students of the following year, who suddenly found themselves stuck at home instead, two days after the start of lessons.

The paper illustrates the initiatives I used to facilitate interaction between students and to set up a mutual dialogue between students and teacher, with the aim of creating, despite everything, a

sense of community. In fact, the creation of a lively community is a crucial prerequisite for an effective educational process, in any area of knowledge (Lugaresi, 2023). Another of my desired aims (and one that in the end proved intimately connected with that mentioned above) was to bring those young people, isolated and shut up in their homes, into contact with the natural environment. This ambitious goal required a great deal of imagination and a significant ability to adapt both on my part and on that of the students, and was obviously pursued with diversified approaches over the two academic years involved, corresponding to the two waves of the pandemic.

2. Strategies to overcome constraints consequent to the pandemic

During the first wave of the pandemic, the University of Trento decided to suspend lessons before the end of the first week of courses. A few days later, students and teachers were informed that teaching activities would continue online. The solutions proposed were: online lessons in synchronous mode or online lessons in asynchronous mode. However, as a result of the obvious organizational difficulties, the suggestion was to try, at least in a first phase, the asynchronous mode, for which precise instructions were given. During the second wave of the pandemic, at the University of Trento it was possible, in the second semester, to hold lessons in the classroom, in blended mode. Naturally, students had to respect social distancing (seats were assigned at the beginning of the course and had to be maintained) and both students and teachers were required to wear protective masks during class hours. Furthermore, between lessons there was an obligation to air the classroom. Since the lessons were held in blended mode, it was necessary to equip the classrooms with the necessary IT tools; this required a major organizational effort on the part of the university staff in charge. With everything perfectly ready before the start of lessons, those students who wanted–or were able–to do so began following lessons in person while the rest did so from home, asking questions, interacting with their classmates present in the classroom, and participating actively in lessons: a great progress compared with the previous academic year!

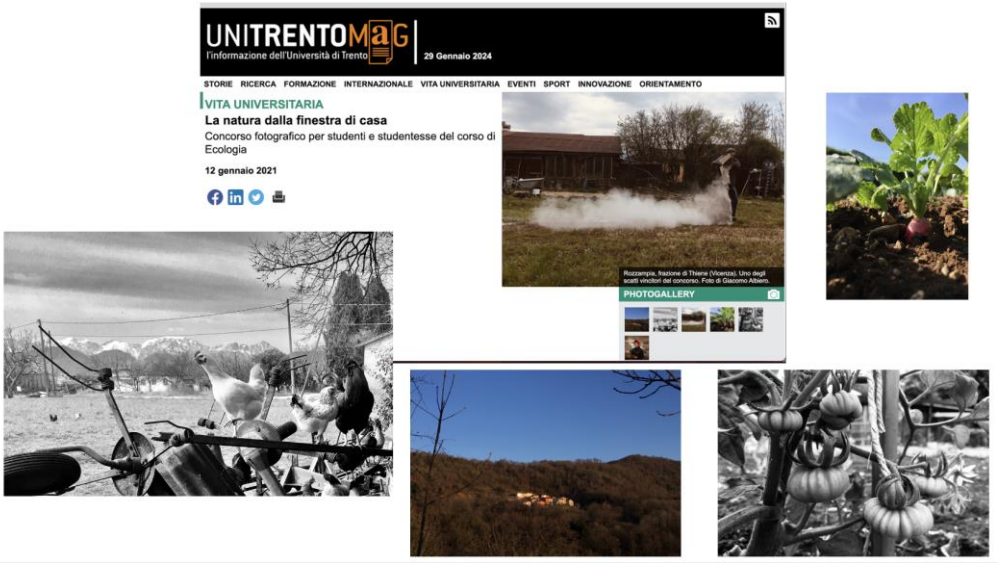


Figure 1. shots of the competition's winning photographs

2.1. Experiences from the academic year 2019–2020

When I suddenly found myself confined to my room, pensively staring at the computer screen, my first concern was how to encourage my students to connect with the natural environment. In normal conditions, an activity, very much appreciated by the students, was what I had called "a hop outside the classroom": short walks in the park surrounding the faculty to observe the phenological aspects of the vegetation, first in winter habitus and gradually with the changes that occur with the onset of spring. This is an excellent exercise for learning to observe. The ability to observe is an important yet often underestimated aptitude, indispensable for understanding phenomena and processes in the surrounding world (Walker, 2019). It must therefore be encouraged, especially in students who will have to deal with environmental problems in their professional future (Cantiani, 2019). I had opted for asynchronous lessons, and continued to enrich the presentations with photographs taken from my personal archive, but it was not enough. Suddenly, an idea struck me; to launch a photography competition entitled "Nature from the window of my house": anyone could look out of the window, or go down into the garden, or walk the 200 meters allowed, in order to document the seasonal transformation of the vegetation or to immortalize meteorological manifestations in the form of an image, such as wandering clouds or stormy skies. The students took up the challenge with enthusiasm and actively participated (in Figure 1, the winning shots and the announcement made by the university magazine).

The desire to involve students more actively and create the conditions for fruitful interaction led me to rethink the possibility of still proposing the seminar on forest management and ecosystem services (which I had initially decided to cancel). I then proposed various activities, to be carried out through group work. Everyone was free to choose depending on their personal interest. I met with the students in small groups, on the platform Zoom, to analyze the work in progress. Finally, the results of the various activities were shown to everyone in plenary meetings.

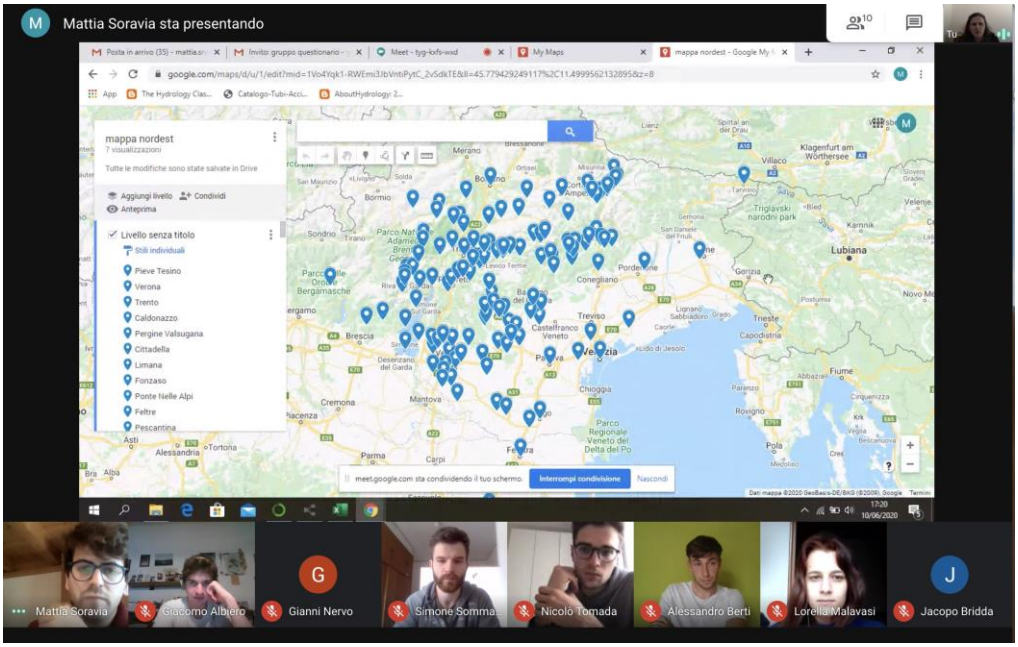


Figure 2. screenshot taken during the final plenary meeting

One of the proposed activities consisted of a survey on the perception of forest management conducted through a questionnaire developed by the students, appropriately guided, and submitted online to relatives and friends. From June 6, 2020, the start date of the survey, to June 14, the final date, 460 people were contacted, with a complete response rate of 86%. The methodological approach and the results of this experiment were described in a publication (Cantiani M.G. & Cantiani P., 2021), publication in which the names and photographs of the students involved can be found (in Figure 2, a screenshot taken during the online final plenary meeting).

Another activity consisted in the creation of a virtual herbarium, made up of the forest species that students are required to learn about at the end of the Ecology course. Each participant chose a species to focus on in relation to their area of residence, took photographs, and described the

geographical characteristics of the location. The herbarium, consisting of a set of cards containing photographs and descriptions of each individual species (see Figure 3) was then made available to all students and is still used today to prepare for the exam.

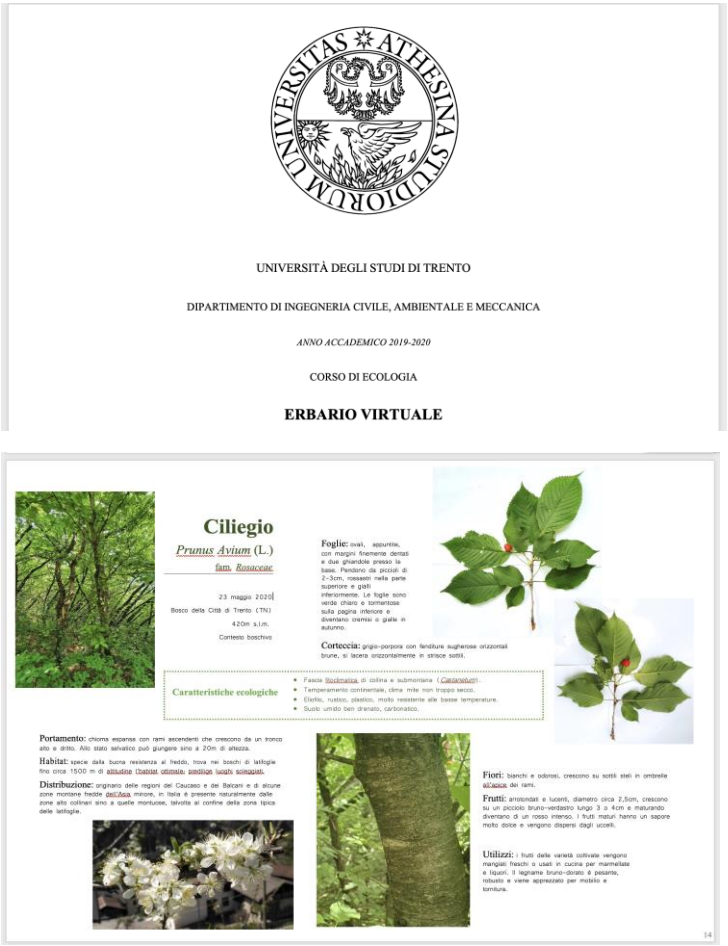


Figure 3. card from the virtual herbarium

2.2. Experiences from the academic year 2020–2021

Finding yourself face-to-face with another person again, despite the impediment of a mask, was wonderful. Blended teaching, nevertheless, posed its own problems; first of all, the risk of "losing" those students who followed lessons from home.

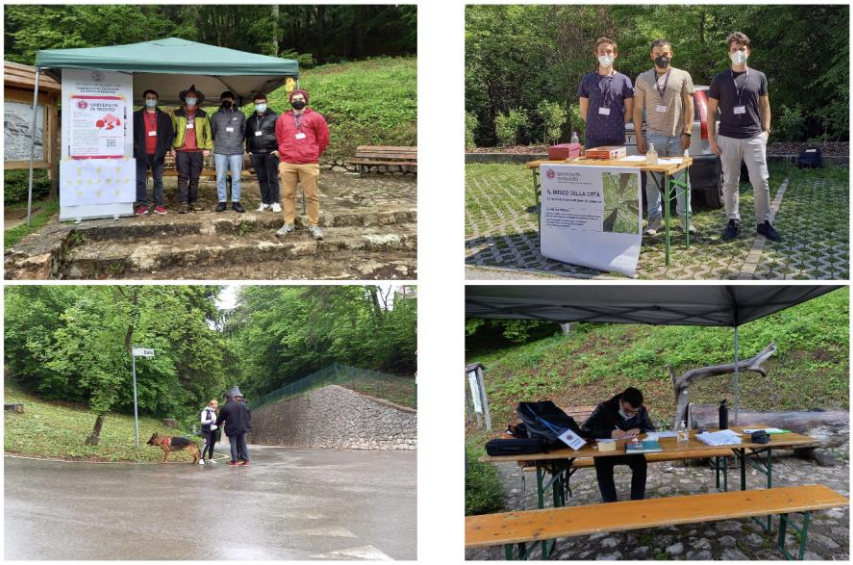


Figure 4. moments during the interviews

I thought it might be useful to get students to reflect on just how important urban green areas and peri-urban forests are, especially to be better able to deal with periods of crisis such as those we were experiencing. Being in contact with Nature has a positive impact on physical and mental health, helping reduce stress and anxiety. (De Meo et al., 2023). But are people aware of this? And how did the use of green areas change at the time of the COVID-19 pandemic in Italy? In order to answer these questions I decided, together with the students, to carry out research through a protocol discussed and developed collaboratively. Those students who followed the lessons from home developed a questionnaire, administering it following the example of the students from the previous year. Those students who attended in person, instead, carried out direct interviews with visitors to some popular forests located around the city of Trento (Figure 4). Talking to people, exchanging opinions with the teacher, discussing matters with peers, trying to untangle the results of the survey, and finally presenting them in plenary sessions was without doubt an excellent exercise, and one that gave the students a new key to understanding the world around them.

3. A few conclusions

The outcomes of these experiences may be considered positive, even if it is not easy to make an objective evaluation. The methodological approach was adopted under the pressure of necessity and urgency and not previously designed. However, some elements allow an assessment to be made: the very positive marks given by students to the course in the annual evaluations, the high number of theses in ecology I was asked to be tutor for and the fact that some of the

initiatives taken during the pandemic, such as the photography competition, are still offered to students today and higly appreciated by them. But perhaps the most important lesson that can be learned from this educational experiment concerns the fact that an empathetic attitude, even in critical situations, can be strongly motivating and promote effective learning.

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The Potential of Using Social Service Robots in the Healthcare Environment

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Abstract

This study investigates the perceived value of social service robots within simulated healthcare settings, focusing on the TEMI robot. Utilizing Likert scale questionnaires, based on previously created scales, 25 diverse participants (16 female, 9 male; average age 41 with a minimum of 23 and a maximum of 65) engaged in scenarios involving the robot's interaction in a hospital context. The research aimed to understand adults' perceptions of service robots' value in healthcare and the factors influencing this perception. Results revealed overwhelmingly positive assessments across various facets of perceived value, indicating significant interest in integrating service robots into healthcare practices. Notably, gender and age variations influenced specific aspects of perceived value, with males showing more interest in utilization and females valuing comprehensibility and interaction positions. However, concerns arose regarding learning challenges and physical dimensions, particularly for taller individuals. To enhance the study's reliability, future research should replicate the experiment in real hospital environments, focusing on a larger sample of hospital workers, and include healthcare college teachers and medical students as participants to enrich the study's scope.

Keywords: *Social Service Robots; Perceived Value of an Innovation; Healthcare Technology; TEMI Robot; Hospital Simulation*.

1. Introduction

Modern semi-autonomous, socially adept service robots are positioned as a promising solution (Weinstein et al., 2014) for addressing the challenges posed by an aging population, particularly in the realm of telehealth, crucial for bridging healthcare access gaps and enhancing health

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outcomes. A service robot is often defined as "*a freely programmable kinematic device that performs services semi- or fully automatically*," that provides useful services but is not an industrial automation application (Schraft, 1993). When used in human-centric environments, these robots need to be able to navigate uncontrolled environments (Wirtz et al., 2018) of public spaces, utilizing AI and natural communication skills (Bieber et al., 2019) to engage with people and follow social norms, including choosing the correct communication distance (Kim et al., 2013). Some service robots designed for semi-autonomous telepresence, such as the TEMI robot (Temi USA, 2023; see Figure 1), are capable of acting as autonomous social assistants (Holland, 2021), interacting with individuals, accompanying them, or facilitating direct communication between physically present and remote participants through telepresence.

The introduction of service robots into healthcare has presented a range of innovative applications, each tailored to specific healthcare needs, with the potential to transform patient care and support for medical professionals. Firstly, service robots could facilitate remote patient monitoring, offering continuous surveillance for elderly patients without the need for physical presence. Using mobile video monitoring, these robots could enable swift responses to health disorders or risk factors, lessening the workload for medical staff and ensuring timely intervention in cases of falls, congestive heart failure, or other health issues (Sather et al., 2021). They could also assist homebound patients in measuring vital signs like pulse, blood pressure, and oxygen saturation levels, allowing for health assessments, medication administration, and remote oversight by healthcare providers and family members (Sather et al., 2021). Additionally, service robots could serve as an immersive platform for remote consultations, enabling healthcare providers to engage in face-to-face interactions with patients or family members, particularly beneficial in remote areas (Vaughn et al., 2015). Moreover, these robots could play a crucial role in alleviating social isolation among elderly patients by physically being present in the same room. They can create a profound sense of social belonging and intimacy, positively influencing the patient's well-being and potentially reducing their reliance on healthcare services (Koceska et al., 2019). Finally, service robots are invaluable in medical education, granting students remote access to educational settings, medical rounds, conferences, and demonstrations, ultimately enhancing learning opportunities and providing wider access to expert knowledge (Wong et al., 2021).

However, the acceptance of service robots in healthcare involves inherent complexities, and practical issues encountered during implementation could potentially impede their utilization. A pivotal factor in promoting the deployment of service robots in healthcare is introducing them through medical education. This not only enhances learning opportunities but also expands access to expert knowledge (Wong et al., 2021), possibly increasing the perceived value of the technology. In the summer of 2023, we conducted an experiment with 25 participants utilizing the social service robot TEMI in two simulated hospital scenarios at CITY Health Care College. Post-test Likert questionnaires were employed to assess how participants perceived the value of

using the robot in these scenarios. Our methodology involved engaging a heterogeneous sample comprising individuals with diverse backgrounds, including those in medical, university, and robotics fields. The guiding research inquiry driving our study was "*How do adults perceive the value of social service robots within the hospital environment?*"

2. Method

2.1. Sample

The sample for the study (N = 25) consisted of teaching staff (n = 18) and administrative employees (n = 1) from different STATE1 and STATE2 universities (CITY University of Technology, CITY Health Care College, CITY2 University of Technology and CITY 3 University), employees from STATE1 East-CITY Central Hospital (n = 4) and from the service robot companies COMPANY1 and COMPANY2 (n = 2). The sample encompassed both male (n = 9) and female (n = 16) participants from diverse cultural backgrounds, with varying ages (minimum 23, maximum 65, average 41). The individuals in the sample possessed diverse experiences with social service robots: some had no prior encounters, some had encountered them briefly, and a few had briefly used them in their professional capacities. The participants are collaborative partners of CITY University of Technology and were invited to participate via email in the experiment. Their involvement was voluntary, based on their interest in studying the behavior patterns of a social service robot. As this area aligns with the research interests of the participants, the experiment was conducted on a regular working day. Written consent was obtained from all participants before the experiment, acknowledging that personalized data would not be collected. The form also outlined that all photos would be blurred for research purposes, and videos would be deleted after analyzing observational data.

2.2. Procedure

The service robot used in the experiment was an autonomously operating personal AI assistant robot TEMI V3 (Temi USA, 2023; see Figure 1), designed with an additional focus on video interaction. It is able to recognize and follow commands, save preset locations, and seamlessly navigate both home and office environments. It can also be used for telepresence communication with friends, family or professional connections.

The experiments with the social service robot TEMI took place at the CITY Health Care College, following two scenarios typically encountered in a hospital setting. The experiments were conducted on a single floor, and the rooms provided adequate space for the trials. Each experiment lasted for 10 minutes, with 5-7 minutes dedicated to the experiment itself and 3-4 minutes for discussion, totaling 60 minutes for transitioning between rooms. The robots and their controlling computers were connected to an independent Wi-Fi network operating at a 5

GHz frequency, ensuring a minimum speed of 10 Mbit/sec. The sample comprised five groups, each consisting of five members, intentionally designed to be as heterogeneous as possible, encompassing diverse genders, nationalities, institutions, and levels of experience. Each participant was assigned a unique code for data collection purposes. While two groups concurrently conducted experiments with the social service robot, the remaining three groups engaged with telepresence robots, which are not elaborated on in this article. All five groups participated in two scenarios with the social service robot, each overseen by an observer.



Figure 1. The setup for the scenarios. Left: a robot-mediated nurse contacting a patient (Scenario 1); right: a robot-mediated nurse guiding a patient (Scenario 2).

Scenario 1 (Figure 1, left). In the first scenario, the TEMI robot, guided by a researcher operating a computer, assumed the role of a hospital nurse in a pre-mapped room. The room layout included designated areas for the nurse's station, patient room, and rest area. The "robotemi" user interface and room map were displayed on the robot's screen. A participant played the role of a bedridden patient interacting with the nurse through the robot, while another participant acted as the patient's relative. Observers assessed the realism, naturalness, comfort, and functionality of the scenario, evaluating its success in a real-life hospital-like context. During the experiment, the TEMI robot navigated to the patient's location using the pre-created room map. The patient contacted the nurse through the robot's interface, requesting a newspaper. The nurse received the call on her computer, confirmed the delivery through the robot, and ended the call. The nurse then directed the robot to fetch the newspaper, delivered it to the patient's room, and communicated with the patient again via the robot. After the scenario, a brief 3-4 minute discussion followed, exploring participants' experiences.

Scenario 2 (Figure 1, right). The second scenario involved the TEMI robot, directed by the researcher, placed in a pre-mapped corridor with indicators for three doctors' offices. The researcher acted as a receptionist, and the robot's screen displayed the "robotemi" environment

and room map. A participant, playing the patient, sought directions to a doctor's office. Observers assessed realism, naturalness, comfort, and functionality, including communication flow, audibility, and intelligibility. The patient interacted with the robot-mediated nurse, who guided them to the doctor, engaging in conversation along the way. Observers could join as passersby. After reaching the destination, the nurse bid farewell, ending the communication and directing the robot back to its initial position. A 3-4 minute discussion followed, focusing on participants' experiences

2.3. Data Collection and Analysis

The experiments aimed to assess participants' perceptions of the value of using service robots in a hospital environment, relying on both individual experiences and observations. After the experiments, participants completed a questionnaire, including the option to write notes, while observers documented their observations on separate sheets. The collected surveys were digitized and analyzed using Excel.

To evaluate the perceived value of social service robots in healthcare, we drew on the works of Pütten & Bock (2018), Pinto et al. (2022), and Sánchez-Fernández & Iniesta-Bonillo (2007), along with the expertise of our authors from CITY Health Care College and East-CITY Central Hospital. We constructed a questionnaire to gain insights into participants' perceptions of various aspects of robot-mediated communication, such as complexity, comprehensibility, physical comfort zone, safety, reliability, and pleasantness. It also explored participants' inclination to learn to interact with the robot and their interest in incorporating it into their work. The survey, consisting of eight Likert scale questions allowing respondents to rank perspectives from -3 to +3, included supplementary inquiries about the sample's demographics.

3. Results

Our research question focused on understanding how adults perceive the value of social service robots within hospital settings. The findings illustrated that, barring the learning dimension, all other aspects of perceived value garnered predominantly positive assessments (Figure 2), with participants expressing significant interest in integrating service robots into their work. Across each aspect of perceived value, only 1 to 2 individuals out of the 25 participants held negative perceptions. However, regarding the learning aspect (phrased as, "*To what extent do you think using a tele-robot at work requires separate learning/training?*" in the questionnaire), the scenario differed significantly: 80% of the participants either expressed uncertainty regarding potential difficulties or perceived the learning process as rather challenging.

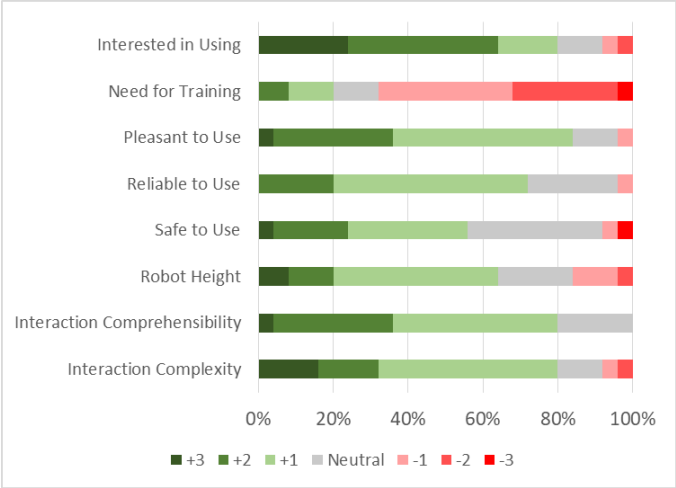


Figure 2. Facets of perceived value of using service robots in healthcare.

Gender variations in perceiving the value of social service robots were not notably distinct. Nevertheless, male participants were slightly more interested in utilizing the robots in their work (mean value 5.89 vs 5.37) – whereas female participants assigned higher rankings to the robots' comprehensibility (mean value 5.44 vs 4.78) and interaction position or robot's height (4.97 vs 4.33). The median age within our sample stood at 41, creating two distinct age brackets: (a) 23-41 years old, and (b) 41-65 years old. Notably, the younger subgroup rated the robot as more complex (mean value 5.46) and also found it more interesting for their purposes (mean value 5.92) compared to the older subgroup (scoring 4.77 and 5.15 respectively).

4. Discussion

In this study, we explored the perceived value of the TEMI social service robot within a simulated hospital environment, enacting scenarios ranging from aiding in patient interactions to guiding individuals in clinical settings. Our study suggests that healthcare workers have the personal readiness to adopt social service robots; however, successful implementation necessitates appropriate training to alleviate fears and equip staff with effective strategies. It is essential to recognize that initial optimistic biases towards unfamiliar technology might obscure uncertainties (Clark et al., 2016), especially regarding the perceived risks of using the novel technology (Calandrillo et al., 2021). These concerns could already be addressed in medical higher education through specialized courses.

The high interest among participants in integrating service robots into their work likely stems from the burden faced by healthcare workers due to staff shortages (as pointed out in Christensen et al., 2009), prompting them to seek relief through robot assistance. Notably,

gender and age differences revealed that males and younger participants were more interested in using the robots for their purposes. These variations may stem from distinct preferences, experiences, or comfort levels with such technology. Addressing these divergences in perception is vital for tailoring robot functionalities and interfaces to meet diverse user needs. Concerns were raised regarding the robot's short height, potentially posing a challenge for taller individuals. Overall, it appears imperative to test service robots thoroughly in complex healthcare settings to understand their value in demanding situations. This includes considerations such as battery life, reliability during peak hours, among others.

In harnessing the potential of service robots in healthcare, it is crucial to focus on targeted training, adaptable designs, and ongoing research to address demographic-specific challenges. Efforts should center on easing learning challenges and enhancing the comprehensibility and interactive capabilities of these robots for successful integration into healthcare practices. Furthermore, the integration of service robots into medical education holds promise, serving as a valuable tool to familiarize future healthcare professionals with emerging technologies like telehealth and robots (also indicated by Wong et al., 2021). Medical education should embrace these technologies to empower future doctors to adapt to evolving healthcare landscapes.

The limitations of the study presented include the need for increased reliability through replication in an actual hospital environment with a larger sample consisting solely of hospital workers. Additionally, expanding the research to incorporate healthcare college teachers and medical students as participants would enhance the study's comprehensiveness and relevance.

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Enhancing pediatric and neonatal CPR competency through clinical simulation: an educational innovation approach

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Abstract

This study presents an educational innovation program aimed at enhancing pediatric and neonatal CPR competency among nursing degree students. The program utilizes clinical simulation, debriefing techniques, and an annual action research methodology to improve knowledge acquisition and student satisfaction. The specific aims include assessing the educational impact on CPR technique learning and identifying elements for improvement. Results indicate improvements in knowledge assessment items, but also highlight the need for ongoing quality enhancement, particularly in prior evaluations and access to materials. The study emphasizes the importance of continuous improvement and the utilization of debriefing techniques to enhance student satisfaction. Overall, the educational innovation has positively impacted student satisfaction, but further refinements are necessary to achieve optimal learning outcomes. This work contributes to the ongoing development of effective CPR training methodologies in nursing education.

Keywords: *Cardiopulmonary Resuscitation; Education, Nursing; Patient Simulation; Pediatrics; Neonatology; Educational Innovation.*

1. Introduction

Cardiorespiratory arrest (CPA) is defined as a sudden, unexpected and potentially reversible cessation of the heartbeat and breathing. This situation occurs both in the healthcare environment, with an annual incidence between 1.5 and 2.8 per 1000 hospital admissions, and in the out-of-hospital environment, with an annual incidence of between 0.67-1.70 per 1000 inhabitants (Perkins, Gräsner, Semeraro, Olasveengen, Soar, Lott et al, 2021).

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Anyone who is facing CPR must begin cardiopulmonary resuscitation (CPR) as soon as possible. In the hospital environment, CPR will be initiated by health professionals and in the out-of-hospital environment by the person closest to the affected person. In both cases, nursing professionals must be competent to assess the emergency situation and apply the appropriate level of life support based on their resources and scientific evidence (Perkins, 2021).

To achieve this learning, which includes specific knowledge, skills and attitudes for emergency interventions, the educational methodology of clinical simulation can be used. This methodology is based on the artificial representation of real situations that promote learning in realistic clinical scenarios of varying complexity, in a safe environment and that allow formative evaluation of the participants. Clinical simulation is used in healthcare environments to train, train or evaluate people or teams in special clinical situations such as a PCR. Among the different modalities of clinical simulation we can find task trainers, virtual reality, standardized patients, virtual patients and high-fidelity simulators (López, Ramos, Pato and López, 2013; Casal, 2016).

Nursing degree students must achieve competency development that includes, as a specific competency, recognizing life-threatening situations and knowing how to execute basic and advanced life support maneuvers (Hinzmann et al, 2023; Ministry of Universities, 2023). Cardiac arrest is a time-dependent, high-acuity event, which requires the coordination of various healthcare professionals at once to optimise the success of cardiopulmonary resuscitation (CPR). Adjusting to the recommended times, as well as determining the optimal time to monitor the rhythm, epinephrine and defibrillation are important aspects that could improve the team's performance (Crabb et al, 2020) To achieve this competence, from the subject "Nursing in Child and Adolescent Health" (ESIA) of the Faculty of Nursing and Podiatry of the University of Valencia, a teaching innovation program was started in 2017 (SEPIE UV, 2017) linked to this specific competence. Similar experiences in our educational environment have shown good results in the acquisition of related competencies (Arrogante et al, 2021).

The ESIA teaching program includes a 2-hour theoretical session and a 2-hour practical laboratory dedicated to pediatric CPR. The practical laboratories allow you to put into practice and consolidate the knowledge acquired in the theoretical session (García-Molina et al, 2018 and 2019; Hinzmann et al, 2023) as well as implement or acquire skills and attitudes that are transversal to the nursing profession. The laboratory exercise consisted of three clinical simulations in which the students had to respond to instrumented CPR in a three-year-old person, to CPR to a 1-year-old infant, and to advance CPR to a newborn. To achieve maximum use of the laboratory, they were tutored by a member of the ESIA faculty and two collaborating students from 3rd and 4th year of the Nursing degree.

To consolidate learning, the debriefing technique was used, an activity carried out after a clinical session, led by an expert, and in which information is transmitted to the participants about their

performance during the simulation. This technique allows you to emphasize activities carried out successfully, highlight positive attitudes and review errors made during practice. It also allows participants to share concerns and feelings related to the simulation, which allows deepening attitudinal learning. This methodology is based on the educational principles of experiential learning and reflective practice. (Kolb, 1984; Schön, 1992; Tortajada-Lohaces, 2018; Hinzmann et al, 2023).

The entire teaching innovation program has been based on an annual action research methodology aimed at improving the acquisition of knowledge and student satisfaction. Once the data was collected through knowledge and student satisfaction questionnaires, in the 2017-18 academic year a possibility of improvement was observed in the project's teaching materials, on which the satisfaction of the participants was intervened and improved. In the 2018-19 academic year, the physical simulation facilities were identified as a proposal for improvement; the pandemic situation prevented this action from being evaluated since the in-person clinical simulation had to be suspended. During the 2019-20 and 2020-21 academic years, the clinical simulation could not be reproduced under optimal working conditions and a physical change also occurred when the Faculty of Nursing and Podiatry moved to a new building.

The improvement proposals proposed for the 21/22 course collected from the teachers and students of the previous courses included a new layout of the simulation room that would allow a closer relationship between teachers and students, resuming the two-hour duration of clinical simulation, development of a Debriefing guide to normalize and standardize this training activity, including a system for checking the use of virtual resources prior to the laboratory and completing the questionnaires at the end of the training session in digital mode.

The objective of this educational innovation is to assess the educational impact on the learning of pediatric and neonatal CPR techniques in students in the 2nd year of the Nursing Degree. Assess student satisfaction with the teaching methodology used in the educational innovation project. Identify elements for improvement in the educational innovation project.

2. Educational innovation

From 2017 to the 2021/22 academic year, the process of continuous improvement of the proposed educational innovation has configured a work methodology that includes 2 areas of action: educational innovation that affects the teaching team and educational innovation implemented with the students.

2.1. Teaching educational innovation.

The teaching team is made up of teachers from the ESIA subject and collaborating students from the 3rd and 4th nursing courses who will participate as facilitators and promoters of the clinical

simulation. To achieve quality standards in the use of simulators, computer systems and training dynamics, the entire team attends a work session in which members of the Association of Health Sciences Students in Emergencies and Emergencies (AEMES) and the Project directors carry out a review of materials management, an update of the current algorithms in PCR performance and the teaching methodology to be implemented.

2.2. Educational innovation with students

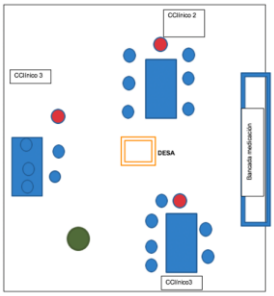
Clinical simulation is the fourth stage of educational innovation aimed at students. The first phase includes a two-hour theoretical session in the classroom. The second phase is composed of a telematic self-training process that includes: a) bibliography and consensus documents on pediatric and neonatal CPR that are shared in the virtual classroom, b) a document is shared with the presentation of the theoretical session and, c) two Serious Games focused on the management of the crash cart and the implementation of pediatric Basic Life Support. The third phase of the project includes the transversal nature of a pediatric medication management laboratory, which affects the preparation and administration of medication in urgent or emergency situations. And the fourth phase includes clinical simulation with three clinical cases: instrumented CPR in a three-year-old person, CPR in a 1-year-old infant, and advanced CPR in a newborn and subsequent debriefing.

During the 2021/22 academic year, the improvements proposed in the previous year were incorporated:

1. The period dedicated to the simulation was increased to 2 hours, distributed in 10 minutes for completing the prior knowledge questionnaire, 10 minutes for the presentation of the activity, 60 minutes dedicated to the clinical simulation, 30 minutes for debriefing and 10 minutes for completing the knowledge questionnaire.

2. A change was implemented in the distribution of the simulation room, adapting it to the new facilities and allowing closer contact between teachers and students. In addition, a redistribution of the material was carried out within the stop cars to facilitate location by the participants (figure 1, figure 2).

3. The new guide for carrying out the debriefing (figure 3), based on the DASH methodology (Center Medical Simulation, s.f.; Neil, Cert & Wotton, 2013; Waxman, 2010) was shared among the teaching team.



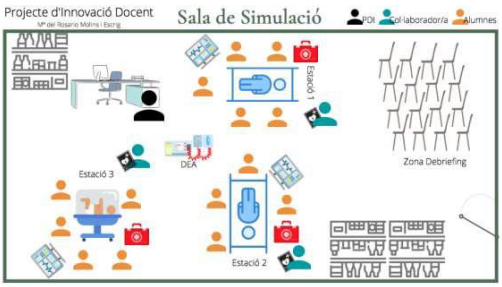
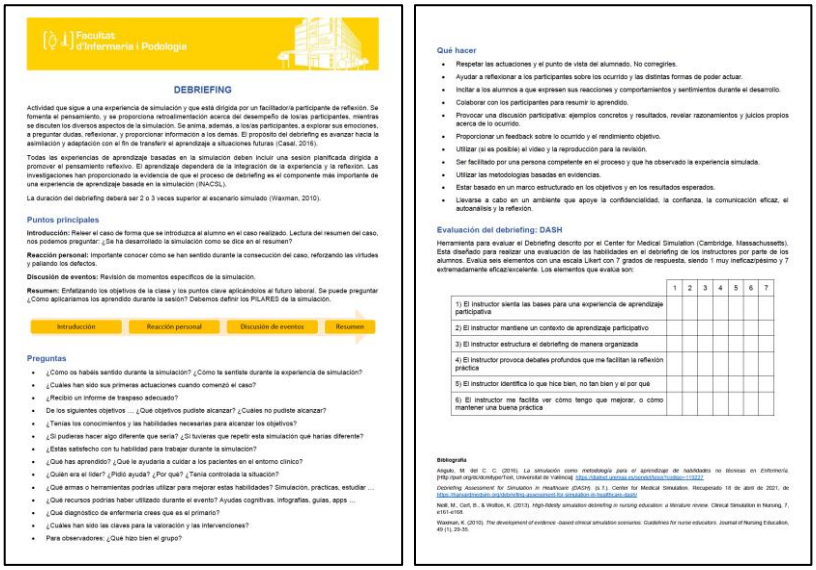


Figure 1: Distribution of the simulation room 2019. *Figure 2: Distribution of the simulation room 2021*



Facultat d'Infermeria i Podologia

DEBRIEFING

Actividad que sigue a una experiencia de simulación y que está dirigida por un facilitador/a participante de reflexión. Se fomenta el pensamiento, y se proporciona retroalimentación acerca del desempeño de los/as participantes, mientras se discuten los diversos aspectos de la simulación. Se anima, además, a los/as participantes, a explorar sus emociones, a preguntar dudas, reflexionar, y proporcionar información a los demás. El propósito del debriefing es avanzar hacia la asimilación y adaptación con el fin de transferir el aprendizaje a situaciones futuras (Casal, 2016).

Todas las experiencias de aprendizaje basadas en la simulación deben incluir una sesión planificada dirigida a promover el pensamiento reflexivo. El aprendizaje dependerá de la integración de la experiencia y la reflexión. Las investigaciones han proporcionado la evidencia de que el proceso de debriefing es el componente más importante de una experiencia de aprendizaje basada en la simulación (NACSL).

La duración del debriefing deberá ser 2 o 3 veces superior al escenario simulado (Waxman, 2010).

Puntos principales

Introducción: Relear el caso de forma que se introduzca al alumno en el caso realizado. Lectura del resumen del caso, nos podemos preguntar: ¿Se ha desarrollado la simulación como se dice en el resumen?

Reacción personal: Importante conocer cómo se han sentido durante la consecución del caso, reforzando las virtudes y palando los defectos.

Discusión de eventos: Revisión de momentos específicos de la simulación.

Resumen: Enfatizando los objetivos de la clase y los puntos clave aplicándolos al futuro laboral. Se puede preguntar ¿Cómo aplicaríamos los aprendido durante la sesión? Debemos definir los PILARES de la simulación.

Introducción → Reacción personal → Discusión de eventos → Resumen

Preguntas

- ¿Cómo os habéis sentido durante la simulación? ¿Cómo la sentiste durante la experiencia de simulación?
- ¿Cuáles han sido sus primeras actuaciones cuando comenzó el caso?
- ¿Recibió un informe de traspaso adecuado?
- De los siguientes objetivos … ¿Qué objetivos pudiste alcanzar? ¿Cuáles no pudiste alcanzar?
- ¿Tenías los conocimientos y las habilidades necesarias para alcanzar los objetivos?
- ¿Si pudieras hacer algo diferente que sería? ¿Si tuvieras que repetir esta simulación qué harías diferente?
- ¿Estás satisfecho con tu habilidad para trabajar durante la simulación?
- ¿Qué has aprendido? ¿Qué le ayudaría a cuidar a los pacientes en el entorno clínico?
- ¿Quién era el líder? ¿Pidió ayuda? ¿Por qué? ¿Tenía controlada la situación?
- ¿Qué armas o herramientas podrías utilizar para mejorar estas habilidades? Simulación, prácticas, estudiar …
- ¿Qué recursos podrías haber utilizado durante el evento? Ayudas cognitivas, infografías, guías, apps …
- ¿Qué diagnóstico de enfermería crees que es el primario?
- ¿Cuáles han sido las claves para la valoración y las intervenciones?
- Para observadores: ¿Qué hizo bien el grupo?

Qué hacer

- Respetar las actuaciones y el punto de vista del alumnado. No corregirles.
- Ayudar a reflexionar a los participantes sobre los ocurrido y las distintas formas de poder actuar.
- Incitar a los alumnos a que expresen sus reacciones y comportamientos y sentimientos durante el desarrollo.
- Colaborar con los participantes para resumir lo aprendido.
- Provocar una discusión participativa: ejemplos concretos y resultados, revelar razonamientos y juicios propios acerca de lo ocurrido.
- Proporcionar un feedback sobre lo ocurrido y el rendimiento objetivo.
- Utilizar (si es posible) el video y la reproducción para la revisión.
- Ser facilitado por una persona competente en el proceso y que ha observado la experiencia simulada.
- Utilizar las metodologías basadas en evidencias.
- Estar basado en un marco estructurado en los objetivos y en los resultados esperados.
- Llevarse a cabo en un ambiente que apoye la confidencialidad, la confianza, la comunicación eficaz, el autoanálisis y la reflexión.

Evaluación del debriefing: DASH

Herramienta para evaluar el Debriefing descrito por el Center for Medical Simulation (Cambridge, Massachussetts). Está diseñado para realizar una evaluación de las habilidades en el debriefing de los instructores por parte de los alumnos. Evalúa seis elementos con una escala Likert con 7 grados de respuesta, siendo 1 muy ineficaz/pésimo y 7 extremadamente eficaz/excelente. Los elementos que evalúa son:

	1	2	3	4	5	6	7
1) El instructor sienta las bases para una experiencia de aprendizaje participativa							
2) El instructor mantiene un contexto de aprendizaje participativo							
3) El instructor estructura el debriefing de manera organizada							
4) El instructor provoca debates profundos que me facilitan la reflexión práctica							
5) El instructor identifica lo que hice bien, no tan bien y el por qué							
6) El instructor me facilita ver como tengo que mejorar, o cómo mantener una buena práctica							

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Figure 3: New guide for debriefing.

To analyze the impact of the interventions carried out, the knowledge and satisfaction questionnaire specific to the innovation project since 2017 was used. The knowledge assessment questionnaire is made up of 11 multiple response items that are completed at the beginning and at the end of the simulation with an order of questions and random answers. Satisfaction is measured using a scale made up of 20 items that are evaluated using a Likert-type response from 0 to 10.

The study variables were the level of knowledge of the students, identified as score per item and final score of the knowledge questionnaire, the level of satisfaction valued as average score per

item and average final score of the scale. A score of 9 out of a maximum of 10 in the questionnaire was identified as a quality standard in student satisfaction, identifying as possibilities for improvement those items that did not reach the standard. A descriptive study of the variables was carried out, a comparative study of the variables of the 21/22 course with those of the 20/21 course was carried out using the SPSS 23.0 program.

3. Results

A total of 221 students participated in the 2021/22 academic year, compared to 263 participants in the previous academic year. In the level of knowledge prior to educational innovation, the correctness in questions 1 and 10 stands out, in both cases greater than 76%, and the low level of correctness in presumed questions 7 and 8, in both cases less than 20%. In relation to the learning reflected in the level of knowledge after the intervention, there are increases in accuracy of 53.26% in item 8 and 24.82% in item 9 and decreases in accuracy of 49.65% in item 1 and 11.99% in item 4. The final score of the knowledge test, measured as a percentage of correct answers, gives us an average correct score of 44.9%, improving the score of the previous questionnaire by 8.91%. to innovation (table 1). Regarding the reliability of the measurement scales, Cronbach's alpha for the satisfaction questionnaire was 0.944 and the knowledge questionnaire was 0.757.

Educational innovation has produced improvements in 5 of the 10 knowledge items in relation to the previous year, with a greater increase (8.91%) in the impact of innovation measured as an overall score of the questionnaire compared to the previous year (4.26 %). It is important to highlight the overall difference in prior knowledge that the participants present: 55.61% in the 2020/21 academic year and 35.99% in the 2021/22 academic year in order to interpret the impact, use and improvement of the practical workshops of the innovation.

Satisfaction with the innovation project reaches an average of 9.1 points out of 10, highlighting that 15 of the 20 items exceed the quality standard of 9 points. Five items would be identified as possible proposals for improvement, highlighting: the teaching media and resources used in the innovation (8.84 points), the delivery of material and documentation with sufficient time (8.73 points) and the logistical organization of the laboratory (8.76 points) (Table 2).

The new layout of the simulation room or the logistics of the laboratory, although it does not reach the quality standards proposed, has shown a clear improvement, increasing satisfaction from 6.82 to 8.76. Furthermore, the impact of innovation has been reflected in the typology of the laboratory as appropriate for acquiring knowledge, going from 8.86 to 9.14.

Table 1: Absolute number, percentage and calculation of the difference of participants who get the question right

	2020/2021					2021/2022				
	Pre (n=263)		Post (n=221)		Difference	Pre (n=221)		Post (n=220)		Difference
	n	%	n	%		n	%	n	%	
Q1. Duration of Insufflation	186	70.72%	98	44.34%	-26.38%	170	76.92%	60	27.27%	-49.65%
Q2. FBAO, Choking	175	66.54%	156	70.59%	4.05%	108	48.87%	128	58.18%	8.31%
Q3. Compressions ratio 15:2	170	64.64%	151	68.33%	3.69%	76	34.39%	64	29.09%	-5.3%
Q4. Revaluation 2 min	170	64.64%	132	59.73%	-4.91%	138	62.44%	111	50.45%	-11.99%
Q5. Depth of Compression	171	65.02%	191	86.43%	21.41%	140	63.35%	174	79.09%	15.74%
Q6. Adrenalin dose	195	74.14%	194	87.78%	13.64%	147	66.52%	193	87.73%	21.21%
Q7. Adrenalin mins	138	52.47%	85	38.46%	-14.01%	37	16.74%	74	33.64%	16.9%
Q8. Adrenalin dilution	156	59.32%	171	77.38%	18.06%	34	15.38%	151	68.64%	53.26%
Q9. Instrumental	202	76.81%	194	87.78%	10.97%	136	61.54%	190	86.36%	24.82%
Q10. Duration of Intubation	195	74.14%	168	76.02%	1.88%	168	76.02%	154	70.00%	-6.02%
Q11. Vital Signs	170	64.64%	159	71.95%	7.31%	110	49.77%	121	55.00%	5.23%
Overall score	55.61%+/-22.13%		59.87%+/-18.86%		4.26%	35.99%+/-20.32%		44.90%+/-19.53%		8.91%

Table 2. Average assessment of the satisfaction of the participants in the innovation. Comparison of the 4 previous courses

	2017-18	2018-19	2019-20	2020-21
The expectations I had regarding the usefulness of the training action in which I participated have been met.	8.651	9.070	8.663	9.050
The content developed during the training action has been useful and has been adapted to my expectations.	8.581	9.232	8.810	9.097
I will be able to apply the knowledge acquired in my professional practice.	9.062	9.280	9.006	9.223
The typology (laboratory) has been appropriate for learning to perform CPR.	8.968	9.118	8.859	9.139
The modality (face-to-face, non-face-to-face, e-learning, etc.) has facilitated the learning of the contents taught.	8.384	9.184	8.086	9.017
The teaching methods used by the teachers have been appropriate for optimal development...	8.159	9.196	8.736	9.000
In your case, the distribution of the groups has been appropriate for the development of the activity.	8.742	9.266	8.896	9.013
The evaluation system (the briefing) used has allowed me to know my level of CPR mastery…	8.774	9.136	8.779	8.912
The documentation and materials have been available sufficiently in advance for the development of the laboratory.	8.518	8.941	9.000	8.735
The teaching media and resources made available have been appropriate for the optimal development of the laboratory.	8.566	9.011	8.748	8.840
The duration of the laboratory has been adequate to acquire knowledge about CPR…	8.484	8.615	8.791	8.916
In general, the logistics organization has contributed to the development of the laboratory.	8.254	8.643	6.822	8.759
In general, I am satisfied with the participation and intervention of the team of 3rd and 4th grade students.	8.474	8.881	8.509	9.038
In general I am satisfied with the participation and intervention of the teaching team.	9.375	9.629	9.160	9.395
The teacher has shown to have mastery of the contents he/she has taught.	9.157	9.586	9.104	9.282
The teacher has managed to maintain the students' interest and adapt the case to the expectations...	9.488	9.800	9.595	9.513
The teacher has encouraged participation.	9.344	9.638	9.368	9.399
In general, I am satisfied with the development of the laboratory.	9.379	9.638	9.479	9.445
I would recommend other students to take this laboratory on pediatric and neonatal CPR.	9.143	9.492	8.982	9.332
The duration of the laboratory has been adequate to acquire knowledge about CPR…	9.541	9.726	9.411	9.521
Media	8.851	9.253	8.840	9.131

The improvements introduced in the evaluation process through Debriefing have had a positive impact and, although they do not reach the proposed quality standards, an increase from 8.78 to 8.91 in student satisfaction has been observed.

Access control to virtual resources by students could not be implemented due to technical problems of the organization. These elements have been highlighted as a necessary improvement to be implemented in future courses since the items with the lowest rating are linked to this area of improvement: the teaching media and resources used in innovation (8.84 points) and the delivery of material and documentation with enough time (8.73 points).

The lower score in the prior knowledge test could be linked to the decrease in perceived satisfaction in delivering the documentation with sufficient notice, but the decrease in satisfaction is 0.3 out of 10 and would not justify the decrease of almost 20% in successes among students of both courses.

Finally, the inclusion of the digital questionnaire after the intervention as part of the laboratory itself has allowed us to eliminate the percentage of participants who did not return the questionnaire at the end of the intervention.

4. Conclusion

Educational innovation has shown improvements in 5 of the knowledge assessment items, but not in the rest, making it necessary to continue with the quality improvement cycle.

The improvements implemented in this educational innovation have had a positive impact on student satisfaction, although items remain below the proposed quality standard.

Elements for improvement have been identified related to the low level of correctness of the students in the prior evaluation phase and in access to the materials used prior to the laboratory.

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A Centralized Course e-Portfolio Repository for Fostering Continuous Improvement and Strengthening Teaching Community of Practice in Higher Education

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Abstract

Course portfolios in higher education are much more than a collection of teaching and assessment materials. When created properly, they could provide a clear anatomy of the offered courses depicting the details of the teaching and learning practices in classrooms. Making course portfolios available to other colleagues promotes the best and most effective teaching practices and fosters strong faculty ties with the teaching community. Despite the many advantages of course portfolios, their adoption in higher education is still limited. This paper introduces a case study of the design and deployment of a centralized course portfolio repository at (removed for blind review). The aim of the repository is to promote teaching effectiveness and continuous improvement of offered curricula, while providing faculty with autonomy, flexibility, and data privacy control.

Keywords: *Teaching technologies; course portfolio; community of practice; continuous improvement.*

1. Introduction

Educating the next generation of students and preparing them for the job market has always been the core business of higher education institutions (HEI). With the emergence of the fourth industrial revolution and the ubiquity of internet technologies and applications, higher education institutions are currently facing several novel challenges such as i) the increasing need for life-long learning; ii) the evolving needs and expectations of students; iii) the emerging technologies and business models; iv) and the transition towards a "skills over degrees" model (Østergaard & Nordlund, 2019). Other major challenges include global competition, the increasing social and geographical diversity of the student body, and the reduction in state and federal funding. A study by IBM's Institute for Business Value found that only 43% of surveyed industry and

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academic leaders believed higher education equipped students with necessary job market skills, and only 41% thought it met industry needs (Morrison, 2015).

Therefore, there is currently considerable pressure from governments and academic accreditation agencies on HEI to improve the effectiveness of their teaching practices to overcome the above challenges and shortcomings. Measuring teaching effectiveness in higher education environments, however, is not as easy as measuring research and service effectiveness. Evidence of research and service activities are usually publicly available, which make them easier to locate and evaluate. Teaching activities, on the other hand, take place behind closed doors, where only students and faculty are usually involved. Hence, many universities rely on tools such as student evaluation of teaching, peer evaluation of teaching, and course portfolios to collect evidence regarding the effectiveness of the teaching process (Aylett & Gregory, 1996; Buckridge, 2008; Cerbin, 1994; De Rijdt et al., 2006; Melland & Volden, 1996). Other evaluation tools such as achievement of learning outcomes, teaching related publications, and teaching awards are also mentioned in literature (Berk, 2005).

Out of these tools, course portfolios stand out for their potential to improve teaching and learning processes. They serve as quality assurance tools, allowing faculty to reflect on pedagogies, analyze learning outcomes, and provide recommendations for continuous improvement. Their ability to document and share teaching experience and provide details on the best practices to implement in classrooms makes them an excellent tool for strengthening the ties of faculty to the teaching community of practice (CoP).

Despite these benefits, creating comprehensive course portfolios is not widespread due to a lack of understanding, awareness of their potential benefits (Swart, 2018), or perceived time commitment. A study by Griffith University (Buckridge, 2008) emphasized the need for institutional commitment to the scholarship of teaching to encourage portfolio development.

This paper introduces a case study of the design and deployment of a centralized course e-portfolio repository at (removed for blind review). The aim of the repository is to foster teaching effectiveness and continuous improvement of offered curricula. The repository is deployed online, which facilitates the sharing of e-portfolios within a department, across the campus, and externally (with accreditation agencies) if needed. It also strengthens the teaching community of practice, as faculty can easily share their developed e-portfolios for peer feedback, evaluation, and recognition. The paper discusses the repository's structure and the flexible access permission scheme that was adopted to provide faculty with full autonomy of their e-portfolios, while satisfying the requirements of national and international accreditation agencies.

2. Course Portfolios

A fundamental question that is facing all professions is how to generate, exchange, and build on existing knowledge to enhance their respective practices. In higher education, course portfolios

have been utilized for several years to assess student learning and enhance teaching practices. They provide faculty with as effective way to showcase their instructional strategies, teaching philosophy, and course objectives (Barton & Collins, 1997). They can also be used to reflect on instructional practices, identify areas of strength and weakness, and make informed changes to the course materials. Research has shown that course portfolios are effective in promoting reflection on teaching practices and improving faculty member self-awareness (Klenowski et al., 2006). Faculty who create course portfolios have a better chance to evaluate the effectiveness of their teaching strategies and identify areas for improvement.

Pat Hatchings studied how course portfolios could help faculty investigate and document what they know and practice as teachers in ways that will contribute to the improvement of student learning (Hutchings, 1998). He defined course portfolio as the collection of teaching, assessment materials, and artifacts that focus on the unfolding of a single course, from conception to results. William Cerbin described the course portfolio as a scholarly manuscript, which focuses on how both teaching and learning occur in a specific course (Cerbin, 1994). Edgerton et al. (1995) also defined course portfolios as "a coherent set of materials, including work samples and reflective commentary on them, compiled by a faculty member to inquire into and represent his or her teaching practices as related to student learning and development".

2.1. Benefits of Course Portfolios

Several benefits could arise from the implementation of course portfolios including using them as a formative tool to enhance the faculty teaching competencies and facilitate the attainment of CLOs. They streamline the documentation of the most effective teaching techniques identified by faculty and highlight the discovered deficiencies and the major challenges that affect the teaching and learning processes. By doing so, faculty can share their knowledge with colleagues and promote the adoption of best practices across the institution.

Having an up-to-date course portfolio gives faculty more time to focus on innovating their teaching techniques and considering curriculum revisions. They could also share their course portfolios with others for discussion, feedback, formal review, as well as gaining peer recognition of teaching excellence.

Sharing course portfolios could provide a head start to new faculty and enable others teaching the same course to continue the improvement cycle and to build on what has been accomplished by their colleagues. De Rijdt et al. (2006) reported that using course portfolios stimulates faculty to reflect on their own teaching, actualize the learning content, improve their course materials, and search for alternative educational methods.

Course portfolios could also be used as a summative tool to document teaching effectiveness for promotion, tenure, and accreditation decisions. Scrutinizing the quality of the course portfolios is a standard practice in many national and international accreditation visits. This is

mainly because the time an accreditation team spends on campus during the accreditation visit is limited. Hence, the team relies mostly on the provided course portfolios to assess the quality of the offered curriculum.

3. Case Study: Developing Course E-Portfolio Repository

Developing course portfolios has always been an integral part of the academic culture of United Arab Emirates University. Prior to 2014, course portfolios were managed locally at the department level. Departments seeking international professional accreditation (e.g., ABET, and AACSB, etc.) mandated that faculty create a paper-based portfolio for each offered course and submit them to the department office by the end of each semester. Other departments requested faculty to create and submit course portfolios for evaluation purposes when annual evaluation, contract renewal, or promotion consideration is due.

While preparing for initial ABET accreditation for the BSc in Information Technology program, an initiative was launched in Fall 2009 to substitute the paper-based portfolios with their e-portfolios counterpart. Subsequently, in 2013, the university administration decided to pursue multiple institutional and programmatic accreditations from national and international accrediting bodies. Consequently, having up-to-date course portfolios for all courses offered by the university became a necessity.

However, creating a course portfolio for the first time could be an overwhelming task for many faculty members. They often lack the knowledge about where to begin and what artifacts to include. Consequently, providing faculty members with no guidance would result in inconsistent portfolio structures that might overlook critical content. Therefore, to ensure consistency, a comprehensive e-portfolio manual was drafted and made available on the University's Intranet. The manual stipulates the course portfolio directory structure and specifies the artifacts that must be included in each folder, along with their file naming convention. Despite the predefined directory structure, faculty retain complete independence in terms of the content they incorporate into their portfolios.

Implementing a stipulated directory structure for faculty portfolios brings about several advantages:

- Provide a head start and clarity: Faculty members are given a clear starting point and guidance on what specific items to include in their portfolios.
- Serve as a quality assurance mechanism. By specifying the files and artifacts that must be included in each folder, it helps ensure that the portfolios are comprehensive and meet the required standards.
- Streamline review and quality assurance processes,
- Ensure compliance with accreditation requirements.

3.1. E-Portfolio Directory Structure and Content

In order to meet the criteria defined by various accreditation agencies, it is essential for the e-portfolio directory structure to include comprehensive information about each course offering. This content should clearly demonstrate the range of teaching activities and provide evidence of the achievement of Course Learning Outcomes (CLOs). However, to minimize the time and effort involved in creating and updating the course e-portfolio, the e-portfolio structure is divided into two primary folders, categorized based on the frequency of updates they require as shown in Fig. 1.

3.1.1. Syllabus and Teaching Materials

The folder titled "Syllabus and Teaching Materials" contains subfolders dedicated to storing various components essential for the course. These components include the course syllabus, lecture notes, handouts, lab instructions, lab manuals, videos, links to forum discussions and blogs, recommended readings, and online materials. It may also include any other teaching materials developed or adopted by the faculty member.

The teaching materials typically remain consistent from one semester to another, eliminating the need to save new copies each time the course is offered. Instead, faculty members are required to initially store a complete copy of the teaching material during the creation of the course portfolio. As these materials evolve over time, the stored versions are revised to reflect the latest updates and changes. The objective is to maintain only the most up-to-date version of the teaching material in the course portfolio, ensuring its accuracy and relevance.

The "Syllabus" subfolder stores all revisions of the course syllabus to track the significant enhancements aimed at improving the students' learning experience. This organization of the "Syllabus and Teaching Materials" folder, with its subfolders and revision tracking, facilitates effective management and documentation of the course materials. It ensures that faculty members have access to the most current and accurate teaching materials while also preserving a record of the evolution and improvements made to the course syllabus. This systematic approach supports continuous enhancement and refinement of the teaching materials, contributing to an improved learning experience for students.

3.1.2. Assessment Instructions & Reports

In contrast to the "Syllabus and Teaching Materials" folder, which is updated when needed to incorporate course improvements, the "Assessment Instruments & Reports" folder is updated regularly each semester the course is offered. A new folder is created for each offered section to store copies of all the assessment tools utilized throughout the semester such as assignments, quizzes, exams, projects, lab reports, and other evaluation materials. Moreover, the folder also includes other important components such as the model answer or solution, the marking scheme

or grading rubric used for evaluating the assessments, and samples of graded students' work, usually representing various performance levels (e.g., A, B, C, and D grades).

Creating a new folder for each offered section facilitates the organization and accessibility of assessment materials. It also allows faculty members and relevant stakeholders to easily locate and retrieve the needed assessment artifact. This systematic approach streamlines the assessment process and ensures consistency and transparency in evaluating student performance across different sections of the course.

3.2. Centralized Online Repository

Despite the numerous advantages of course e-portfolios, storing them locally on individual computers limits their effectiveness. To overcome this limitation, the second phase of the project established an online central repository for maintaining the created e-portfolios for all courses offered by the University. The structure of this online repository is outlined in Figure 1. Having a centralized repository is crucial for promoting collaboration between departments and facilitating the development of multidisciplinary programs. It also simplifies academic quality assurance and provides convenient access to e-portfolios during accreditation visits. However, transitioning course portfolios to an online platform introduces concerns regarding data security and privacy, especially for sensitive files such as final exams and SET reports.

To ease the concerns regarding the security and privacy of the online e-portfolios, the management of e-portfolio directories is decentralized at the department level. Each academic department has full control over its own folder within the repository and is expected to adopt the directory structure depicted in figure 1. To facilitate effective management of e-portfolios at the department level, a repository lead is appointed by each department. The repository lead is

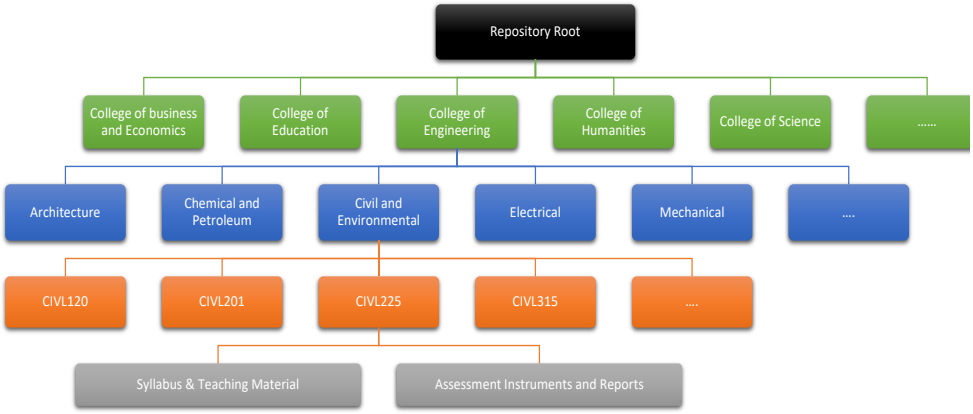


Fig.1. Centralized Online Repository Structure.

granted comprehensive access permissions for the department's folder, including initiating the creation of the department's repository structure and providing faculty with appropriate permissions to upload and update their course e-portfolios. Additionally, the lead is responsible for enforcing the access permission scheme approved by the department.

4. Conclusions

Since the deployment of the centralized repository in fall 2014, its size has grown to more than 300 GB, and it currently hosts e-portfolios for more than 3000 courses. The e-portfolio repository has significantly contributed to the successful accreditation of more than 100 graduate and undergraduate programs. Having the repository available online allowed academic programs to easily share their course portfolios with review teams even before the start of the accreditation visit. This was also instrumental during COVID 19 pandemic, as all the university accreditation visits were administered online.

The latest collected statistics indicate that 8026 remedial actions have been created by faculty so far. Out of these recommendations, 2929 are already implemented and closed, 602 have been implemented but not closed yet, 698 actions in progress, while the remaining are still pending. Out of the closed action items, 933 actions had positive impact on students' performance.

One of the key factors that contributed to the success of the project was the strong support received from the administration. Their commitment and willingness to revise existing policies and procedures played a pivotal role in promoting the adoption of the new repository.

Involving faculty members from the project's early stages was crucial. By integrating them into decision-making and facilitating open discussions, the project addressed concerns effectively. Faculty apprehensions, such as perceived maintenance overhead and technical literacy challenges, were considered during design and implementation, resulting in user-friendly features. While emphasizing academic freedom and data privacy further garnered faculty support. The repository aimed not to restrict autonomy but to serve as a platform for showcasing teaching effectiveness. To incentivize adoption, evaluation criteria for promotions and contract renewals were adjusted to consider the completeness and quality of e-portfolios. This linkage directly tied the use of course portfolios to faculty career advancement.

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(Re-)Discovering the treasure within – The contribution of a Design Your Life Module to Undergraduate Education

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Abstract

This paper presents a description of a Design Your Life (DYL) module delivered to a multi-disciplinary group of undergraduate students. This approach as developed in Stanford University uses principles of Design Thinking to support students to consider their own agency and development pathways as they journey through university and beyond. The implementation of this programme is underpinned by an active evaluation strategy. As part of which, three focus groups were conducted with 15 students who had participated in the module over the past three semesters. This paper presents an analysis of student feedback on their participation, locating this feedback in the context of an overarching theory of student engagement. In so doing, this paper seeks to contribute to how these approaches can support students in their journey as active learners and, by building their resilience and self-efficacy, facilitate their discovery of the treasure within.

Keywords: *Design your Life; Psychological Capital; Resilience, Adaptability, Design Thinking*

1. Introduction

According to Delors (1996), "the treasure is learning itself, that remarkable asset possessed by every human and every culture which needs to be tilled and used wisely. Knowledge and minds are not commodities, not just 'human resources' to be developed, exploited and then cast aside, but treasures to be cultivated to improve the quality of life of both individuals and societies" (p.188). This paper describes the contribution a Design Your Life (DYL) module can make in supporting undergraduate students to undertake a journey of self-discovery and a lifetime commitment to ongoing learning and development. DYL forms part of a larger programme at the University of Galway, Designing Futures (DF), which focuses on preparing students for the world of work and for life in general, both at university and beyond graduation.

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Designing Futures represents a transformational educational initiative, changing fundamentally learning and teaching across the university – for both students and faculty. The innovative features of DF include research-led teaching (vertically integrated projects (VIPs); cross- and multi-disciplinary learning (transdisciplinary teaching modules (TDMs); a bespoke, entrepreneurial space on campus, IdeasLab; and partnership with enterprise and industry, both in the design and delivery of the DF programme. The project team has located the various project initiatives within the student engagement literature and specifically in this paper we focus on psychological capital. Tomlinson (2017) defines psychological capital as "a potentially significant form of capital as it is based on the psychological resources which enable graduates to adapt and respond proactively to the inevitable career challenges" (p.347). He explains that there are number of elements to psychological capital "one of which is problem-focused coping towards developing proactive strategies in the face of challenge, mainly in the form of learning from experience" (Tomlinson, 2017, p.347). He argues that there is an onus on those of us working in higher education to "establish the importance of resilience and ways of proactively managing what are likely to be less linear and stable pathways during early careers and beyond" (Tomlinson, 2017, p.348).

The DYL methodology at University of Galway is based on the Life Design approach developed by Burnett and Evans (2016), originators of the Stanford Design Your Life/Life Design programme, which offers students access to a series of tools and templates designed to help them move from "dysfunctional beliefs" to "reframing" with a "bias to action" as a methodology to systematically address their career and life decision-making (Burnett and Evans, 2016). Life Design is growing in popularity in higher education internationally, particularly as an approach to supporting learners' life and career development. Three main theoretical frameworks underpin the approach, namely Design Thinking (Brown, 2008), Emergent Adulthood (Arnett, 2015) and Self Authorship (Baxter Magolda, 2001). This paper provides an overview of student feedback on their participation and signposts potential impacts on their psychological capital and autonomy.

2. Methods

The Designing Futures team have introduced the first University of Galway in-curriculum Design your Life (DYL) module; this is the first time the DYL approach has been taught for-credit in an Irish university. Developed and delivered jointly by the Student Success Coaching Team and the Designing Futures' Director of Educational Design Research, this 5 ECTS module utilizes the design tools and templates developed in the Stanford Life Design Lab. The delivery of Life Design is also characterized by a novel and alternative approach to higher education, the module is supported by a wider student success coaching (SSC) programme, wherein students can avail of one-to-one and group coaching. Module teaching is also done in teams (there are five lecturers jointly teaching DYL at University of Galway, with individual and pairs of

lecturers alternating each week), which brings a rich diversity of perspectives to students' classroom experience. This follows the Stanford University approach where DYL is taught collaboratively. Each of the lecturers has also completed the Stanford Life Design Lab training and University of Galway, and Designing Futures is affiliated with the Stanford Life Design global research network. Furthermore, students engage in collaborative learning in each class, and the foundational educational approach underpinning the module is experiential and hands-on, with students participating in a variety of design thinking challenges and tasks, both individually and in groups, over the 12 weeks of the module.

2.1. Programme Outcomes

The team identified the following learning outcomes for the module, which support students in helping them to figure out how to get the most out of their university educational experience while best preparing them for the future world of work and their future lives:

- Identify and describe Design Your Life concepts, methods and tools that can be helpful in discerning the best professional and life path;
- Select and apply, as is personally best for them, Design Your Life tools for a given work and life decision;
- Critically and creatively, in an informed way, (using Design Your Life), discuss work and life decisions.

Throughout the 12-week, semester-long programme, the participants were introduced to a range of Life Design tools and approaches. Students are asked to conduct three sets of assigned work for this module. For assessment, they complete reflections on both the "Workview/Lifeview" tool and the "Odyssey" planning tool. The "Workview/Lifeview" helps learners to consider and define what values they hold important in terms of what work and life mean to them. The "Odyssey" helps learners to unpack what kind of future career and life they would like to lead by designing three alternative life scenarios: (1) the one they believe they currently live; (2) what if Life 1 was not possible and a Plan B was needed; and (3) what if there were no constraints. In addition, they develop and submit a digital story based on their experiences on the module. Adapting the Lambert and Hessler (2018) model developed at Berkeley StoryCenter, and initially introduced at University of Galway in teacher education (Thompson Long & Hall, 2018), the digital story is a 3–5-minute narrative, comprising first-person spoken text, images, and music. Through the technology-enhanced reflective medium of digital storytelling, students illustrate what they have learned from their engagement in the module and the DYL challenges and tasks over the 12 weeks. During it's first three semesters, this module was attended by a total of 91 students, with 62 of these registered with the College of Science and Engineering, while 29 are registered with the College of Arts, Social Sciences and Celtic Studies. The gender profile of students participating is biased more towards female than male students (64 vs 27). The average age of students undertaking their undergraduate degree in the University of Galway is 21 years.

2.2. Module Feedback

The evaluation team gathered student feedback on their participation through both surveys and a focus group. This paper focuses on an analysis of student feedback based on three separate focus groups which were completed with students each semester at the end of the module. The number of participants in each focus group varied from 4 students in two of the groups and 7 students in the third group. The focus groups were conducted by a postdoctoral researcher who was independent of the module teaching team. Focus groups were transcribed verbatim and analyzed using a thematic approach by two researchers who were independent of the students' teaching team (Braun and Clarke, 2022). Ethical approval for this study was gained from the University of Galway Research Ethics Committee (Reference Number - 22.08.015)

3. Results

A total of 15 students provided feedback in this data set, there were 5 male students and 10 female students in the sample, with most students studying an undergraduate degree in the College of Science (n=13) and the remainder studying in the College of Arts, Social Science and Celtic Studies (n=2). In terms of demographic profile, the focus group profile is a good match for the overall group of students who have registered for this module over the semesters in question. The student's feedback highlighted that participation in the module helped in particular with developing their communication and teamwork skills, given the small group environment, collaborative learning and teaching approach and thus the need to communicate with one another during each session. They also reported that the work helped them with project management as they worked through the module assignments. Finally, they reported that the personal development focus on the module helped with their resilience and confidence about the future. Student feedback is summarized under three key thematic areas below with supporting quotes. Pseudonyms are used to ensure anonymity.

3.1. Building awareness of their internal and external resources

The students explained how the Odyssey Planning exercise enabled them to reflect on where they want to 'be' in the future. For some the exercise made them think about what they actually want to do after graduation and for students like Blathnaid it has led her to determine what she doesn't want to do.

"It's probably like it pushed me to … like what would I actually want to do. I'm doing science, … Just looking at your Odyssey planning and looking at your work view and life view and stuff like that. I think it might be something like the media or television or something. It will have to be work in science as well, but like I don't want to work in a Lab, and I know that now." (Blathnaid)

For others like Finn the plan empowered him to appreciate what his dream was and how to achieve it but more importantly he perceives that he has the capacity to achieve anything he wants.

"The Odyssey plan for me, seeing what my dream was and how achievable it is. It really puts that in perspective for me really, any kind of life path that I want to go down right now is actually really achievable for me and I have like the resources to achieve anything that I actually want to do". (Finn)

For Jackson, Odyssey planning facilitated him to think about his future and gave him the tools to improve how he makes decisions about his life, what he likes and more importantly what he doesn't like.

"The reality of it, because in college, you are just doing college. And this is actually about life, you know that kind of way. … It's kind of like a process of elimination because you realize what you don't like, and it points you in the direction of what you do like… The fact that you break it down, like current situation, decision to change. Stuff like that, that can really help. Like sometimes we just make decisions when we actually don't know where we are right now". (Jackson)

3.2. Resilience

Having engaged in Odyssey Planning students realized that life circumstances can change and subsequently life plans change however, they still have agency to cope with the uncertainty of life. Dervla reflected that her involvement in the module supported her in realizing that she needs to work in order to achieve her goals in life, however, she is assured her resilience will ensure that she can cope with life's uncertainty:

"For me, there's two words that come to my mind, consistency, and resilience ... So, this module helped me to acknowledge that everything is on me. It's not gonna come and I have to work for what I want. But also, like resilience of there's so many ways to do what I want. And if it doesn't work one way it will work another way if I keep being consistent." (Dervla)

3.3. Adaptability

The students discussed how Odyssey Planning helped them to understand that when things don't go the way we had hoped in life we still have options. For Orlagh prior to this she perceived that she had two options 'not failing college' and her 'life falling apart' or making it through college.

"Odyssey planning for me that was really helpful to making the three life pathways drawing them out and basically thinking of where I want to be in five years. What I could do if this didn't work out and what I would do if I had unlimited resources. It was really helpful because made

me realize, like I have other options as well. And it's not failing college and life falling apart or making it. It's not just those two." (Orlagh)

Across each of these three themes, the students are demonstrating their active engagement with the module and in particular with their own agency and psychological capital. The evaluation team plan to conduct further focus groups with students over the coming semester. In addition, they will integrate these findings with the outcomes of pre- and post-survey which uses Lorenz et al.'s (2016) measure of psychological capital. In so doing it is hoped to further explore the impact of students' participation in Design Your Life.

4. Discussion

The deployment of this module within the University of Galway is part of the Designing Futures project (DF), a government funded initiative to enhance the employability of graduates by offering additional practical and creative teaching, learning and skills development alongside traditional degree studies. This student feedback illustrates that the strengths-based and design-informed orientation of the DYL module and in particular resources such as the Odyssey plan can have a particular mobilizing impact on their psychological capital, specifically their agency and resilience. As a foundational context for students' engagement with Designing Futures, DYL represents the crucial, personal development and formation element of the overall programme.

Alongside preparing graduates for the workplace and a fruitful career, higher education nonetheless remains fundamentally about educating active and critical citizens for the complex and challenging world of today (Hall et al., 2023). Therefore, DYL occupies a critical place within Designing Futures, in helping young people to figure out how they might navigate the future - in ways that are personally meaningful, while contributing positively to wider society. The idea of DYL is not to dictate how someone might live their life, nor denigrate the life they already live, but rather provide them with tools and systematic concepts and ideas for seeing how they can add to certain aspects of their life, as is, and plot the future that makes the most sense for them. Tomlinson (2017) argues that within higher education we need to plan for the inclusion of supports that can help our students to proactively manage uncertainty and complexity, nurturing the development of their confidence and resilience, especially as they embark on the first, formative steps of their careers and future lives.

Our findings point to the significant potential of Design Your Life to provide this kind of proactive support to students. DYL can help to build students' capacity to be adaptable and resilient, through fostering systematically their potential for positive self-authorship, founded on a clear and reflexive awareness of their capabilities and strengths.

5. Conclusion

In her digital story for the module assessment (November 2023) Naomi offered the following insights with respect to the DYL module, and two of the activities in particular: "The Heart and Head mapping and the Odyssey planning really helped me come to an important realization: "I had to reframe my life's narrative." All these years I kept trying to define myself based on my career choices and then losing myself every time things didn't work out, instead of realizing that my strengths, passions and beliefs is what defines and gives purpose to my life regardless of what career pathway I choose or what life throws at me." This quote illustrates how the DYL module can support students to develop deeper insight into themselves as lifelong learners, and by understanding their signature strengths, instill confidence and resilience in how they face the future. Furthermore, this student noted: "Doing the different Odyssey plans I saw repeating patterns. No matter how far-fetched the life plan was, "Mental and physical Wellbeing, Nature & Knowledge" were always at the core of all my decisions. And things started flow and make sense again". This feedback shows how DYL can offer students concepts and tools so they can discover/rediscover the treasure within and move forward in their learning and life with a renewed sense of confidence and purpose. These findings form part of an ongoing evaluation of DF and the DYL module and further publications are in process detailing the range of initiatives over the lifecycle of the programme.

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Case-based work with classroom cartoon vignettes as a way to explore pre-service mathematics teachers' multi-criterion noticing

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Abstract

In classroom situations, mathematics teachers need the competence to notice situation aspects with respect to multiple knowledge-based criteria for being able to optimally support students in their learning. However, even if the body of research into teacher noticing is growing, research on noticing with respect to multiple knowledge-based criteria is still relatively scarce. This study hence focuses on assessing pre-service teachers' multi-criterion noticing by means of classroom situation vignettes. In particular, the design of vignettes in cartoon format affords balancing out the requirements of situation authenticity and multiple criterion relevance. Correspondingly, a set of such vignettes was designed with built-in analysis needs related to multiple criteria and was used for assessment. The results point to professional development needs, as most pre-service teachers only focused on a rather low number of analysis criteria. Case-based work with knowledge-based reflection on classroom cartoons can provide solutions, which are discussed in a concluding section.

Keywords: *Multi-Criterion Noticing; Classroom Cartoons; Vignettes; Representations of Practice, Pre-Service Mathematics Teachers, Case-Based Learning*

1. Introduction

Case-based work in initial profession-related learning, in particular in the university context, has received more wide-spread attention across disciplines, building on experience in law, medicine, and economics, in particular (e.g. Kaiser, 1983). For mathematics teacher education, the emphasis of case-based learning includes a focus on classroom situations, as these contexts bring high demands in teachers' professional practice: mathematics teachers have to focus on content aspects, the students' (potentially heterogeneous) understandings and learning prerequisites, the presentation of tasks, among many more criteria and situation aspects. For introducing and translating such profession-related requirements into profession-related

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learning opportunities in the academic context, so-called *vignettes* can be used as representations of classroom practice (Buchbinder & Kuntze, 2018), e.g. in video, text, or cartoon format. Against the background of findings that video vignettes can bring high cognitive load (Sweller, 1994) in the perception of pre-service teachers in learning contexts (Syring et al., 2015), particularly the cartoon format appears as a very helpful format for designing vignettes, as disturbing context information can be reduced, foci to relevant theory can be strengthened, and meaningful context information can often be represented easily by graphical means (Friesen & Kuntze, 2016). In particular teachers' noticing in the sense of knowledge-based reasoning (Sherin et al., 2011) is a key competence when teachers are faced with classroom situations. The growing body of research in mathematics education has mostly concentrated on noticing related to a single specific criterion area. There is hence a need for empirical research into noticing in the case of *several* potentially relevant knowledge-based criteria. This study addresses this research need and explores pre-service teachers' multi-criterion noticing. The participants were asked to analyse a set of correspondingly designed cartoon vignettes.

We will in the following (1) give insight into the theoretical background of this study, (2) deduce the research aims, (3) describe the design of the study and the methods used, (4) present results, and (5) discuss them in a concluding section.

2. Theoretical Background

From the perspective of mathematics education, the aspect of knowledge-based reasoning is key to the notion of teachers' noticing (Amador et al., 2021; Sherin et al., 2011; Berliner, 1991): For supporting students in learning mathematics, the connection of observations in classroom situations with relevant criterion knowledge from mathematics education is crucial. For instance, when a teacher explanation is unsuccessful, disconnected representations of mathematical objects (Duval, 2006) might be a reason for this, and mathematics teachers should be able to notice this by using the corresponding criterion knowledge when making sense of what they are observing in the classroom situation (Dreher & Kuntze, 2015; Friesen & Kuntze, 2016, 2021). Noticing in this sense hence requires professional knowledge (Shulman, 1986; Kuntze 2012), and when faced with classroom situations, mathematics teachers often will have to check whether specific criterion knowledge from their professional knowledge background fits to an observation in the sense that it can explain what can be observed in the classroom situation. For successful knowledge-based reasoning, teachers thus have to jump back and forth between the sphere of their professional knowledge background on the one side and the sphere of their classroom situation observations on the other side. This process has been described in an analysis cycle model (Kuntze & Friesen 2018, cf. Fig. 1), in which repeated cycles may occur when observations are connected with professional knowledge with respect to one or more criterion domain(s).

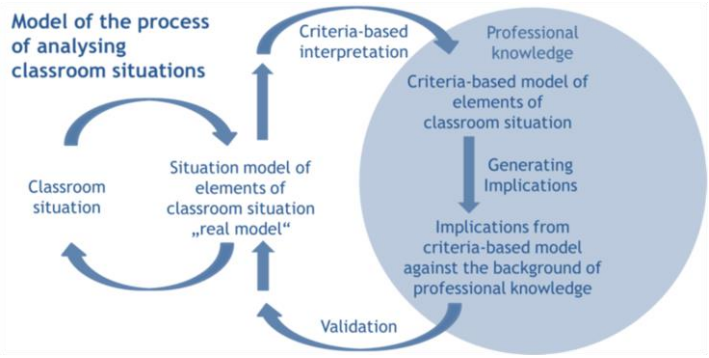


Figure 1. Noticing in the classroom situation analysis cycle (Kuntze & Friesen, 2018, p. 277)

Against the background of this model, it is plausible that in multi-criterion noticing (Kuntze et al., 2021) different noticing criteria can be expected to be in a competing relationship with each other. This means, for instance, that not only a lack of professional knowledge can be the reason for an absence of knowledge-based reasoning with respect to a criterion, but also the situation analysis with respect to a different noticing criterion (or several criteria) could dominate, so that a teacher might not consider a criterion in the noticing process, even if s/he possesses the necessary professional knowledge for a corresponding situation analysis. In such cases, analysis cycles as shown in the model could be abandoned or impeded in taking place. Multi-criterion noticing can hence be expected to be a complex process with potentially high cognitive load, due to the different criterion foci to be taken into account. Despite its relevance for classroom practice, specific empirical research is still relatively scarce. In a first study (Kuntze et al., 2021), a group of pre-service mathematics teachers were asked to analyse a vignette showing a fictitious classroom situation in a secondary school. A majority of the pre-service teachers referred to none (around 25%), one, or only up to two criteria (both less than 40%) out of the four criteria corresponding to the built-in criterion-based noticing requirements. The situation was framed as a classroom situation with students with heterogeneous learning needs, a setting in which different noticing criteria play a particularly important role (Kuntze et al., 2021). Among these, the following aspects can be crucial:

- When introducing tasks, unnecessary obstacles in language and context descriptions should be avoided in order to prevent from potential comprehension difficulties.
- The task context should be consistent with the mathematical content the teacher aims to refer to in subsequent modelling.
- Mistakes that appear in the classroom interaction should be used as opportunities for initiating learning processes in the learning group (e.g. Oser, 2005)
- Students should be encouraged to produce multiple solution pathways, and the students should not be limited to using only one solution pathway.

- Unnecessary changes of representations (Duval, 2006) without connecting the newly introduced representation with the prior representation in which a learner's difficulty has occurred can impede the learner's understanding and should therefore be avoided.
- The use of hands-on material can only be expected to support a learner's understanding if it is consistent mathematically with the question under examination and if the material use can bring an added value or insight.

These criteria with different professional knowledge foci show the relevance of the multi-criterion approach to noticing.

3. Aims of the Study and Research Questions

As mentioned above, the topic of multi-criterion noticing needs a broader empirical research base – in particular, there is to our knowledge neither any study with a focus on classroom situations in primary schools nor any study that bases its empirical results on a set of different vignettes with a parallel design. Therefore, this study aims at responding to this research need and (1) exploring whether pre-service teachers are able to successfully analyse classroom situation vignettes showing situations in primary schools with respect to several built-in criteria. Moreover , the study aims at exploring potential reasons for or patterns of difficulties in the pre-service teachers' multi-criterion noticing through a bottom-up interpretive analysis (2). More specifically, the following research questions are in the centre of this study:

(1) To what extent are the pre-service teachers able to successfully analyse classroom situations with respect to multiple relevant analysis criteria?

(2) Which potential patterns of difficulties in multi-criterion noticing can be detected?

4. Design and Methods

N=32 pre-service mathematics teachers (around two thirds female) were asked to analyse the vignettes. The pre-service teachers were enrolled in the master's degree program and prepared for teaching in primary schools (N_1=14), secondary schools (N_2=16), and schools for students with special needs (N_3=2). On average, the pre-service teachers were in their 8.8^{th} semester (SD=1.96) of their studies at a University of Education in South-Western Germany.

A vignette-based questionnaire was used to collect pre-service teachers' analyses; it comprised of 8 vignettes. Vignette 2 (which is represented in Figure 2), for instance, shows a classroom situation in which the students worked on a task on speed control. The vignette is characterised by six different built-in noticing requirements, which were related to varying criteria (see those introduced above), i.e. the criteria focused on different theory elements in mathematics education. In the vignette (see Figure 2), the vignette teacher …

- … introduces a task with unnecessary language-related obstacles , e.g. unnecessary notions that can be expected to be unknown to some of the students (criterion 1)
- … produces a contradiction between the multiplicative mathematical model and the task context, which can be expected to be marked by statistical variation (criterion 2).
- … does not react or encourage other students to react to or learn from a mistake that appears in the classroom situation (criterion 3)
- … does not acknowledge or accept other solution pathways than the one favoured by the teacher (criterion 4)
- … changes representation unnecessarily (cubes) without connecting the previous representation with the newly introduced alternative representation (criterion 5)
- … uses hands-on material with a student without any substantial supportive potential for the student's understanding and is mathematically not in line with the questions raised by the student previously (criterion 6).

The pre-service teachers were asked to analyse what they saw as positive/negative in the classroom situation, whether they would act similarly or which aspects they would change, and to justify their answer. The answers were coded in a top-down interpretive coding process based on the criteria introduced above (Mayring, 2015). A second rating was carried out, which yielded an acceptable inter-rater reliability of κ=.70 (Cohen's Kappa). In all cases of different ratings among the raters, an agreement could be reached in post-hoc discussions.

5. Results

The first research question focuses on the extent to which the pre-service teachers are able to successfully analyse classroom situations with respect to the multiple built-in analysis criteria. Figure 3 shows the relative frequencies of the number of criteria the pre-service teachers referred to in their noticing, i.e. in their situation analysis. In more than a quarter of the pre-service teachers' answers, none of the criteria was referred to by the participants. More than 45% of the pre-service teachers used one criterion in their situation analysis. The relative frequencies of the use of multiple criteria were lower: two, three, or four criteria were detectable in the answers of about a quarter of the participants in total in their analyses. None of the participants in the sample showed evidence of multi-criterion noticing based on five or six of the criteria introduced above.

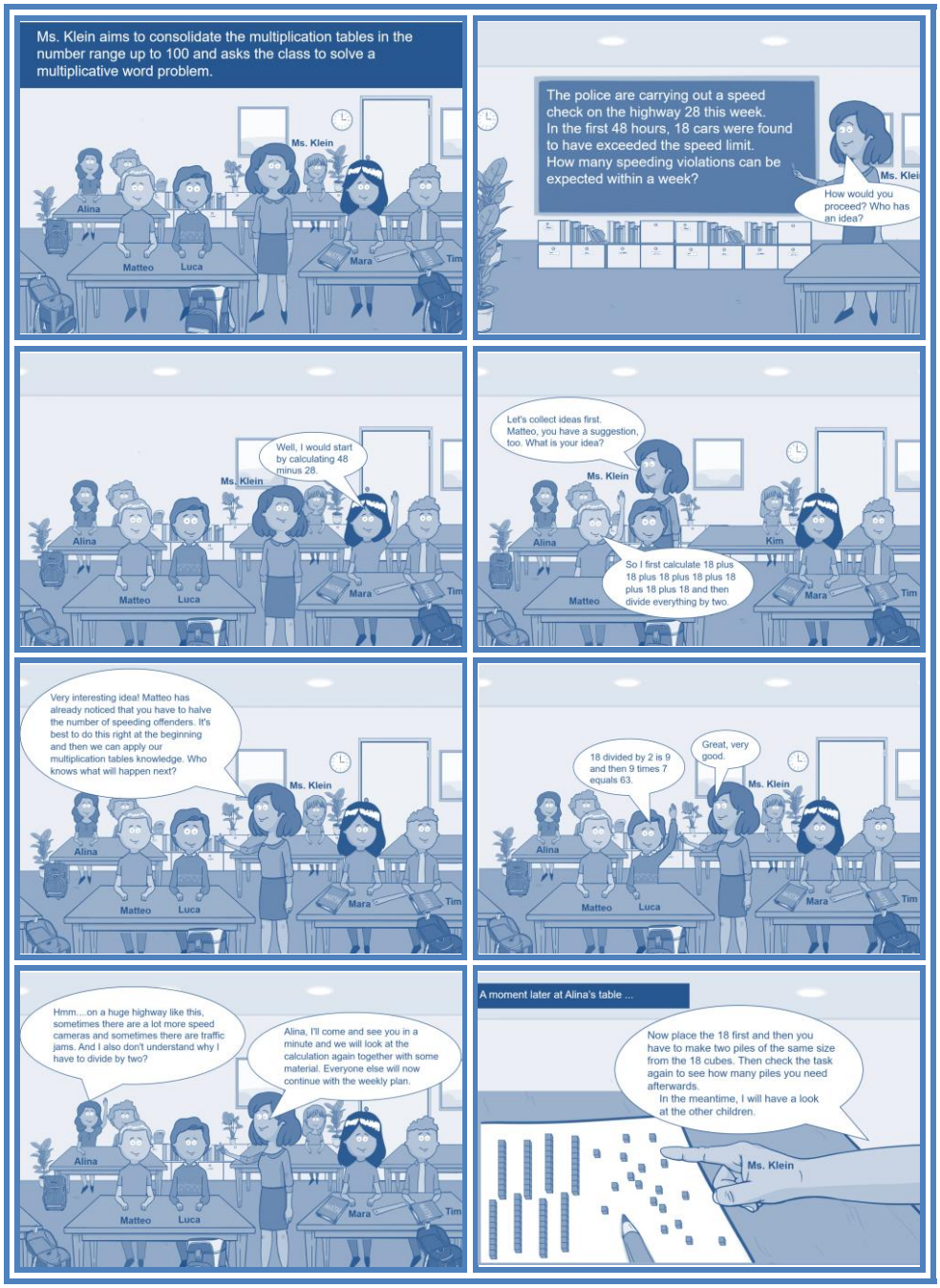


Figure 2. Sample vignette, generated with support from the coReflect@maths project (www.coreflect.eu)

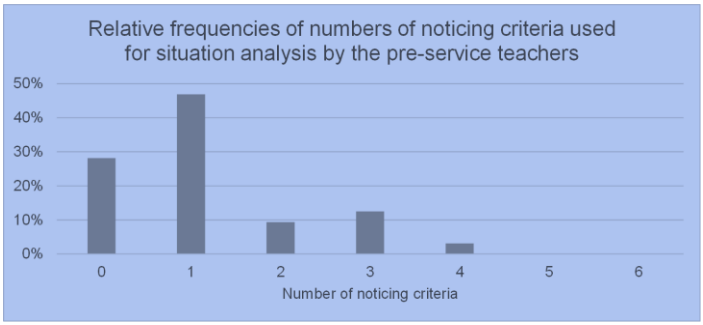


Figure 3. Number of analysis criteria in pre-service teachers' answers related to the vignette in Figure 2

The second research question focuses on possible patterns of pre-service teachers' difficulties related to multi-criterion noticing. The corresponding interpretive bottom-up analysis yielded two main observations: The first observation is the almost absent analysis of the task quality and its enactment, i.e. this part of the vignette teacher's action appears to be somewhat neglected in the pre-service teachers' analyses. The second observation is the mostly positive evaluation that several students contribute to the situation on a surface level of interaction, which appears to block the analysis of the content quality of interaction with respect to how mistakes are dealt with, of the vignette teacher's fixation on a standard solution pathway, and further content-related issues of the interaction represented in the vignette.

6. Discussion, Conclusions, and Outlook

The findings replicate the earlier evidence of pre-service teachers' difficulties in multi-criterion noticing (Kuntze et al., 2021) and extend these to the field of mathematics education in the primary school context. Profession-related learning opportunities are hence needed in mathematics teacher education in order to support pre-service teachers' development of classroom-related noticing. Research on such developments and on in-service teachers' multi-criterion noticing merits increased attention, correspondingly. The further development of vignettes for research and interventions can build on the results of the coReflect@maths project (www.coreflect.eu).

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Designing Authentic Assessment to Improve Academic Integrity

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Abstract

The use of AI chatbots has sparked worldwide debate regarding assessment practices in higher education. Early indications on the use of AI chatbots, signal significant disruption to the higher education system in relation to academic misconduct concern. In terms of the research approach, initially, a systematic literature review was conducted to examine the association between academic integrity and authentic assessment with 32 focused publications from 2019 to 2023 analysed. This led to the development of a robust 'Model for Practice' to guide the implementation of authentic assessment in a way that simultaneously improved academic integrity. This paper presents the main findings of a case study approach with two final year student groups whose teaching and assessment schedule was based on this Model. Results show that the Model addresses the issue of assessing students in a manner that engages students, improves their employability skills, and ensures adherence to academic integrity guidelines.

Keywords: *Authentic Assessment & Design; Academic Integrity; Contract Cheating; Academic Misconduct; ChatGPT*

1. Introduction

The rapid launch of ChatGPT in November 2022 has resulted in a dearth of educational research into the relationship between assessment design and the use of advanced machine learning algorithms in higher education. This lack of literature, along with the changing educational landscape, has motivated the current study exploring the impact of authentic assessment design on academic integrity. The uncertainty surrounding ChatGPT has led to widespread disparity on the possible implications for higher education, with some studies warning of a potentially catastrophic impact on assessment, and others dismissing these concerns, stating that ChatGPT may bring opportunities in terms of new modes of learning and assisting educators. The necessity for higher education institutions to produce 'employment ready' graduates has positioned authentic assessment as a primary tool for developing students' professional skills

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needed for today's multifaceted workplace (Ajjawi *et al.* 2023). The acquisition of these employability skills, however, is reliant on evaluation and assessment procedures that hold students to the highest academic standards. The legitimacy of a higher education institution will be undermined if the institution cannot guarantee that an assessment accurately measures student learning. Although guidance on how authentic assessment can incorporate ChatGPT will undoubtedly increase, the novelty of such studies means that empirical evidence is urgently required to support this guidance and to ensure confidence in any findings.

2. Research Context: Authentic Assessment and Academic Integrity

Authenticity has long been recognised as an inherently valuable characteristic of assessment design (Ajjawi *et al.*, 2023). Authentic assessment is defined as 'assessment which aims to engage students in real-world scenarios that are complex, ambiguous, and unpredictable, to simulate the real-life situations and problems that students will face in their careers (Bretag *et al.*, 2019). Authentic assessment has emerged as an alternative to standard exams, which emphasise memorisation and recall and, instead, aims to assist students in contextualising their learning, encourage internal motivation, promote inclusion, and improve higher-order critical thinking, problem-solving, application and self-reflection skills (Sotiriadou *et al.*, 2020).

Bretag *et al.*, (2019) define academic integrity as compliance with ethical, moral, and professional principles, values and standards that serve as guidance for making decisions and taking action in education, research, and scholarship institutions. Ellis *et al.*, (2020) state that there is a growing awareness of new academic misconduct practices, such as contract cheating, in higher education institutions and yet there are no definitive answers in relation to the volume of assessments procured through contract cheating providers, and the optimal management and penalisation processes for academic misconduct. Academic misconduct threatens academic standards, quality, and credibility in higher education, leading institutions, and regulators globally to urgently explore potential solutions. Maintaining the trust placed in assessment and its ability to ensure that students have demonstrated learning to a level that is worthy of an award is critical in combatting academic misconduct. Assessment needs to evolve along with a changing academic integrity landscape to ensure that students who engage in academic misconduct are not awarded a qualification that they have not earned (Ellis *et al.*, 2020).

It is proposed that authentic assessment should be at the forefront of an assessment movement that addresses; the requirement for improved student equity, the rise of artificial intelligence, and threats to academic integrity in higher education (Ajjawi *et al.*, 2023). Studies have challenged the view of authentic assessment as an academic integrity panacea; for example, although authentic assessment may reduce academic integrity breaches, there is no one assessment that can prevent it, and, furthermore, the assessment type itself is not enough to address academic misconduct (Bretag *et al.*, 2019). Moreover, the real-world, career-focused,

complex problem-solving task aspects of authentic assessment may be overly complicated for academically and lingually diverse students (Ellis *et al.*, 2020). Additionally, lecturers may lack resources to provide scaffolded support to students, leading students to seek assistance from illicit sources. Nevertheless, there is sustained interest in authentic assessment, and its place in the pedagogical environment cannot be disputed. Evidence supporting the claim that authentic assessment is the solution to academic integrity remains absent. This paper aims to address the research question; *"Can Authentic Assessment Design Improve Academic Integrity?"*

3. Methodology

3.1. Systematic Literature Review

The initial research method employed in this paper was a systematic literature review, where clearly defined searches, rigorous inclusion criteria, and comprehension evaluations were used. The article searches used Scopus, Taylor and Francis, ERIC and Science Direct databases to provide a comprehensive, multi-disciplinary view of the relationship between authentic assessment and academic integrity. Articles were included if they were peer-reviewed, written in English and focused on higher education. Articles before 2019 were excluded due to the plagiarism focus, as this study aims to incorporate new cheating practices. Articles were included for further analysis if the title, abstract or keywords included the keywords 'authentic assessment/task/learning' and 'academic integrity/misconduct/contract cheating'. These keywords were selected to ensure that all relevant papers would be returned while accounting for differing terminology globally and across disciplines. 760 initial results were limited to 32 articles, which were analysed in detail (the five seminal papers that influenced the current research are referenced in this paper). This systematic and critical literature review identified a dearth of authentic assessment designs that grapple with the complexities of the new academic integrity landscape. A thematic analysis was conducted to identify key theoretical perspectives on improving academic integrity through authentic assessment design; summarised in Table 1. Specific guidance on how to incorporate these theoretical perspectives into assessment design is summarised under the Authentic Assessment section of Table 1, and the subsequent impact these elements will have on academic integrity is also shown.

Based on a summary of the systematic literature review and resulting theoretical perspectives, six characteristics are recommended as essential authentic assessment design features. The proposed framework (Figure 1), developed in this study, displays these characteristics, and it is proposed as part of this research, that the design should minimise academic misconduct, and improve student engagement and employability skills. The framework recognises that a holistic academic integrity culture and lecturer assistance are necessary for implementation.

Table 1. Theoretical Perspectives on Authentic Assessment Design to Improve Academic Integrity

Theoretical Perspective	*Authentic Assessment*	*Academic Integrity*	*Main Authors*
Well-Timed, Personal, Unique Tasks	Adequate time, Personalised; Evidence gathering	Meaningful; Verifies participation; Peer pressure	Sotiriadou *et al.*, 2020
Engagement	Active contribution; Students as partners	Motivation; Partnership gives students support	Bretag *et al.*, 2019; Ellis *et al.*, 2020
Complexity	Scaffolded complex tasks; Group work; External engagement	Difficult to outsource complex tasks; External scrutiny	Bretag *et al.*, 2019; Ellis *et al.*, 2020
Teaching & Learning Environment	Personalised teaching, feedback; Student-lecturer relationship; Clear assessment requirements	Lecturer detection due to student ability awareness; Early identification of struggling students	Harper, Bretag and Rundle, 2021
Scaffolding	Distinct, interconnected, progressive, reflective assessment components	Subsequent progressive tasks; Reflecting on class and group sessions; Feedback on each task	Bretag *et al.*, 2019; Ellis *et al.*, 2020; Sotiriadou *et al.*, 2020
Support/ Instructional Material	Assessment support; Clear instructions; Lecturer recordings; Exemplars; Rubrics; Training	Expectations clarified; Student understanding of assessment requirements and marking criteria	Sotiriadou *et al.*, 2020
Inclusion	Assessment and Rubric Co-Design	Refine assessment design; Adapt to learning styles	Sotiriadou *et al.*, 2020
Feedback	Peer feedback; Feed-forward	Familiarity with work; Learning Ownership; Student-lecturer dialogue	Bretag *et al., 2019*
Industry Partners	Partner with a company; Real-world setting	Presenting externally; Employment opportunities	Ellis *et al.*, 2020
Culture	Assessment Design to minimise cheating; Supportive environment	Promote academic integrity culture and visuals; Dedicated staff	Ellis *et al.*, 2020
Assessment Type	In-Class Tasks; Personalised work; Orals/Vivas; Reflections	Random nature of lecturer questions; Defending personal work	Harper, Bretag and Rundle, 2021

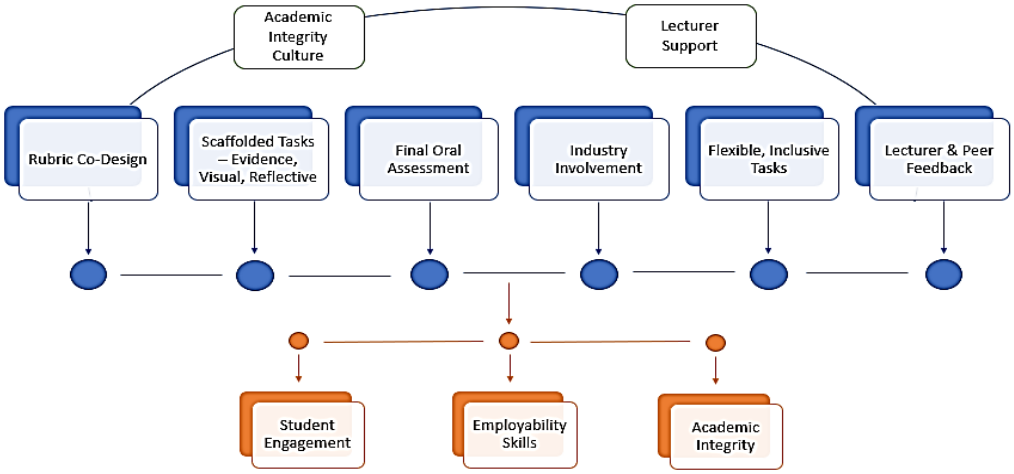


Figure 1. Authentic Assessment Design Framework

3.2. Implementation

To explore an authentic assessment approach with the students, the authentic assessment characteristics and theoretical perspectives were broken down here into a weekly implementation plan for a 13-week semester, as shown in Figure 2.

This plan was implemented with two final year student groups – Marketing (97 students) and Home Economics and Business (32 students) taking a mandatory Corporate Strategy module. The industry partner for the authentic assessment element was the Marina Market, a local market to the University and City consisting of a multipurpose venue with an indoor food hall set up in an old warehouse with 40 vendors permanently occupying the space. Confirmation was sought that all students visited the Marina Market before deciding on this partner, so that no student

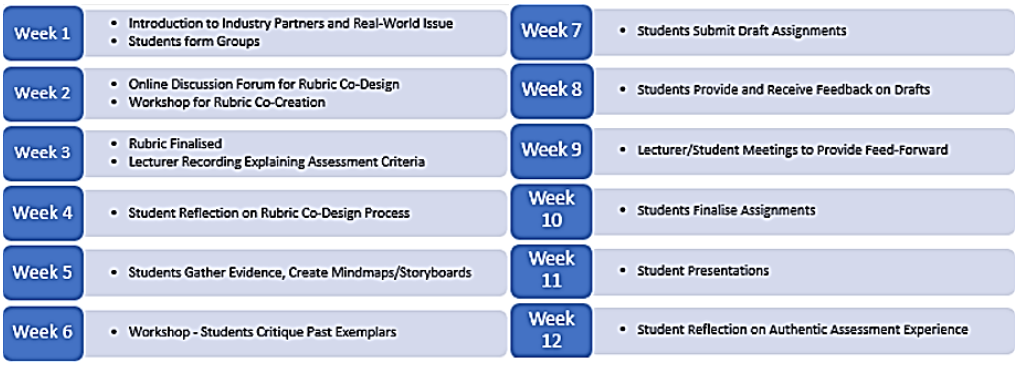


Figure 2. Authentic Assessment Weekly Implementation Plan

would be disadvantaged. Representatives from the Marina Market presented information on the businesses and outlined that they were seeking unique event ideas for their venue. Students formed groups and took part in a rubric co-design workshop where they were provided with a past assignment rubric and asked to suggest changes individually using an online discussion forum on the learning management system, Canvas. Students could not view suggestions from their peers until they commented. Marks for this element (5% of module) depended on critical thought process leading to the students' suggestions. The lecturer analysed all suggestions, altered the rubric, and recorded a tutorial explaining the rubric, marking criteria and all assignment requirements, and posted this recording on Canvas.

The main assessment task (32%) was to carry out a strategic analysis of the Marina Market and students proposed that this be presented in a 'scrapbook' document, consisting of a mix of visuals to evidence their learning and analysis in text format. An exemplar workshop took place, where students reviewed examples of past assignments, graded, and ranked each assignment and provided feedback. The presentation (30%) focused entirely on the students' event idea for the Marina Market, to tie in with industry partners' requirements. Students submitted drafts of their event ideas anonymously to Canvas. Each idea was reviewed by two peer groups and feedback returned anonymously. Students were awarded up to 8% for this peer feedback process depending on the quality of the feedback provided. Lecturer-student feed-forward sessions took place before the scrapbook and presentations were completed. Finally, students were asked to reflect on the experience (25%) and express their thoughts on authentic assessments' role in upholding academic integrity. A quantitative survey was utilized to gather empirical data directly from this large student group. A positivist approach was taken to verify students' views on the authentic assessment process through objective analysis of the survey results. Questions on academic integrity were included, therefore, the survey was conducted anonymously in the hope that students would be honest about their experiences. The majority (57%) responded (73 out of 129), providing confidence in the reliability and representativeness of the results. Ethical clearance was received for this research adhering to university policies.

4. Initial Findings

Initial survey results (Figure 3) present definitive evidence that there is a positive alignment between authentic assessment design and academic integrity improvement. The overwhelming majority of students agreed that the authentic assessment 'live case' with the Marina Market improved their engagement with the module, enhanced their employability skills, and helped with academic integrity guidelines. Additional results from the survey show that students believe they could approach the lecturer for support, they felt they received sufficient feedback, and they clearly understood the assessment requirements. It is evident that the authentic assessment framework helped to create a supportive and collaborative learning environment

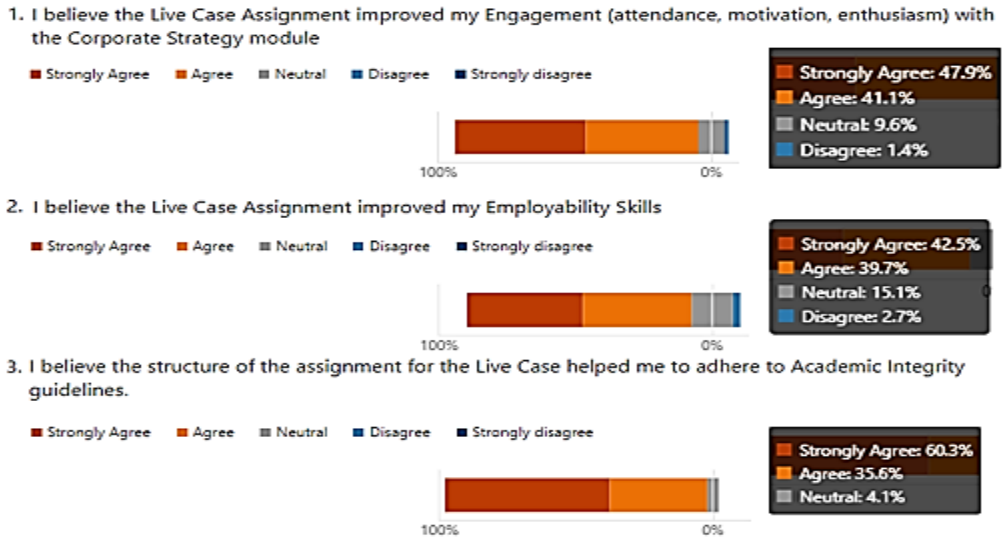


Figure 3. Authentic Assessment and Academic Integrity Survey Results

which led to the anticipated framework outcomes being met – improving engagement, employability skills and academic integrity.

5. Discussion

Along with the survey results, informal student feedback was received through lecturer-student meetings and classes about the authentic assessment experience. Survey results indicate that the framework process reduced student motivations to cheat as students report being engaged, motivated and enthusiastic. There was strong interest and attendance at the rubric co-design and exemplar workshops, and students spoke to the lecturer about how they felt their voice was heard and their opinion was valued. The industry partner's event idea allowed students to develop events targeting their demographic, which they felt was inclusive and meaningful. The top event ideas were chosen by the Marina Market and students presented their ideas to industry representatives. The potential opportunity to be chosen as a finalist served as a further motivator for students. The opportunities to cheat were reduced through scaffolded tasks which began at the beginning of the semester with the rubric co-design. Each task was progressive, therefore, students had to understand the previous task to move forward. In terms of lecturer detection, each students' input into suggested changes for the rubric was verified by the lecturer on Canvas and the rubric was discussed with each student group in the workshop. Students evidenced their learning with visuals which included pictures of the group visiting the Marina Market and working on the project which reduced opportunities to cheat and aided lecturer detection. The

lecturer asked each student a question at the end of the presentation to verify their understanding of the task and their involvement in the project. Students were extremely encouraged by the lecturer-student feed-forward sessions and felt that these were invaluable to their learning and skill development. These sessions also allowed the lecturer to become very familiar with students' work. The personalised nature of students' final reflections made it difficult to cheat, as students needed to participate to be able to reflect deeply.

6. Limitations and Conclusion

The authentic assessment framework proposed in this paper can transfer across academic disciplines, however, it will only be viable where assessment types involve industry interaction. Student reflections continue to be analysed and feedback sought to further probe student views on the experience and improve practice. The framework developed in this study lays the foundations for the emergence of evidence-based approaches to authentic assessment design that foster academic integrity across multiple disciplines and will be a useful tool to offset assessment disruption. This paper provides evidence to support the claim that incorporating authenticity and key theoretical perspectives into assessment design provides a potential solution to the issue of assessing students in a new ChatGPT landscape.

Acknowledgements and Conflicts of interest

No funding or competing interests.

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Remote Assessment in Higher Education: Insights from Southern Europe

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Abstract

This research focuses on remote learning in STEM fields, emphasizing challenges in online education in HEI's, particularly those posed by disruptive technologies, including Generative Artificial Intelligence. Using qualitative methodology, semi-structured interviews with experts in Southern Europe (Spain, Italy, Portugal) will provide insights into regional variations. The research comprehensively examines STEM learning, exploring challenges and adaptations. It extends its focus to the future evaluation of STEM education in remote settings, anticipating long-term impacts. Emphasizing the critical role of understanding teaching assessments in higher education modernization, the project contributes valuable data to inform educational evolution. Additionally, the research addresses gender bias in STEM degrees, fostering diversity and equal participation. By delving into implications for future evaluations and tackling gender bias, the study aims to enrich academic knowledge and improve practical aspects of STEM education, promoting inclusivity and equity in evaluating student performance.

Keywords: *Remote assessment; Technology; future of Higher Education Institutions (HEIs); STEM; gender bias.*

1. Introduction

In the rapidly evolving landscape of higher education, the integration of remote learning, especially in the STEM fields, has become a pivotal area of exploration. This research directs its attention towards the challenges inherent in online education within Higher Education Institutions (HEIs), with a special focus on the disruptive influences of emerging technologies, including Generative Artificial Intelligence. Employing a qualitative methodology, the study conducts semi-structured interviews with experts across Southern Europe, encompassing Spain, Italy, and Portugal, to unravel regional variations in the context of remote STEM learning. The research takes a holistic approach, thoroughly examining challenges and adaptations in STEM education while extending its gaze towards the prospective evaluation of STEM education in

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remote settings, anticipating long-term impacts on the educational landscape. Recognizing the paramount importance of understanding teaching assessments in the modernization of higher education, this project aims to contribute valuable data that informs the evolution of educational practices. Furthermore, the research addresses gender bias within STEM degrees, actively promoting diversity and equal participation. By delving into the implications for future evaluations and tackling gender bias, this study seeks to enrich academic knowledge and enhance the practical aspects of STEM education, ultimately fostering inclusivity and equity in the evaluation of student performance.

2. Literature review

The integration of online assessment tools within Higher Education Institutions for STEM subjects brings forth numerous benefits (Jordan, 2023), notably the provision of instant feedback and the enhancement of overall learning outcomes. Various forms of online assessments (Heil & Ifenthaler, 2023), ranging from computer-marked evaluations to peer assessments, have demonstrated significant potential in facilitating and augmenting online learning experiences (Skliarova et al., 2022). The unprecedented challenges posed by the COVID-19 pandemic have further underscored both the advantages and complexities associated with online education and assessment methodologies.

Previous studies offer a comprehensive examination of STEM education, focusing on challenges, adaptations, and future evaluations within remote settings. Beginning with an exploration of key challenges across research, policy, and practical implementation in STEM education (MacDonald et al., 2020) , there is a clear emphasis on the imperative need for effective approaches applicable across various educational levels. Transitioning to the TRAILS 2.0 project, Knowles et al. (2023) highlight its mission to address the educational needs of underserved rural students by implementing an integrated STEM curriculum. This initiative not only emphasizes authentic learning experiences but also establishes a community of practice. Also, Teo (2019) suggest the critical importance of evaluating STEM education in remote settings, concurrently reflecting on the dynamic evolution of STEM education particularly in Singapore.

Gender bias significantly contributes to the gender disparity in STEM fields, affecting various aspects of academia and hiring practices (Moss-Racusin et al., 2012). A study indicates that faculty teaching face-to-face or hybrid classes receive higher scores compared to online instructors, exacerbating gender gaps in STEM disciplines. Disparities in online and traditional STEM learning further reveal that while female students outperform males in traditional courses, they slightly lag behind in online settings (Reuben et al., 2014). STEM hiring practices, influenced by implicit gender bias, show in-group favoritism by male managers, perpetuating gender imbalances. To address these issues, embracing gender-blindness in STEM hiring is proposed as a means to diminish stereotyping and promote inclusivity. Both implicit and explicit

gender biases are acknowledged, emphasizing the need for comprehensive strategies to foster diversity and inclusion in STEM fields and overcome the multifaceted challenges hindering equal representation (Knezz et al., 2022).

3. Method

3.1. Sample

Semi-structured interviews with experts from Higher Education Institutions (HEIs) and assessment were conducted, employing a suitable approach for understanding the perspectives of academics and HEI managers. The qualitative data collection was performed from April 2023 to October 2023, during which a total of 35 interviews were carried out. It is important to note that these interviews were recorded and subsequently transcribed, ensuring accuracy and facilitating a thorough analysis of the gathered information. This additional step enhances the reliability of the data and provides a valuable resource for in-depth examination and interpretation.

The interview structure, in terms of the questions posed, was as follows: 1) How do you imagine the university of the future?; 2) How will the students of the future differ from those of today?; 3) How do you think that online / remote assessment methodologies can affect learning practices differently depending on the gender? … on the studies typology? Will it be different in stem studies from the rest?

3.2. Gioia Method

The qualitative research was conducted using an adapted version of the Gioia Methodology (Gioia et al., 2012), which was essential for ensuring precise interpretive analysis and a comprehensive presentation of the research findings. Following the Gioia methodology, the research process encompassed study design, involving a thorough definition of the research question and a literature review. Subsequent steps included data collection, followed by a shift to data analysis. The analysis involved a series of steps, starting with the initial coding of information extracted from interviews. A nuanced understanding of first-order themes then led to their organization into second-order codes. Finally, the process included assembling terms and linking second-order codes into aggregate dimensions, creating a comprehensive framework for interpreting the research outcomes.

4. Results

In the evolving landscape of education, institutions are becoming more mission-driven, with a focus on tackling global challenges and providing meaningful experiences for students. This shift entails a differentiation from traditional models, with a greater emphasis on

internationalization, multiculturalism, and addressing societal issues. The role of universities in addressing environmental and social challenges is expected to evolve, spurred by the transformation from traditional classroom teaching to digital formats accelerated by the pandemic. A blended approach, incorporating virtual reality and user-friendly software, is becoming increasingly important. Looking ahead, disruptive technologies like artificial intelligence and virtual reality are poised to significantly impact education in the next 20 years. The focus will shift towards upskilling and reskilling competencies, with universities serving as

Table 1. Aggregate dimensions of Question 1: How do you imagine the university of the future?
Source: Own Elaboration

1st Order Concepts	**2nd Order Themes**	**Aggregate Dimensions**
Mission driven; Pursuing global challenges; Meaningful for students; They kept a focus on some specific missions that differentiate this institution from other institutions that existed and disappeared; More international; More focused on solving global/societal problems; More multicultural. The role of universities in addressing environmental and social challenges will evolve.	Mission Driven	Mission-driven institutions
	Global and Social Challenges	
	Multicultural	
Transformation from traditional classroom teaching to digital formats, accelerated by the pandemic. Importance of a blended approach. Virtually reality in education and the need for user-friendly software.Transformations driven by these changes and innovations. In 20 years, disruptive technologies like artificial intelligence, the metaverse, and virtual reality will impact education.	Transformation and Innovation	Technology & Innovation
	Blended Approach	
	Disruptive Technologies	
Focused on upskilling and reskilling competences; it will be a learners' competencies center; expertise in more collaborative environments; will be more focused on the skills and learning outcomes of the students; We will have a lifelong and skills-based higher education. Regarding assessment, he values critical thinking over; Importance of teaching students to discern credible information from falsehoods in the digital age.	Upskilling and Reskilling Competences	Competence Development
	Critical Thinking	
Importance to promote active learning, where students learn how to look for knowledge and how to use that knowledge Universities will begin to explore micro-credentialing institutions.. The activities will be focused on solving real world problems, solving exercises, completing group tasks, teamwork a lot, taking quizzes, executing projects, analyzing scenarios and case studies, and using the specific software's and applications that they will need in the real world; Involve flipped classrooms, gamification, and adaptive learning.	Active Learning	Future teaching methodologies
	Micro-Credentialing	
	Real-World Application	

Table 2: Aggregate dimensions of Question 2: How will the students of the future differ from those of today? Source: Own Elaboration

1st Order Concepts	2nd Order Themes	Aggregate Dimensions
Given the more flexible models, there will more variety / diversity of students. Diversity means some students may prefer traditional approaches while others seek flexibility and guidance; future students as a globally diverse and collaborative generation, seeking personalized and engaging learning experiences aligned with their passions.	Flexibility	Diversity and Flexibility
	Diversity, variety	
They are supposed to be more autonomous and more engaged in their learning process (though the research does not back that up); More autonomous, more responsible, more involved in their learning path, more engaged learners; they will be more engaged, since universities will be more engaged environments; they will me more involved in research. They will to asked to think critically.	Student Engagement	Autonomy and Engagement
	Autonomy	
The dimensions of citizenship and civic virtues but also political and social engagement will be part of student's path; Additionally, global citizenship and addressing critical global issues like climate change and human rights will be emphasized in education.	Global Citizenship	Global Citizenship and Social Responsibility
	Social Changes involvement	
Learning materials will shift from traditional books to multimedia information systems. evolving nature of future students who grew up with mobile devices. They excel in quickly gathering and synthesizing information from various sources, but may struggle with sustained deep thinking modern students are skilled at navigating vast online information sources; Critical analysis skills, especially in the face of emerging technologies like artificial intelligence, which can provide results but require careful evaluation.	Technology driven	Technological & Critical thinking
	Critical thinking competence	

centers for lifelong learning. Assessment will prioritize critical thinking and digital literacy skills, preparing students to discern credible information in the digital age. Hybrid and blended models of instruction will continue to grow, with an emphasis on active learning, problem-solving, teamwork, and the integration of emerging technologies like mobile learning and artificial intelligence.

In the changing landscape of education, the rise of flexible learning models will bring about a more diverse student body. This diversity will encompass varying preferences, with some students leaning towards traditional approaches while others seek personalized, engaging learning experiences aligned with their passions. Future students are expected to be globally diverse and collaborative, though research has yet to fully support assumptions of increased autonomy and engagement. Nevertheless, students will likely take on greater responsibility for their learning paths, engaging in critical thinking and research. Education will also emphasize

citizenship, civic virtues, and global issues like climate change and human rights. Learning materials will shift towards multimedia information systems, reflecting students' adeptness with technology. However, challenges remain in developing critical analysis skills, particularly in evaluating emerging technologies like artificial intelligence.

Table 3: Aggregate dimensions of Question 3: How will online / remote assessment methodologies affect learning practices in STEM, differently depending on…Gender? Studies typology? Source: Own elaboration

1st Order Concepts	2nd Order Themes	Aggregate Dimensions
Gender disparities in course choices arise earlier in education. To address these disparities, intervention is needed at the primary school level.	Gender participation	Gender issues
COVID forced rapid adaptability, demonstrating that professionals can adjust to remote teaching. Faculty have learned during the pandemic and can continue to invest in further development.	Lecturers' adaptation	
We will have more girls on STEM studies because with technologies, with our online environments, we could act in three levels that literature find out important: reducing gender bias; creating welcoming environments to promote communication between girls and communication with women that already work at STEM areas; integrating socially relevant projects (which would bring more girls to STEM).	Technological Gender Gap	
The greatest transformation probably will be in non-STEM areas. We'll probably see more emphasis on the digital dimension in non-STEM areas and a greater emphasis on non-digital dimensions or non-technological dimensions in science and technology. Students seek a balance, recognizing the limits of online learning and the need for hands-on experiences.	Early technology introduction	Study typology: STEM application advantage
	Field-specific effectivenes	
The assessment will not be so much dependent on whether teaching and learning is remote or not. When we talk about different forms of assessment as learning and for learning, peers will be a relevant part in assessment as well. Reservations about the effectiveness of online assessment method	Pedagogical relevance	
	Inclusive assessment opportunities	

According to our results, remote assessment methodologies could influence gendered learning differently due to potential disparities in access to technology, participation in online activities, and learning preferences. For example, studies have shown that women may face additional challenges in technological environments due to gender stereotypes and gaps in technological confidence. Educators should consider strategies to foster equitable participation and mitigate any gender bias in online assessments.

It is likely that online assessment methodologies will have a different impact on STEM studies compared to other fields. In STEM, where problem-solving and practical application are fundamental, online assessments can more easily be adapted to assess mastery of technical skills and performance-based problem-solving. However, it may be more challenging to evaluate qualitative or conceptual aspects of learning in STEM, such as deep theoretical understanding. Therefore, online/remote assessment strategies in STEM may focus more on the practical application of concepts and problem-solving, while in other fields, they may emphasize critical reflection and written communication.

5. Discussion and implications

This research sheds light on the challenges and adaptations in remote learning within STEM fields, particularly in higher education institutions (HEIs). By focusing on disruptive technologies, the study delves into the complexities of online education, . Results examines the landscape of STEM learning in remote settings, anticipating long-term impacts on education. A crucial aspect highlighted is the need for a nuanced understanding of teaching assessments, which plays a critical role in the modernization of higher education. Additionally, the project addresses gender bias in STEM degrees, aiming to foster diversity and equal participation. By exploring implications for future evaluations and addressing gender bias, this study contributes to academic knowledge and practical improvements in STEM education. It advocates for inclusivity and equity in evaluating student performance, paving the way for a more inclusive and equitable educational landscape. Looking ahead, it is crucial for universities to become lifelong learning centers, focused on the development of competencies and skills relevant to the constantly evolving job market. Lastly, student assessment should prioritize skills such as critical thinking and digital literacy, preparing them to discern credible information in the digital age. The need for ongoing adaptation and transformation in higher education is underscored to address the evolving demands of society and to equip students for success in an increasingly complex and technologically advanced world

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Academic Integrity differences across faculties: A student survey

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Abstract

In this work, we report on an Academic Integrity-focussed survey conducted in late 2023 at Munster Technological University. We investigated possible correlations between respondents' discipline areas and their experiences of academic integrity. We found that more students of the university's Faculty of Engineering and Science report familiarity with relevant institutional policies than do their peers in Business and Humanities Faculty. Reported frequency of in-lecture discussions about academic integrity also differed, with more frequent discussions on aspects of academic integrity by lecturers in the former faculty than in the latter. While the kinds of academic misconduct engaged in and witnessed by students of both faculties also vary, the use of GenAI was the most frequently observed type of misconduct by students in both faculties. We also found a similar majority of students from both faculties would like a reporting mechanism, but would not report academic misconduct by another student.

Keywords: *Academic integrity; Student survey; Generative AI.*

1. Introduction

The present study was conducted at Munster Technological University (MTU) which spans six campuses across counties Cork and Kerry, Ireland. In 2023, in response to evolving sector-wide academic integrity concerns, a group of MTU staff initiated a project entitled "Academic Integrity: Supporting Staff-Student Courageous Conversations". The ultimate objective of the project is to support the embedding of the practice of "courageous conversations" (Murdoch & House, 2023) in the university. These are initial conversations between academics and students who may have breached academic integrity and are intended to act as a holistic precursor to or substitute for formal academic misconduct investigations.

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An essential first step in our project was to establish students' perceptions of academic integrity and misconduct, as well as their understanding and use of GenAI. As such, a survey was designed and administered to selected student cohorts across MTU. In line with a range of historical studies of academic integrity and misconduct (e.g. Bowers, 1967), the first part of our survey took account of a range of demographic factors and aimed at weighing the impact of intrinsic and extrinsic influences on students' beliefs about and practice in relation to academic integrity. Like surveys administered by McCabe (2005) and Christensen Hughes & McCabe (2006), it took a broad view of academic integrity and investigated multiples modes of academic misconduct.

The possible reshaping of core academic functions including research, teaching, and administration in light of the increasing embeddedness of GenAI has been evaluated by Barros et al. (2023). However, an increasing body of research on the interface of GenAI and learning has raised questions regarding the ethics of GenAI in higher education. For instance, Healy (2023) has pointed to the social justice and equity implications of GenAI use by students to produce unoriginal work and by academics to detect this plagiarism (Healy, 2023). Conversely, Sullivan et al. (2023) underscore its potential to promote academic success among students from traditionally under-represented cohorts. GenAI, therefore, could be a decisive factor in fostering the culture of equity in academic and research integrity outlined by Eaton (2022). However, as Bearman et al. (2024) note, facilitating students to develop critical judgement in relation to GenAI-produced content will be essential.

This emerging research focus on student attitudes towards academic integrity and misconduct and towards the use of GenAI is a research priority to which we aim to contribute with this study. As noted above, it is hoped that by expanding understanding of higher education students' perceptions of integrity and its dialogue with GenAI, meaningful policy and pedagogical responses will be formulated. In this, we build on recent studies such as Johnston et al.'s (2023) survey at the University of Liverpool, to which 54.1% of student respondents indicated support for the use of tools such as Grammarly, whereas 70.4% expressed ambivalence about using generative tools such as ChatGPT to compose assessed writing. In another recent large-scale study, Malmström et al. (2023) surveyed almost 6,000 students from across Swedish universities about their use of and attitudes towards GenAI for learning purposes. Similarly to Johnston et al. (2023), they found most student respondents to hold positive views about the technology and its possible impact on their learning. Building upon the findings of these key papers, the second part of our survey sought to ascertain students' views of GenAI and possible links to academic misconduct.

This paper presents our findings regarding possible correlations between our respondents' field of study and their perceptions and experiences of academic integrity and academic misconduct. To elucidate these, we will focus on students' self-reported awareness of the university's academic integrity policies and the sources of this knowledge, where relevant; on their

knowledge of academic integrity breaches committed both by themselves and by peers; and on their personal stances on academic integrity. In all three cases, we aim to uncover any notable differences between or convergences of responses from students of two faculties: the Faculty of Business and Humanities and the Faculty of Engineering and Science.

2. Materials and Methods

2.1. Design and deployment of survey

This 22-question survey was designed and deployed during semester 1 of the academic year 2023-2024. Its purpose was to establish students' opinions of and familiarity with academic integrity, particularly with respect to the emergence of recent Artificial Intelligence (AI) tools. It was deployed across specific cohorts of students at the University and targeted students from a range of academic disciplines and stages. Overall, the survey was split into three sections: the first recorded specific background information from the students, the second section recorded general information regarding general familiarity with and experience of academic integrity, while the third section focused on Artificial Intelligence. The survey contained a variety of questions (both quantitative and qualitative) and was operated under approval from the university's Research Ethics Committee (MTU-HREC-MR-23-024-A).

2.2. Impact of field of study on students' knowledge of academic integrity

Feedback was sought from students across the two campuses in the University. The majority of respondents (547 out of 608) were from the faculties of Business and Humanities (Cork campus) and the Faculty of Engineering and Science (Cork campus), therefore in this paper we present only the results from these two faculties. Specific information such as age, study area, stage of award, gender, and competence in English was sought. Related information was then recorded regarding each student's familiarity with academic integrity, associated University policies and supports provided around assessment literacy. Finally, this related information was analysed from the perspective of study area to determine any associations and correlations.

2.3. Impact of field of study on students' knowledge of breaches of academic integrity

Subsequent responses were sought which set out to evaluate whether students in specific disciplines were more likely to witness or admit to breaches of academic integrity. Using a Likert scale, these questions specifically elicited information on students' experiences with plagiarism, inappropriate sharing, fabrication, falsification, contract cheating, and GenAI.

2.4. Impact of field of study on students' opinions on academic integrity

This part of the study set out to evaluate whether students in different disciplines had similar or conflicting views on the reporting of academic integrity breaches, whether reporting tools should be made available and what types of penalties should be in place for students found to be guilty of breaches.

3. Results

The survey was available to students for four weeks, between weeks 7 and 10 of semester 1. Since the university has a significant number of modules that are assessed continuously, the survey was released such that many students would already have completed at least some assessments at the time of taking the survey. The timing also increased the likelihood that even first-year students would have had a chance to experience aspects of academic integrity within the university before submitting their responses to the survey.

The details of the respondents' faculty affiliation are given in Table 1, with relatively similar gender and degree-stage breakdowns observed between faculties. Slight differences in terms of gender distribution are noted, however. The number of students in each faculty was approximately 2,000, giving a response rate of over 10%. We also note that 34% of Business and Humanities respondents would have had at least one Covid-19-affected semester, as would 27% of participants from Engineering and Science.

Table 1. Breakdown of respondents according to faculty.

Faculty	# Student Responses	%	Male – Female %	Stage of Award: 1/2/3/4/PG %
Business and Humanities	283	51.7	48– 51	45/19/13/21/02
Science and Engineering	264	48.3	62 – 36	38/25/16/11/09

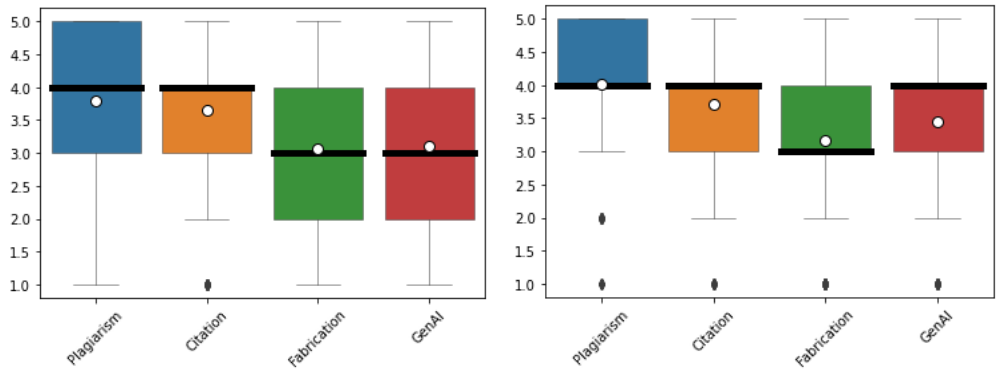
3.1. Impact of field of study on students' knowledge of academic integrity

We first investigated students' awareness of academic integrity policies in the university. The results showed that there was a significant difference between Engineering and Science students and Business and Humanities students. 57% of the former stated they were informed of existing relevant academic integrity policies, compared to just 34% of the latter cohort.

Of the 163 Engineering and Science students who stated they were informed of academic integrity policies, nearly 75% indicated that lecturers were one of their sources of information,

compared to just over 60% for the 118 Business and Humanities students. On the other hand, more Business and Humanities students than Engineering and Science students used the university's online resources for information (45% vs 37%).

To interrogate the nature of the information provided by lecturers, we then asked students about the different aspects of academic integrity that were outlined in class when a lecturer discussed it, and about the frequency of such discussions across their lecturers. Boxplots of the results per category are given in Figures 1 (a) and (b) below for the two different faculties. A score of 5 for a category meant that the student felt it was discussed "*very often*" by their lecturers, while a score of 1 maps to "*never*". White dots indicate the average score, and thick black lines the median.



a) Business and Humanities *b) Engineering and Science*

Figure 1. Academic integrity categories discussed by lecturer.

Plagiarism was by far the most frequently discussed aspect by lecturers in both faculties, with an upper quartile of "*very often*", and a lower quartile of *"often"* in the faculty of Engineering and Science. It is interesting that the use of GenAI was discussed much less frequently, particularly in the Faculty of Business and Humanities. We also note that there was more frequent discussion of academic integrity in general by lecturers in the faculty of Engineering and Science, mirroring the previous findings.

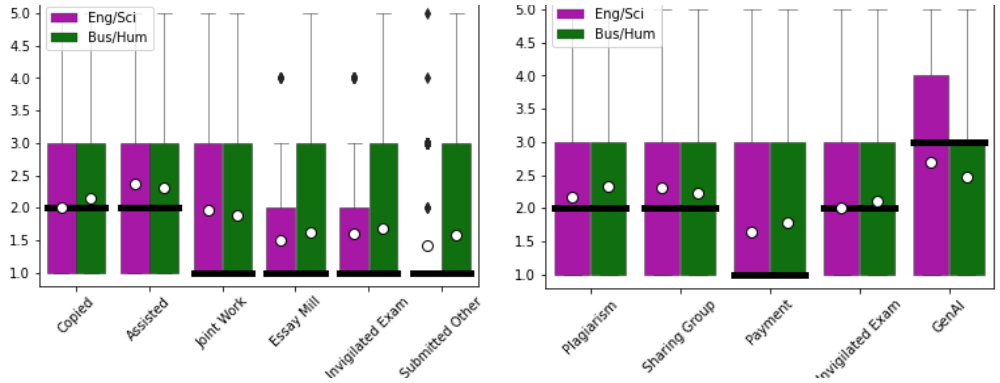
3.2. Impact of field of study on students' knowledge of breaches of academic integrity

Students were asked about their participation in different aspects of academic misconduct. In particular, they were asked if they had copied from a source without acknowledgement; assisted another student with a submission; worked jointly on an assignment without permission; used an essay mill (contract cheating); cheated in an invigilated exam; or submitted someone else's work as their own. Respondents were then asked about their experience of witnessing academic

misconduct by other students, including payment to someone else for doing an assignment, and the use of GenAI for assignments.

Boxplots of the Likert score are given in Figure 2, with (a) giving results for cases where students stated the frequency with which they participated in a form of academic misconduct, and (b) giving results for cases where students stated the frequency with which they observed others participating in academic misconduct (with again 1 mapping to "*never*", and 5 mapping to "*very often*".

In terms of participation, we note that there was more frequent participation in the final three categories (use of contract cheating, invigilated exams, submitting others' work) in the Faculty of Business and Humanities. Interestingly, in terms of observed behavior (Fig 2. (b)), this is somewhat contradicted with payment and invigilated exam both having more similar score distributions for the two faculties. Notwithstanding that, the greater participation in contract cheating and misconduct in invigilated exams may also speak to differences in appropriate assessment strategies between the two faculties.



a) Participated *b) Observed*

Figure 2. Academic misconduct: Participation and observation

The main takeaway is that GenAI is, as expected, the largest observed category of academic misconduct in both faculties, albeit that it is somewhat more frequently observed in the Faculty of Engineering and Science. This finding is of particular interest given that GenAI was one of the aspects of academic integrity least discussed by lecturers as shown previously in Figure 1.

3.3. Impact of field of study on students' opinions on academic integrity

Students in different disciplines had nearly identical views across the three questions on reporting academic integrity breaches, and penalties for such breaches. Just over 10% of students said that they would report a fellow student for cheating, compared to nearly 60%

saying there should be a reporting tool. This suggests that the majority of students are not happy about other students cheating, but at the same time do not wish to report breaches themselves.

4. Discussion and Conclusions

While the self-reported student responses suggest that students in the faculty of Engineering and Science were more informed about the university's academic integrity policies than their peers in the Business and Humanities Faculty, this gap could potentially be a function of different assessment strategies in the two faculties. For instance, where modules are preponderantly assessed by invigilated examination, in-lecture discussion of plagiarism and academic integrity may occur less frequently. Conversely, modules which are assessed through project-based assignments may prove more obvious venues for discussions of academic integrity and of the university's policies regarding, for example, plagiarism. It should be noted, however, that slight differences in the gender profiles of respondents from each faculty may have some impact on this difference, as might, for instance, the higher proportion of first-year undergraduate respondents from Business and Humanities and the higher proportion of postgraduate respondents from the Engineering and Science faculty.

However, notwithstanding the above possibility, we note that GenAI was the category with largest score for frequency of observation in both faculties. This may result from the ubiquity of the technology or from its potential application to tasks outside of formal, summative assessment. Furthermore, while plagiarism was the aspect of academic integrity most frequently discussed by lecturers in the faculties, GenAI was the most frequently observed type of breach of academic integrity by fellow students. This clearly suggests that lecturers need to focus more on acceptable and unacceptable uses of GenAI within assessment work.

Our findings suggest that there is scope for further research on possible correlations between disciplinary cultures, typical disciplinary assessment strategies, and instances of academic misconduct. It also highlights potential for the embedding of academic integrity resources and supports within module delivery, perhaps especially those requiring students to produce work independently over extended periods. It points to the importance of further investigation of students' beliefs about the learning opportunities presented by AI but also of the best means by which students and staff can address and manage dissatisfaction caused by increasing use of AI in assignment completion.

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Empowering Undergraduates: An Examination of Online Self-Regulated Learning Skills in Higher Education

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Abstract

This study sought to explore the students' self-regulated learning skills (SRLS) in online higher education within the scope of goal setting, environment structuring, task strategies, time management, help-seeking, and self-regulation in addition to the investigation of the relationship between the demographic variables and their SRLS. The sample of the study comprised 832 undergraduate students taking online courses in different universities in Turkey. Adopted as a quantitative design including the analyses of independent sample t tests and ANOVA, this study identified significant differences in SRLS across the subscales. The findings indicated that students generally exhibited moderate to high competence in most SRLS, and some significant differences were detected in SRLS for gender, age, year of education, and faculty, but not for university type. The results provide insights into how demographic factors influence students' SRLS in online higher education by highlighting areas for targeted educational support and intervention.

Keywords: *Self-regulated learning skills; higher education; online learning; demographics*

1. Introduction

Due to a rapid transition to digital learning environments, higher education institutions (HEIs) have been confronted with the challenges of online learning in the post-pandemic era (Crawford et al., 2020). In contrast to the benefits associated with online learning such as flexibility and remote instruction, conducting online courses efficiently requires active engagement and student autonomy (Nerantzi, 2020; Wong et al., 2019). It becomes evident that providing students the ability to take control of their own learning, self-regulation is the key to success in online learning (Xu et al., 2022). Consequently, understanding the functional role of self-regulation can assist HEIs design techniques that support learners' online learning experiences in a more productive and engaging way.

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Defined as the capacity to organize and manage learning activities within an online setting, online self-regulated learning is significant for undergraduate students enrolled in HEIs because it fosters critical thinking, autonomy, personalized learning, responsibility, and other skills necessary for success in professional as well as academic contexts (Jansen et al., 2020; Jin et al., 2023; Kizilcec et al., 2017). According to Perez-Alvarez et al. (2020), students can strategically engage in course materials and activities more precisely in line with their self-regulatory characteristics. Adopting self-regulation within the online learning environment provides students with the skills they need to navigate the complexities of digital education and succeed in their selected career paths.

Students without self-regulatory learning skills may misinterpret the independence offered by online learning and potentially have difficulties in completing expected learning tasks in online courses (Barnard et al., 2009). However, enhancing skills such as goal setting, time management, and environment structuring promotes students' self-regulation in learning (Du et al., 2023; Rodrigues et al., 2019). Therefore, this study aimed to explore the students' self-regulated learning skills (SRLS) and their connection with demographic variables in online higher education within the scope of the constructs including goal setting, environment structuring, task strategies, time management, help-seeking, and self-regulation. The results of this research contribute to gaining valuable insights for educational practices and interventions, and ultimately enhancing the effectiveness of online learning experiences for diverse student populations for educators and policymakers in HEIs aiming to optimize the online learning experience and promote student success.

2. Methods

2.1. Research Design

Employed a quantitative approach, this study sought to explore the students' SRLS in online higher education including the subscales of goal setting, environment structuring, task strategies, time management, help-seeking, and self-regulation in addition to the investigation of the relationship between the demographic variables and their SRLS. Accordingly, the following research questions (RQs) were examined:

RQ1: What is the level of students' SRLS in online higher education?
RQ2: Do students' SRLS vary by demographic variables?

2.2. Participants

The sample of the study comprised 832 undergraduate students enrolled in online courses at different universities in Turkey. The demographics of the participants are presented in Table 1.

Table 1. Demographics of the sample

Gender	**n**	**%**	**Faculty of …**	**N**	**%**
Male	222	26.68	Education	351	42.19
Female	610	73.32	Health Sciences	157	18.87
Age			Science and Letters	73	8.77
$\bar{X} \pm SD$	22.240 ± 3.931		Engineering	68	8.17
University Type	**n**	**%**	Economics and Administrative Sciences	56	6.73
State	783	94.11	Theology	43	5.17
Foundation	49	5.89	Law	16	1.92
Year of Education	**n**	**%**	Fine Arts	14	1.68
1st year	272	32.69	Tourism	13	1.56
2nd year	214	25.72	Management	12	1.44
3rd year	143	17.19	Agriculture	10	1.20
4th year	158	18.99	Communication	10	1.20
5th year +	45	5.41	Architecture	9	1.08
Total	**832**	**100.00**	**Total**	**832**	**100.00**

As listed in Table 1, 73.32% of the participants were female (n=610), and 26.68% of them were male (n=222). The average age was calculated as 22.240 ± 3.931. In terms of university type, the majority of the students were studying at state universities (94.11%; n=783) while the remaining ones were studying at foundation universities (5.89%; n=49). When the distribution of the year of education was analyzed, first-year students constituted the largest group with 32.69% (n=272), second-year students were represented by 25.72% (n=214), third-year students by 17.19% (n=143), fourth-year students by 18.99% (n=158), fifth-year-and-above students by 5.41% (n=45). Regardng faculty preferences, the majority of the participants were studying at the faculty of education (42.19%; n=351) and at the faculty of health sciences (18.87%; n=157) whereas the remaining percentage of the participating faculties was below 9%.

2.3. Research Instrument

The questionnaire conducted in the study consisted of two parts: demographics and "Online Self-Regulated Learning Scale" (O-SRL-S) developed by Barnard et al. (2009) and adapted to Turkish language and culture by Korkmaz and Kaya (2012) with a five-point Likert scale. In the first part, the students were asked about their demographic background including gender, age, university type, year of education, and faculty. Second, the adapted version of O-SRL-S was configured with its 24 items including the subscales of goal setting, environment structuring, task strategies, time management, help-seeking, and self-regulation. Concerning the scale normality and reliability, the kurtosis and skewness values were calculated along with Cronbach's Alpha coefficients of the subscales of self-regulation skills. As a result, the kurtosis and skewness values were found between the limit values of the assumption of normal distribution required for parametric tests (-2 and +2) (George & Mallery, 2010). Regarding Cronbach's Alpha coefficients, the results obtained from the collected data were identified as

greater than 0.700 for all the subscales ranging from 0.773 to 0.819 (Bonett, 2010). Evidently, the normality and reliability were confirmed for O-SRL-S.

2.4. Data Collection and Analysis

Before the data was collected, the Board of Ethics for Human Studies in Social Sciences and Humanities granted permission for this study's compliance with scientific and ethical standards. Based on key demographic and academic variables in the universe, the convenience sampling technique was adopted in the determination of the participants to eliminate potential biases. After the questionnaire form was configured on an e-platform and shared with more than 1000 undergraduate students across the country. The respondents approved their consent for participation in the research, and 832 valid responses were used for the analyses.

After the collection of the data, the normality assumption was, firstly, checked to determine which type of analyses would be applied to the data. Afterward, the reliability was tested for the measurement tool. Then, independent sample t tests were used for the variables with two groups such as gender, age, and university type, and ANOVA was used for the variables with more than two groups such as faculty and year of education. Tukey post-hoc test was conducted to determine the source of the difference between the groups determined as a result of ANOVA. All the analyses were performed by using SPSS for Windows v27.0 package program.

3. Findings

3.1. Self-Regulated Learning Skills in Online Higher Education

Descriptive analyses were carried out to identify the level of students' self-regulated learning skills (SRLS) in online higher education along with the subscales. (RQ1) Accordingly, the overall results revealed that students showed moderate to high levels of competence ($\bar{X}$=3.555; SD=0.712). Goal setting indicated students' competence with a mean score of 3.636±0.810 whereas environment structuring with a score of 4.104±0.730 demonstrated a higher competence in this area. Task strategies with a score of 3.309±0.934 depicted an average performance similar to the score of 3.381±1.001 for time management with a significant variation in SD. Regarding help-seeking and self-regulation, the participants' competence was average (3.492±0.914; 3.410±0.956), which requires improvement in these areas.

3.2. Variability of Self-Regulated Learning Skills by Demographic Variables

Independent sample t test and ANOVA were performed to investigate the relationship between students' SRLS and demographic variables (RQ2). The variability of SRLS by gender was investigated through the independent sample t test, and the results are presented in Table 2. Accordingly, the subscales of goal setting and environment structuring differed according to

gender ($p<0.05$), which indicates that women's goal setting and environment structuring in SRLS were higher than men's.

Table 2. Variability of self-regulated learning skills by gender

SRLS	Male (n=222)	Female (n=610)	t (p)
Goal Setting	3.452 ± 0.804	3.702 ± 0.803	-3.972 (0.000)
Environment Structuring	3.932 ± 0.803	4.166 ± 0.691	-3.851 (0.000)
Task Strategies	3.239 ± 0.901	3.335 ± 0.945	-1.319 (0.187)
Time Management	3.269 ± 0.993	3.422 ± 1.002	-1.954 (0.051)
Help-Seeking	3.429 ± 0.898	3.516 ± 0.919	-1.208 (0.227)
Self-Regulation	3.341 ± 0.924	3.435 ± 0.967	-1.249 (0.212)

The results of the independent sample t test used to examine the variability in students' SRLS by age are demonstrated in Table 3. Before the analysis, two groups were formed by accepting the average age value as the limit value. It was revealed that there was a significant difference in the subscale of goal setting by age ($p<0.05$). Consequently, the goal setting in SRLS for the students aged 22 and above was found higher than those of students under the age of 22, and no significant difference was detected for the other subscales by age.

Table 3. Variability of self-regulated learning skills by age

SRLS	≥ 22.37 (n=245)	< 22.37 (n=587)	t (p)
Goal Setting	3.728 ± 0.807	3.597 ± 0.860	2.134 (0.033)
Environment Structuring	4.142 ± 0.720	4.088 ± 0.867	0.967 (0.334)
Task Strategies	3.381 ± 0.924	3.280 ± 1.080	1.420 (0.156)
Time Management	3.444 ± 0.999	3.355 ± 1.040	1.164 (0.245)
Help-Seeking	3.483 ± 0.903	3.497 ± 1.076	-0.200 (0.841)
Self-Regulation	3.374 ± 0.948	3.425 ± 1.078	-0.658 (0.511)

Regarding the findings of the independent sample t test used to examine the variability of students' SRLS between the students at public and foundation universities, as indicated in Table 4, no statistically significant difference was found between public and foundation university students in the subscales for SRLS.

Table 4. Variability of self-regulated learning skills by type of university

SRLS	State (n=783)	Foundation (n=49)	t (p)
Goal Setting	3.639 ± 0.807	3.580 ± 0.860	0.498 (0.618)
Environment Structuring	4.112 ± 0.720	3.980 ± 0.867	1.230 (0.219)
Task Strategies	3.320 ± 0.924	3.148 ± 1.080	1.249 (0.212)
Time Management	3.382 ± 0.999	3.361 ± 1.040	0.147 (0.883)
Help-Seeking	3.492 ± 0.903	3.505 ± 1.076	-0.085 (0.932)
Self-Regulation	3.417 ± 0.948	3.291 ± 1.078	0.898 (0.369)

The ANOVA results to examine the variability of students' SRLS among the students at different years of education revealed that only the subscale of help-seeking in SRLS differed by

year of education (p=0.028<0.05). As a result of the Tukey post-hoc test performed to determine the source of this difference, it was observed that the help-seeking skills of students in their 4th year of education were higher than those in their 1st year of education as presented in Table 5.

Table 5. Variability of self-regulated learning skills by year of education

Year of Education	n	Goal Setting	Environment Structuring	Task Strategies	Time Management	Help-Seeking	Self-Regulation
1st year	272	3.565±0.840	4.099±0.756	3.276±0.937	3.305±0.999	3.393±0.947	3.331±0.945
2nd year	214	3.649±0.836	4.043±0.793	3.308±0.977	3.419±1.003	3.465±0.940	3.502±0.976
3rd year	143	3.604±0.745	4.184±0.671	3.247±0.889	3.326±1.019	3.507±0.829	3.343±0.944
4th year	158	3.703±0.779	4.130±0.632	3.407±0.896	3.466±1.011	3.690±0.839	3.476±0.919
5th year +	45	3.867±0.779	4.078±0.761	3.378±0.981	3.533±0.906	3.483±1.015	3.428±1.075
F (p)		1.779 (0.131)	0.862 (0.486)	0.738 (0.566)	1.121 (0.345)	2.725 (0.028)	1.337 (0.254)
Difference						1-4	

According to the ANOVA findings used to investigate the variability of students' SRLS among the students studying at different faculties, it was detected that SRLS differed by faculty, and p values for all the subscales were calculated to less than 0.05. As a result, the Tukey post-hoc test was performed to determine the source of this difference as presented in Table 6.

Table 6. Variability of self-regulated learning skills by faculty

Faculty*	n	Goal Setting	Environment Structuring	Task Strategies	Time Management	Help-Seeking	Self-Regulation
F1	351	3.720±0.776	4.131±0.666	3.375±0.909	3.401±1.005	3.657±0.804	3.531±0.907
F2	157	3.585±0.807	4.030±0.784	3.264±0.918	3.295±0.962	3.430±0.908	3.239±0.980
F3	73	3.899±0.708	4.301±0.644	3.541±0.991	3.689±0.980	3.634±0.876	3.538±1.009
F4	68	3.347±0.806	3.923±0.764	3.085±0.867	3.172±0.945	3.147±0.911	3.232±0.939
F5	56	3.629±0.885	4.286±0.683	3.237±0.983	3.524±0.984	3.384±1.069	3.433±0.895
F6	127	3.472±0.861	4.024±0.836	3.205±0.970	3.304±1.054	3.266±1.049	3.297±1.019
F(p)		5.307 (0.000)	3.373 (0.005)	2.513 (0.029)	2.641 (0.022)	6.668 (0.000)	3.274 (0.006)
Difference		F1-F4; F1-F6 F3-F4; F3-F6	F3-F4	F3-F4	F3-F4	F1-F4; F1-F6 F3-F4	F1-F2

*F1: Faculty of Education, F2: Faculty of Health Sciences, F3: Faculty of Science and Letters,
F4: Faculty of Engineering, F5: Faculty of Economics and Administrative Sciences, F6: Other Faculties

As observed in Table 6, several significant differences were found in goal setting between F1 and F4, F1 and F6, and F3 and F6 (F=5.307; p=0.000). It was also detected that statistically significant differences were detected between F3 and F4 for environment structuring (F=3.373; p=0.005), task strategies (F=2.513; p=0.029), and time management (F=2.641; p=0.022). However, the largest differences in help-seeking were identified for F1 and F4, F1 and F6, and F3 and F4 (F=6.668; p=0.000) whereas some significant differences were found in self-regulation between F1 and F2 (F=3.274; p=0.006).

4. Discussion

The findings of the descriptive analyses to assess students' SRLS in online higher education with various subscales indicated an overall moderate to high level of competence among students. Notably, students demonstrated significant competence in goal setting while their competence in environment structuring was even higher. However, task strategies, time management, help-seeking, and self-regulation demonstrated average performance, which can be identified as areas requiring improvement. Students can enhance their goal-setting skills by identifying learning gaps, engaging with online learning modules, and reviewing course details and learning tasks (Du et al., 2023). Environment structuring defined as "managing a set of characteristics in the learning environment" (Rodrigues et al., 2019, p. 53) suggests that students can better access the learning environment possibly due to their digital skills. On the other hand, effective task strategies, involving organizing learning assignments to accomplish objectives, necessitate quality interaction with online learning materials (Du et al., 2023; Kizilcec et al. 2017). Moreover, time management, the ability to complete the learning activities required for a course on time, can be challenging for undergraduate students in an online setting because of the time investment required in course activities (Perez-Alvarez et al., 2020). Help-seeking, defined as locating solutions to queries, can be enhanced through the establishment of course Q&A forums (Jansen et al., 2020). Perez-Alvarez et al. (2020) revealed that learners strategically interact more with the course activities and materials based on their self-regulation profile. Briefly, SRLS supports active participation and autonomy to succeed in online courses.

Accordingly, educators and practitioners can improve the areas identified with average performance, particularly in task strategies, time management, help-seeking, and self-regulation, with targeted interventions and support mechanisms. Providing time management tools, creating interactive course materials, and establishing active support systems like Q&A forums can contribute significantly to enhancing students' overall SRLS. Additionally, fostering a culture of self-reflection and continuous improvement among students can increase self-awareness with a proactive approach to addressing online learning challenges.

As for the variability of students' SRLS by demographic factors, gender disparities emerged in goal setting and environment structuring in favor of female students. Moreover, older students (>22 years) enrolled in online courses showed better goal-setting skills. No significant differences were found based on university type; nevertheless, significant variations in SRLS were evident across faculties and academic years, particularly in help-seeking skills, where fourth-year students excelled. Consistently, Li (2019) identified that students' demographic variables such as gender, age, year of study, and prior experience in online courses predicted goal setting and environment structuring within the realm of SRLS. Therefore, policymakers and educators should consider demographic factors in tailoring support mechanisms to enhance

specific aspects of students' SRLS to create a more effective and inclusive online learning environment.

Concerning the limitations of this study, a quantitative design was employed with statistical analyses, which may comprise the potential lack of depth and context in understanding the research topic. Moreover, external factors such as participants' socio-economic background and access to support services or instructional factors such as course design and online platforms were not included in the investigation of students' SRLS. For future research, longitudinal studies including multiple variables are recommended to track the development of SRLS over time, and qualitative inquiries to gain deeper insights into students' experiences and perceptions of online learning. Besides, intervention studies can contribute to the evaluation of the effectiveness of targeted support strategies in improving SRLS and academic outcomes.

5. Conclusion

This study examined the students' SRLS in online higher education with the subscales of goal setting, environment structuring, task strategies, time management, help-seeking, and self-regulation as well as the relationship between the demographic variables and their SRLS. The results identified the areas of improvement as task strategies, time management, help-seeking, and self-regulation. It was also revealed that demographic factors such as gender, age, year of education, and faculty had a significant relationship with students' SRLS. Policymakers, educators, and practitioners in higher education plan and implement targeted interventions addressing task strategies, time management, help-seeking, and self-regulation while considering demographic factors to enhance students' SRLS and promote success in online learning environments in different disciplines.

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The contribution of digital technology training to the digital competency gap. A case study from Austria

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Abstract

In this paper we ask to what extent additional digital training courses improve young people's abilities to solve everyday digital tasks. We use survey data on digital skills, including an assessment of digital competency tasks, collected among adolescents and young adults (14-35 years) in Austria in 2023. The results show that different types of training correlate in both ways: positively (when it comes to basic training) and negatively (when it comes to specialised training). However, regression models including contextual factors such as gender, education and general attitudes towards technology, show that not all effects persist. The paper concludes that additional digital training can have an effect, but educational measures should also put a focus on strengthening positive attitudes towards digital technologies to promote digital competencies.

Note: The Digital Skills Austria studies 2022 & 2023 were financed by the Austrian regulatory authority RTR (Rundfunk- und Telekomregulierungs-GmbH).

Keywords: *digital competencies; further education; digital training, life-long learning, technology commitment, survey research, Austria*

1. Introduction

The pervasiveness of digital technology and its application in nearly all spheres of public, professional and personal life has led to a renewed focus on the pivotal role of digital competencies (Kraus et al., 2021; Salganik, 2019). This is evidenced by policy initiatives such as those campaigned by the European Union which have identified the need for citizens to develop the skills and competencies to master the digital transition (European Commission, 2024). The rationale behind the EU's goal to foster digital competencies is clear: they are indispensable for the workforce and employability, linked to critical thinking and problem-solving beyond the technical sphere. A gap concerning digital competencies may expand

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(in-)tangible social inequalities as well as reduce social cohesion. However, it remains unclear how to foster these competencies and what educational measures can effectively enhance them. Consequently, the objective of this study is to identify the type of training that correlates with higher scores on the competencies assessment. The subsequent sections provide an overview of the state of research, present insights on the data and methods, summarise the results and a brief discussion of the findings.

2. Background and Reasoning

The social sciences are currently exploring methods for assessing individuals' abilities to navigate in today's digital societies, focusing on developing concepts such as digital competencies, skills, knowledge, and literacy (see e.g. Helsper et al., 2021; van Laar et al., 2020). Recent meta-studies have revealed that discussions on digital skills frequently depend on self-reports, which cannot directly be linked to actual problem-solving competencies (Livingstone et al., 2023). Moreover, discussions on digital literacy are often confined to smaller-scale qualitative case studies within educational contexts, tied to in-depth reflections of actions. The measurement of competencies is relatively rare and faces limitations. It requires technical access, takes longer to complete than typical survey batteries, encounters standardization challenges, and imposes a higher cognitive burden on participants (see e.g. Livingstone et al., 2023, Gruenangerl & Prandner, 2023) In terms of operationalisation, the literature does not always offer clear distinctions between knowledge, skills, literacy, and competencies (Livingstone et al., 2023). Some consensus exists, that the term “digital skills” is used to indicate the ability to use specific technologies, whereas “competencies” are recognised as the goal-oriented application of skills with a focus on problem-solving (Livingstone et al., 2023, Gruenangerl & Prandner, 2023). Indeed, recent research indicates that European citizens’ digital skills and competencies are severely lacking. Van Kessel et al. (2022) show that only a third of respondents to the EUROBAR survey met the EU DIGCOMP Framework's basic skill level, with notable disparities across countries. For Germany (Initiative D21, 2021) and Austria (Rinner et al., 2022) studies have indicated that competencies are underdeveloped, despite the widespread use of technology. Further research suggests that digital navigation ability is less tied to sociodemographics but rather to attitudes towards technology. Individuals with more open and less fearful attitudes tend to perform better (Gruenangerl & Prandner, 2022, 2023). Despite these findings, a systematic literature review by Livingstone et al. (2023) concludes that only a few studies have examined the impact of educational programmes on adolescents' digital skills, suggesting a link between academic performance and certain digital activities. Moreover, they indicated that specific complex competencies, like programming, might even negatively affect digital performance. This is noteworthy because specialised education is often considered crucial for acquiring the competencies needed for digital societies (van Laar et al., 2020). Using this as a foundation, we aim to explore the level of digital competencies among young adults,

the effectiveness of specific educational courses on solving digital and computational issues, and the influence of attitudes towards technology on these competencies through an Austrian case study.

3. Methods and Data

The dataset used for this article is the 2nd wave of the Digital Skills Austria study[1], a CAWI survey conducted in July 2023. It uses the digital skills measures proposed by Helsper et al. (2021). For this paper, we use a subset: young adults (individuals born in 1988 or later) who are likely to have had at least some formal education including digital issues. We follow an expanded definition of young adults from Cook (2016), which focuses on shared experiences relevant to the research topic. Key component of the 2023 survey was a digital competency test, based on thirteen tasks that required respondents to use their digital skills to solve problems. Each task offered six possible solutions and two opt-out options (see Table 2 for more information)[2]. Due to the complexity of the task, only half of the survey respondents were given this test, and of these 351 were in the age range of interest (14-35 years) for this paper. The reliability[3] of the tasks indicates good measurement consistency. In addition, the study used a 12-item scale on technology commitment developed by Neyer et al. (2016), which assesses attitudes towards digital technologies in three dimensions[4]: technology acceptance (TC1, enthusiasm for technical innovations), technology competence (TC2, feeling overwhelmed or anxious about digital technologies), and technology control convictions (TC3, confidence in the ability to manage and solve technology related problems). Regarding training courses on digital technologies respondents were provided with a list of 7 types of courses, linked to typical use scenarios and to specific aspects of digital technology use (see Table 1 and Figure 1 for more details). Participants could indicate that they had taken a course with or without certification, had tried to take one but cancelled it or had never taken one.

[1] The full sample includes 2087 people aged 14+ (matching Austrian resident online population, according to age, gender and education), 351 people from this sample correspond to the 14-35 age group, used as a sample in this paper. The Digital Skills Austria studies 2022 & 2023 were finance by the Austrian regulatory authority RTR (Rundfunk- und Telekomregulierungs-GmbH).

[2] This approach provided multiple paths to success: respondents could rely on pre-existing knowledge, use their research skills, or even use trial and error. All of these strategies were considered valid. The item design and selection process was iterative: (1) from the literature (especially Helsper et al., 2021) to identify essential areas, (2) task development within the research team and (3) quality improvement through pretests. Pretests included cognitive probing (heterogeneous test-group of 10), content-based/functional pre-testing (~ 50 BA students).

[3] KR-20 within age group 0.838, within total population 0.828

[4] Attitudes were measured on a five-point scale, ranging from "does not apply at all" to "completely applies". The expected structure of these scales was confirmed through principal component analysis (PCA), as detailed in Table 1 (for item specifics and wording, see Neyer et al., 2016). Note for the sake of transparency: factor extraction was performed on the entire sample (14+).

Table 1: Overview Analysis Variables (Digital Skills Austria 2023, own calculations)

Dimension	Variable/Question	Scale	Mean (Med.) % coded 1
Digital Competencies			
DC	sum-variable of 13 competency tasks (n=351)	0 (no task completed) to 13 (all tasks completed)	4,8 (5)
Technology commitment (factors calculated based on the full sample)			
TC1	technology acceptance (n=1966)	PCA, total variance explained 72 %, KMO 0,824, Cronbach's Alpha 0,871	
TC2	technology competence (n=1970)	PCA, total variance explained 73 %, KMO 0,882, Cronbach's Alpha 0,843	
TC3	techn. contr. convict. (n=1909)	PCA, total variance explained 61 %, KMO 0,789, Cronbach's Alpha 0,783	
Digital training courses			
INTRO	introduction to the basic use of IT or ICT (e.g. ICDL) (n=330)	Yes, with or without certificate (1) / No, aborted or never took a course (0)	43 %
BASIC	basic application software (e.g. word processing) (n=329)		43 %
SPECIAL	specific application software (e.g. graphics, finances, statistics, …) (n=330)		26 %
SOCNET	use of social networks (e.g. Instagram, Facebook, X...) (n=337)		26 %
COLLAB	use of collab. software (e.g. cloud services, workspaces...) (n=331)		22 %
INFRA	specific IT or ICT infrastructure (e.g. networks, SharePoint...) (n=333)		24 %
CODING	programming and coding (e.g. C#, Python...) (n=331)		25 %
Sociodemographic variables (Control)			
Age	Age in years (n=351)	14 to 36	25,7 (26)
Gender	Male or female? (n=351)	female (1) / male (0)	53 %
Education	Less than lower secondary education (n=175) Secondary education (n=106) Tertiary education (n=60)		51 % 31 % 18 %

The next section presents descriptive and linear regression-based analysis. For control purposes the regression models include gender and education.

4. Results

The results of the competency test indicate that on average, the population aged 14 to 35 was able to correctly solve 5 out of 13 tasks provided. However, the results also demonstrate a considerable range from zero to 12 correct answers, with 11 % unable to solve a single task and a further 31 % achieving only 1 to 3 correct solutions. Additionally, no one was able to correctly answer all 13 tasks. Only 2 % of respondents provided 12 correct answers, while 13 % solved 10 or more tasks correctly.

Table 2: Results: competency test, pop.: 14-35 years (Digital Skills Austria 2023, own calculations)

Results of the competency test, population 14-35 years (n=351)	+	-	d.k.
Interaction with AI	61 %	24 %	15 %
Basic knowledge of programme commands	60 %	21 %	19 %
Identification and use of a QR-code	50 %	38 %	12 %
Linking technical devices	50 %	23 %	27 %
Understanding of basic structure of AI	46 %	33 %	21 %
Understanding of secure internet protocols	39 %	41 %	20 %
Understanding of simple programming codes	35 %	24 %	41 %
Understanding of email communication	33 %	48 %	19 %
Basic knowledge of spreadsheet formula	31 %	42 %	27 %
Use of public administration tools, online queries	31 %	48 %	21 %
Information search in social networks	22 %	52 %	26 %
Pinging an IP-adress	14 %	49 %	37 %
Understanding of user-specific advertising	13 %	72 %	15 %

+ = correct solution, - = incorrect solution, d.k. = don’t know; sorted by share of correct answers

Upon examination of the specific tasks, it becomes evident that young people exhibited a high degree of familiarity with the interaction with AI, possessed a basic understanding of programme commands and demonstrated the ability to follow a QR-Code or identify appropriate technical standards for linking technical devices. Among the respondents, between 50 and 61 % were able to successfully complete these tasks. Conversely, tasks pertaining to user-specific advertising, the identification of IP-addresses and the execution of an information search on a social network proved more challenging for the young population. The results are largely consistent with previous studies indicating a relatively basic digital competence level among Austrians (Rinner et al., 2022). However, the high number of incorrect responses is striking, especially when compared to admitting a lack of knowledge. This is particularly evident in the context of user-specific advertising, social media usage, and the utilisation of digital public administration tools (see also Table 2)

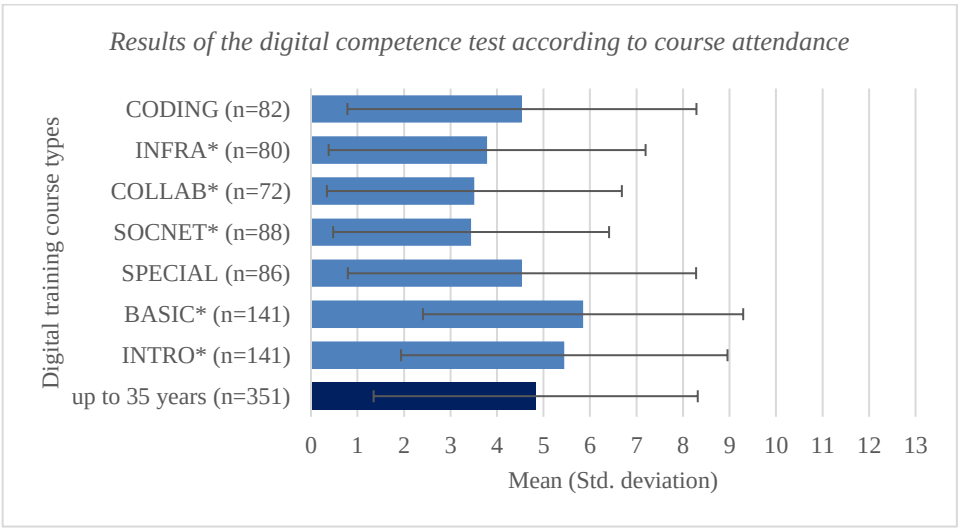


Figure 1: Mean results of the digital competency test with specific course attendance (own calculations, significant t-test results are indicated with *)

Interestingly, when examining various forms of digital technology training, only some of them correlate[5] with better performance. Overall, the spread of competencies shown is quite broad and illustrates that the young Austrian cohort is highly heterogeneous when it comes to their digital competencies. This aligns with the findings of a meta-study by Livingstone et al. (2023), which revealed that individuals who undertook courses on more advanced topics (e.g. coding infrastructure) exhibited poorer overall results. The same is true for those who took courses on social media, collaborative software and specialised software for specific tasks (e.g. statistics, finances, content editing).

The linear regression model modifies these results. It still confirms that basic courses have a positive impact, but only social media-related courses have a negative impact. Other types of courses do not show statistically significant effects. The most important effect comes from including technology commitment. Once introduced to the model, the explained variance increases from 26% to 42% (R^2), emphasising the importance of attitudes towards technology, when discussing competencies. Those who feel overwhelmed by technology (TC2) are more likely to score worse, while those who feel in control of technology (TC3) have better results. Some residual effects concerning education and gender remain. Those with higher education score better, and a small gender bias (men performing better than women) is also present.

[5] All significant t-test results are indicated in Chart 1 with * meaning $p < 0.05$.

Table 3: Linear regression models on digital competence (own calculations)

independent variables		dependent variables			
		digi. comp. (1)		digi. comp. (2)	
dimension	indicator	std. Beta	sig. (p)	std. Beta	sig. (p)
sociodemographic variables	gender (ref.:male)	**-0,199**	**<,001**	**-0,133**	**0,010**
	secondary education (ref.: less)	**0,137**	**0,021**	0,093	0,076
	tertiary education (ref.: less)	**0,292**	**<,001**	**0,211**	**<,001**
training courses on digital technology	INTRO	0,083	0,191	0,058	0,300
	BASIC	**0,283**	**<,001**	**0,197**	**0,001**
	SPECIAL	-0,018	0,783	-0,002	0,967
	SOCNET	**-0,257**	**<,001**	**-0,188**	**<,001**
	COLLAB	-0,124	0,077	-0,094	0,132
	INFRA	-0,073	0,330	-0,072	0,290
	CODING	-0,055	0,421	-0,059	0,339
technology commitment	TC1 technology acceptance (+)			0,043	0,462
	TC2 technology competence (-)			**-0,242**	**<,001**
	TC3 technology convictions (+)			**0,291**	**<,001**
model summary	adjusted R^2		0,265		0,421
	Sig. (p)		<,001		<,001
	n =		250		250

Digital Skills Austria 2023 dataset, population 14-35 years, own calculations, no weights applied. Method: linear regression models on the results of the digital competence test (2) with or (1) without inclusion of the motivational factors. Significant effects ($p < 0,05$) are marked bold.

5. Conclusion

We started this paper with the question if digital training courses offer a chance to increase the performance of individuals in the digital space, thus strengthening digital societies overall. This is of paramount importance, as previous studies have yielded concerning results regarding digital competencies (e.g. van Kessel et al., 2022). Our study of young Austrians indeed revealed a rather low level of digital competencies. The range of results within the population is huge (from 0 to 12 solutions, median 5) and a connection with specific types of training is plausible. Testing indicates that courses on digital technology may not necessarily lead to higher competencies. Multivariate analysis reveals that courses on basic application software may have a positive effect, while social network training may have a negative impact. However, the most substantial effects were tied to the participants' conviction of their ability to handle digital technology related problems and not showing negative attitudes (e.g. anxiety) towards digital technology. Thus, we conclude that education is a necessary tool (especially since tertiary education has an overall positive effect), but definitely needs to focus more on attitude issues

(i.e. fostering control convictions and reducing fear and overload due to digital technologies) in addition to actual technical competencies. This message needs to be communicated both in the classroom, and on a broader societal level. Trainings alone will not be able to solve the digital competencies gap as long as negative attitudes remain.

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Competency development in higher education: Crafting the future self as a driver for change

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Abstract

Comparison between ideal and real self provides the chance to implement a process of social and emotional competencies development. At theoretical and empirical levels, there is still room to measure the effects of the ideal self crafting on the activation of a competency development process and how the real self signals actual strengths and areas of improvement. Nonetheless, literature could devote more attention to the role of higher education institutions in the process of developing the competencies, from helping students in assessing their real self and discovering the needed competencies to achieve the desired future. The present study describes the implementation of this process in the domain of higher education, showing the results from an elective course delivered in a public Italian University to Master's degree students.

Keywords: *Intentional change theory; ideal self; real self; social and emotional competencies; Higher Education.*

1. Introduction

Recent surveys, conducted on both employers and managers, have underscored that the workplace is still characterised by a significant skill gap (McKinsey, 2020; McKinsey, 2021). Results emphasise a shift in the most valued skills within the workforce to focus on emotional and social competencies (ESCs). The discrepancy between labour market expectations and the skills profile demonstrated by graduates has been an ongoing issue in the academic and institutional debate (McKinsey and Company 2012). Higher education institutions (HEIs) are in charge of equipping future workers with the necessary skills they need to enter and perform in the labour market, thus reskilling must be at the centre of HEIs debate. While extant literature calls HEIs to put more effort in adequately preparing students on ESCs (Bonesso et al., 2019), research itself should better sustain this effort by providing new methodologies and stronger evidence on how ESCs can be developed within HEIs programs.

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In this paper, we propose the use of the Intentional Change Theory (ICT) (Boyatzis, 2006; Boyatzis and Akrivou, 2006), as a framework to develop effective ESCs development programs in HEIs, and evaluate the perceived effectiveness of the ICT related stages and activities. Given the development of ESCs requires a complex cognitive and behavioural effort to reshape the brain's neural structure (Boyatzis, 2006; Boyatzis et al., 2019), which is difficult to apply simultaneously to a great variety of ESCs; we suggest creating a personalised process of competency development would favour a successful implementation of the learning process. In doing so, a critical prerequisite is that students become deeply aware of who they are and the kind of future they envision for themselves in order to be able to direct their development efforts towards the most valuable portfolio of competencies to achieve the desired future self. In this regard, the concept of the "ideal self" and the comparison with the concept of "real self" (Boyatzis, 2006) is strictly connected to the management of careers and personal development. The real self has been partially addressed by studies on multisource feedback, which show mixed results on their ability to promote behavioural change (Drew, 2009). While, in exploring the effects of defining the ideal self, extent literature mainly focuses on post-graduate contexts and does not delve into the analysis of consequences after the reflection on desired future. This gap leaves unaddressed the following research question: what is the impact of the Intentional Change Process in mobilising graduate students to acquire the critical ESCs competencies necessary to attain a desired future?

The next section will briefly review the literature on ICT and Future Work Self. Then, the empirical setting will be illustrated with the description of an educational project implemented within a public university in Italy, along with the methodology and related measurement scales developed. The subsequent section presents the analysis of the students' reflections on their learning experience. Finally, the paper offers insights on how to refine the activities to ameliorate the learning journey in the higher education context.

2. Theoretical background

Intentional Change Theory (Boyatzis, 2006; Boyatzis and Akrivou, 2006) is a theory of personal change that relies on the assumption that lasting change is sustainable only if it is intentional and desired (Boyatzis, 2006). The whole process unfolds over five steps, called discoveries, that flow in a sequential order and in an intertwined manner (Boyatzis, 2006). To account for motivation and aspiration, ICT proposes that a fundamental first step in any change process is identifying one's ideal self, which is the individual's image that depicts the characteristics that someone wants to see in his/her future (Higgins, 1987). The seminal article of Boyatzis and Akrivou define the ideal self as "a psychological component of the self […] an image of what kind of person one wishes to be, what the person hopes to accomplish in life and work" (2006: 625). In a similar vein, the research stream of work self proposes a similar construct, with a narrower focus on the work and career domain. Strauss et al. (2012) defined future work self (FWS), as "an individual's representation of himself or herself in the future that reflects his or

her hopes and aspirations in relation to work" (2012: 580). The personal future ideal is formalised in a "personal vision" statement. By ensuring a sense of meaning and direction, and providing optimism and hope, this ideal self image represents a critical mechanism that spurs sustainable and enduring change (Boyatzis and Akrivou, 2006; Oyserman and Markus, 1990). Stronger awareness and clarity on one's future self was found to positively influence various proactive career behaviours, among which skill development (Strauss et al., 2018; Zhang et al., 2017). Similarly, literature provides evidence that adjustment in career design only leads to successful outcomes when those are consistent with individuals' aspirations (Hall et al., 2018). Overall, these results reinforce the role of the future work self not only as motivational driver for skill development, but also as a compass to direct one's change towards the development of ESCs that are consistent with one's career aspirations.

The second discovery of the process relates to one's awareness of who she/he is in the present moment. Gaining knowledge about the real self is essential to being able to reasonably set the starting point of the change process and to better plan the activities to attain the ideal self. Acceptance of vulnerability is a fundamental prerequisite of the real self phase. The acquisition of self-awareness represents a key of this second discovery (Boyatzis and McKee, 2005) as it enables people to understand their current level of ESCs owned and to give sense to their thoughts and reactions along the change process (Bonesso et al., 2017). Scholars suggest self-awareness is better developed through a 360-degree feedback that entails both self-evaluation and evaluation from external observers (Boyatzis et al. 2019). Others' feedback can be considered reliable to the extent to which the external raters know the person quite well and they are in the condition to provide an honest assessment, guaranteeing a safe context to receive the evaluation. In order to motivate change, the real self is compared with the ideal self. In so doing, the person can identify those elements in which the two selves are consistent (individual strengths) and those in which they do not overlap (individual improvement areas).

The third discovery entails the definition of a useful learning agenda, meaning the definition of learning objectives, with corresponding new behaviours to practise. To ensure the design of an appropriate learning plan, priority must be given to the development of those ESCs (learning goals) that the individual identifies as the most necessary to achieve the desired future. For each learning goal specific actions are defined coherently with the personal learning styles (Boyatzis and Kolb, 1995). The discrepancy between the demonstrated and the necessary level of competencies would motivate to commit as much effort as possible to achieve an overlap between the actual-self with the ideal self (Higgins, 1987).

The fourth phase refers to experimentation and practice. New behaviours in different contexts are exercised and real change occurs as long as it is strengthened by continuous practice. The last discovery regards the importance of trusting and meaningful relationships along the whole process, since they enable a person to "experience and process each discovery in the process" (Boyatzis, 2006: 613).

3. Method

3.1. The learning program structure

The present study illustrates the implementation of the ICT process within an educational program designed by an academic centre of an Italian public University. Graduate students enrolled in different disciplinary fields (economics, humanistic, linguistic and scientific study courses) have the opportunity to attend the program as elective. The educational activities are aimed at creating a personalised learning plan to develop students' competencies through the path of ICT discoveries.

The academic centre embraces the experiential learning theory (Boyatzis and Kolb, 1995) and the whole person learning pedagogy (Hoover et al., 2010) as the preferred methodological approaches. Alongside, learning programs are designed to give participants the opportunity to interact with the environment and to derive meaning from their own experience to exploit the possibility to achieve an effective behavioural change, as proposed by social cognitive and constructivist learning orientations (Allen et al., 2022). Graduate students are made aware of the definition of ESCs and the process for their development (Boyatzis, 1982; Goleman, 1995).

Participants attend in-person lessons, where they are involved in each stage of the ICT; between one meeting and another, several assignments are carried out individually on an online platform.

The ideal self is elaborated in a personal vision statement, a written document of a minimum length of 1,000 words. Students are provided with guidelines that support them in a detailed description of their future self, including their inner identity, their personal and professional life. The personal vision accounts for their deepest values, dreams and aspirations to the extent to which they are achievable within a given time frame (from 5 to 10 years). Once they elaborate their vision, they are asked to identify critical competencies necessary to achieve their desired future. As a second discovery, the real self is assessed with a survey in which students have to evaluate themselves on the degree to which they manifest each of the considered ESCs. Each competency is assessed through a multisource feedback process in which students and external raters are asked to evaluate the frequency of manifestation of each competency. Each competency is captured by four items on a 0–10-point scale. The mean value represents the final score for each ESCs. While in most ESCs development programs, the multisource feedback is only aimed at the evaluation of the self-others discrepancy as a proxy of personal awareness (Eckert et al., 2010), in this case the interpretation of the multisource assessment is done also with reference to one’s aspirations. Indeed, students choose their learning objectives in accordance with the second discovery (real self), while being aware of the first discovery (ideal self), focusing on critical competencies to attain their desired future.

3.2. Sample

The sample consists of n=875 graduate students who attended the program over six years (i.e., 2018-2023). The sample average age is 24; 81% is female. The average number of participants per year is n=146.

3.3. Measures

In this section the measures adopted in the different stages of the ICT process are described.

3.3.1. Ideal self: core elements described and reactions

After the submission of the personal vision, students are asked to fill in a survey that aims to measure the extent to which they described the main aspects of their life and the feeling they experienced after writing the vision. Different scales assess: 1) personal identity (8 items); 2) professional identity (4 items); 3) family and wellbeing (3 items); 4) hope (5 items); 5) core interests (2 items); 6) synthesis (3 items); 7) proactive actions (3 items); 8) coherence (3 items); 9) the extent to which the students thought before about their vision (2 items).

3.3.2. Ideal self and real self reflections: perceived usefulness

The perceived usefulness of the proposed activities is evaluated with a second survey delivered 1 week after the end of the program. In this second survey, they are asked to rate on a 1-7 Likert scale the perceived usefulness of the different activities they carried out during the first three discoveries of the Intentional Change Process. Specifically, perceived usefulness has been measured on 4 items: 1) The activities on the ideal self helped me to reflect on my desired future; 2) Writing my personal vision helped me identify my main future professional and personal goals; 3) The real self activities helped me to reflect on my level of social and emotional competencies possession; 4) The activities on the real self helped me to identify behavioural competencies on which to undertake a development pathway.

4. Results

Participants rated the components that were most included in their personal vision. Items regarding professional identity scored higher (M=3.8, SD=0.7) than personal identity (M=3.7; SD=0.6) and family life (M=3.0, SD=0.82). Students agree on having included important concepts (M=4.4, SD=0.62) in a coherent way from a temporal and thematic point of view (M=4.2, SD=0.64). Embracing the process of vision writing strongly correlates with a sense of hope (r=0.46, p <.001) and relates to proactive actions (r=0.23, p<.001). Helpfulness in defining professional career is witnessed by higher correlation (r=0.23, p>.001), rather than personal identity (r=0.10, p=.003).

When asked to assess the perceived usefulness of the reflection activities, all the discoveries had a great impact on supporting students in the change process. First, the reflection on the ideal self

has activated awareness of one's desired future with consequent identification of professional and personal goals (M=6.2, SD=0.93). Verbal comments provide additional evidence, as the following quotes exemplify: "*I think the vision drafting exercise was really useful because otherwise I would never have stopped to think about me in the future and my goals in such a specific way*" or "*The writing of the personal vision made me aware of myself and what I want to become*". Second, real self tasks helped developing awareness of one's manifestation level of ESCs (M=6.3, SD=0.81) and helped identifying of the most critical and urgent ones to be developed in order to achieve one's career goals (M=6.3, SD=0.85); verbal comments report: "*discovering through the real self activities what my strengths are made me more confident in myself and it was equally interesting to discover more clearly my weaknesses to work on and improve*"; "*it was very interesting to analyse, also externally, my own behaviours: like a mirror, it improves awareness of strengths and weaknesses. In general, it allowed one to put in order some perspectives for the future*".

The results provide evidence on the satisfaction and usefulness of the activities, highlighting the relevance of supporting students in a process of individual reflection to gain the hope and willingness to design a learning program to foster the development of their ESCs.

5. Discussion and conclusions

The present study offers two main contributions to the academic and empirical debate.

First, our results strengthen the relevance of the Intentional Change Process in helping people to become aware of their fundamental desires for their future, to recognize the competencies they need and their level of manifestation. Moreover, the process facilitates engagement in a learning plan in which people are motivated to pursue change.

Second, it has been highlighted the strong connection between HEIs' critical role in supporting students in their learning journey. By implementing the learning activities described, it is possible to derive a greater likelihood of reducing the poor employability of graduates through a direct effort to develop a more comprehensive array of skills required by the job market.

However, the study could be advanced when considering several aspects. One example is the effect of the discrepancy that students perceive between their ideal and the real selves; in fact, a gap perceived as too difficult to bridge could hinder the motivation or a gap too small could prevent serious effort in a path of improvement. Future studies could introduce the measurement of the distance between ideal and real self and consider this variable as moderator.

Future longitudinal studies should consider how external events (e.g., pandemic crisis) have modified the way in which students envision their desired future. As a consequence, it could be fruitful to assess levels of satisfaction derived from these activities.

To conclude, the present work shed some light on a possible way to help HEIs reduce the gap between the students' image of the future selves and the embodiment of necessary ESCs

competencies to attain future goals. Furthermore, the aforementioned lines for further research suggest that both academia and practitioners could benefit from a broader analysis and additional investigation on this topic.

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Exploring the Efficacy of ChatGPT in Adapting Reading Materials for Undergraduate Students

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Abstract

Current research explores the efficiency of ChatGPT 3.5 in text adaptation for educational purposes. It aims to investigate reliability of the AI model for reading ease evaluation, its accuracy in reading manipulation on specific parameters, output quality, and prospects of improving user experience. The study considered text, sentence, and word length as the main features for measuring text difficulty. Flesch-Kincaid reading ease statistics was used for input and output text accessibility evaluation. The research identifies the areas of concern of using ChatGPT 3.5 for text manipulation and requirements for successful implementation of the AI model in the process of the reading materials transformation.

Keywords: *text adaptation; reading accessibility; reading manipulation; ChatGPT 3.5, human involvement.*

1. Introduction

Reading effectively is a crucial skill that unlocks a world of knowledge, leading to greater success and personal development. As educators, it is our responsibility to not only encourage students to read but also ensure they comprehend and learn from the material. To achieve this goal, we must design teaching materials that enhance their language abilities and foster a love of reading. Adapting texts to suit the varied needs and comprehension levels of students is an essential task for educators. This becomes particularly challenging in international undergraduate settings where students possess diverse backgrounds, learning styles, and proficiency levels (Murphy, 2013). To address this challenge, there is a need for innovative solutions that can assist language teachers in tailoring reading materials to meet the unique requirements of their students.

ChatGPT, as a cutting-edge language model designed to comprehend and generate human-like text, can be a life-changing experience for those involved in the text adaptation process. The ability of the AI model to understand and respond to user inputs makes it a collaborative and

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interactive tool the right use of which can elevate both student and educator experience to a new level. Leveraging the capabilities of ChatGPT in education presents a promising pathway for language teachers to efficiently adapt reading materials (Plevris et al., 2023).

This research explores the efficacy of ChatGPT 3.5 (further ChatGPT) in the context of undergraduate education for international students, shedding light on its potential as a text manipulation tool.

2. Purpose of the study

The current research aims to explore the functionality of ChatGPT for text adaptation in the context of undergraduate education. The target audience of the study is international students, and the target level of reading complexity is 30-50 (college students). The study explores the efficiency of ChatGPT in (1) evaluating reading accessibility in comparison with acknowledged tools and (2) adapting reading to specific parameters.

3. Research questions

1. How accurate is ChatGPT evaluation of text readability?
2. How accurate is the output of ChatGPT based on predetermined text accessibility parameters?
3. How does the use of ChatGPT impact the efficiency of the text adaptation process?

4. Literature review

Accessibility of learning resources plays a critical role in undergraduate education (Roberts, 2014; Goodman & Freeman, 2013; Case, 2012; Kuimova & Kobzeva, 2011). Text adaptation for undergraduate students is a significant pedagogical consideration as educators face a variety of student backgrounds and learning styles (Murphy, 2013).

It is often argued that students do not understand texts written by native speakers in the same way that native speakers do, hence learning materials comprising reading should be accessible enough to ensure academic progress and success of an undergraduate learner (Krashen, 1988). It is important to take the reader's proficiency into account when selecting specific learning content as text complexity has a direct bearing on how motivated the students are. It would be inappropriate to assign a text that is outside the scope of comprehension for the students, since this could demotivate them to learn (Case, 2012).

Accessibility of learning materials can be adjusted by an educator by using a range of readability formulas and instruments available online. Readability is defined as “The sum total (including all the interactions) of all those elements within a given piece of printed material that affect the

success a group of readers has with it. The success is the extent to which they understand it, read it at an optimal speed, and find it interesting" (Dale & Chall, 1949, p. 12).

Currently, the number of reading accessibility formulas that measure text complexity exceeds 200 (DuBay, 2004). They are utilized to evaluate the text from the point of view of its readability by a specific group of students. The formulas might differ in terms of the quality of their output, features for measurement, and hence their success (Torki, 2013).

The Flesch-Kincaid Reading Ease formula (Currier, 1977) is one of the most popular measurements researchers and educators use. It calculates the reading complexity based on a score from 0 to 100, where 0 means the text is very difficult to read and 100 indicates its high accessibility. In addition, the formula identifies the grade of the assessed reading, indicating the grade-school level the text is accessible for.

Table 1. Flesch-Kincaid Reading Ease score

Score	School grade	Readability
90 - 100	5th	Very Easy
80 - 90	6th	Easy
70 - 80	7th	Fairly easy
60 - 70	8th – 9th	Standard
50 - 60	10th – 12th	Fairly Difficult
30 - 50	College	Difficult
0 - 30	College graduate	Very Difficult

This tool is used in the current study to explore the efficiency of ChatGPT in adapting reading complexity to a required accessibility level.

Text adaptation is a laborious procedure that takes a lot of an educator's time, attention to detail, and effort. The emergence of several AI models is expected to benefit educators appropriately (Plevris et al., 2023). According to experts studying artificial intelligence models, one benefit is modifying course materials for more individualized instruction without increasing the teacher's workload (Fütterer, 2023; Mondal & Mondal, 2023; Pearce, 2023).

ChatGPT is one of the most widely used AI models nowadays. GPT, short for Generative Pre-trained Transformer, is a language model developed by OpenAI. ChatGPT is crafted to produce text responses that resemble human language, drawing from input. ChatGPT employs deep learning techniques to comprehend and generate text. Its training involves extensive data collection from the internet and various sources, enabling it to grasp language patterns and structures (Plevris et al, 2023). All you need to do is to provide a well-thought-out, detailed prompt to receive the desired output of appropriate quality (Chamurlyiski, 2023). Educators and researchers widely discuss multiple benefits and drawbacks of the model in different fields. ChatGPT, with a different level of success, can summarize text, produce outlines for essays,

write sections for research papers, perform statistical analysis, and solve math problems (Mondal & Mondal, 2023; Plevris et al., 2023). However, numerous researchers point out that the AI model does not encourage critical thinking, produces output with unreliable information, and even generates plagiarized content (Fütterer, 2023; Mondal & Mondal, 2023).

There are multiple investigations on the successful utilization of ChatGPT for text generation. However, to our knowledge, no research has been done yet on the efficiency of ChatGPT in text adaptation. Hence, current study aims to explore this niche to identify capabilities, accuracy, and human dependence of the AI model in reading manipulation for international undergraduate students.

5. Methodology

5.1. The source

The current study describes an experiment on ChatGPT usability for text adaptation for international undergraduate students.

The reading material used for the investigation was a paragraph from the text 'Digital natives or digital refugees? Why we have failed Gen Y' by Combes (2009). The text was used as an input for ChatGPT to explore its efficiency in text evaluation and adaptation to a selected level. ChatGPT was utilized for the current experiment. Prompts were created to generate output that meets the needs of non-native English-speaking undergraduate students.

The study was preceded by an interview with ChatGPT (ChatGPT, January 15, 2024) on its knowledge, information access breadth, and self-assessment of its capabilities and drawbacks on text evaluation and manipulation (see Table 2). The AI model was asked three questions about the Flesch-Kincaid Reading Ease tool utilized for human adaptation of the text under study. The interview was conducted for two reasons: (1) to ensure ChatGPT is aware of the above instrument and can use a similar approach to text evaluation if requested, (2) to enable a consistent analysis of the output by ChatGPT in terms of its quality and accuracy.

Based on the obtained response, ChatGPT is aware of the Flesch-Kincaid Reading Ease tool; it can analyze text complexity based on the suggested tool and modify a text to a certain reading ease score stated in the prompt. The study reports one possible response that ChatGPT could provide for those questions.

Table 2. Interview with ChatGPT

#	Question	Answer
1	Do you know what Flesch-Kincaid Reading Ease formula is?	Yes, I'm familiar with the Flesch-Kincaid Reading Ease formula. It is a widely used method for evaluating the readability of English text. The formula generates a numerical score that reflects the ease or difficulty of reading a particular piece of text. The higher the score, the easier the text is considered to be. The formula is based on two factors: average sentence length and average number of syllables per word. The Flesch-Kincaid Reading Ease score is calculated using the following formula: 206.835−(1.015×average words per sentence)- (84.6×average syllables per word)
2	Can ChatGPT accurately analyse a text based on Flesch-Kincaid scale?	Yes, I can certainly help analyze a text based on the Flesch-Kincaid readability scale. …I can calculate the Flesch-Kincaid Reading Ease score for you and offer insights into the readability of the text.
3	Can ChatGPT modify a text to match a specific score based on Flesch-Kincaid scale?	Certainly! If you provide me with the text you'd like to adapt, along with the target Flesch-Kincaid Reading Ease score, I can attempt to modify the text to align with the specified readability level.

5.2. Procedure

The selected reading was analyzed with the help of the Flesch-Kincaid reading ease tool (see Table 1). An experimental input on reading ease analysis of the text under study was given to ChatGPT to compare the actual text accessibility evaluation provided by Flesch-Kincaid statistics to the output of the AI model for accuracy.

The process of adapting a text with ChatGPT included three steps:

Step 1: *Writing clear instructions for the AI*. The output of ChatGPT depends on the clarity of instructions provided in the prompt. The more precisely the requirements are described, the better output can be expected. This condition was considered at the stage of prompt design. The prompts were worded carefully to ensure ChatGPT understands the parameters of the expected manipulation result. Every output was regenerated twice for result consistency assessment.

Step 2: *Reviewing the output*. The generated material was inspected to ensure the desired result was achieved. The Flesch-Kincaid reading ease tool was used to review each output of ChatGPT after every input.

Step 3: *Iterating*. If the review showed unsatisfactory output, Steps 1 and 2 were repeated to obtain a better result. The criteria for identifying the output quality were the Flesch-Kincaid statistics of the text under study.

6. Results

The experiment on ChatGPT text manipulation was a three steps procedure that included (1) designing a prompt instructing the model on requirements to the adaptation, (2) evaluating the output of text transformation with the Flesch-Kincaid statistics tool, (3) returning to amending input instructions in case the output did not satisfy the expectations of reading accessibility defined in the prompt.

The experimental comparison was conducted to research the accuracy of ChatGPT reading ease evaluation.

6.1. Experimental comparison

The results of the interview with ChatGPT showed that the model is aware of the Flesch-Kincaid statistics tool and can adapt the provided reading to match a certain reading ease score (see Table 2). However, considering the possible inconsistency in ChatGPT output (Fütterer, 2023), it was decided to explore the AI model accuracy and level of consistency in identifying text difficulty before the main experiment.

Prompt 0: “Please evaluate the reading ease of the following text based on the Flesch-Kincaid statistics scale”.

Below, you can find the results of the experimental accessibility evaluation of the text used for the current study. ChatGPT was requested to generate and then regenerate the response based on the same Prompt 0. Overall, three evaluation attempts were made to investigate the range and caliber of the AI model output. Table 3 presents the Flesch-Kincaid statistics compared to three reading ease evaluation attempts by ChatGPT.

Output 0.1 was descriptive and contained no text complexity score. The explanation provided by the model was as follows: “I don't have the exact word and syllable counts for your provided text, but I can offer a general assessment based on its characteristics. Given the nature of the content, it might fall in the range of a high school or college reading level” (ChatGPT, January 15, 2024). Here we can see a mismatch between ChatGPT's response to interview Question 2 where it stated that it “…can calculate the Flesch-Kincaid Reading Ease score … and offer insights into the readability of the text” (see Table 2) and the output quality it provided in response to the prompt requesting the model to assess text accessibility based on Flesch-Kincaid statistics scale.

Table 3. Comparison of text reading ease evaluation by Flesch-Kincaid statistics tool and ChatGPT

Readability statistics details	Flesch-Kincaid statistics	Output 0.1 statistics	Output 0.2 statistics	Output 0.3 statistics
Flesch reading ease	13	"…high school or college reading level"	32.2	44.4
Flesch-Kincaid grade level	22.9		15.5	12.5

Outputs 0.2 and 0.3 generated numeric data despite the response found in Output 0.1. Statistical data retrieved after two response regenerations varied from 32.2 to 44.4 points on the readability scale. In terms of accessibility of the analyzed text, both results fall within the score of 30 – 50, which identifies the text as 'difficult'. The readability level identified by ChatGPT Output 0.2 is 15.5, which is equivalent to a college sophomore or higher, and Output 0.3 is specified as 12.5, a high school graduate accessibility level.

Based on the Flesch-Kincaid formula evaluation, the text under study score equals 13 points, which places it within the range of 0 – 30 points on the reading ease scale, and the grade level is 22.9, which means the text in question belongs to the category of 'very difficult' reading accessible for college graduates.

The data above demonstrates multiple gaps in the reliability of ChatGPT in reading ease evaluation. First, the AI model is inconsistent in its evaluations as it provides different results every time the user requests regeneration. The output ranged from a descriptive evaluation with no statistical data (see Output 0.1) to numeric output with different values (see Outputs 0.2 and 0.3). Secondly, neither ChatGPT descriptive nor the two numeric outputs match the actual score of the text complexity provided by Flesch-Kincaid statistics with the tendency towards exaggerating the accessibility of the text under study.

6.2. Main experiment

6.2.1. Writing a prompt

Following the three-step process of the experiment, a prompt was designed for ChatGPT requesting the model to manipulate the input text. In the pre-research interview, the chatbot claimed that it is familiar with the Flesch-Kincaid reading ease formula and can adapt a text to a required readability score (see Table 2).

Prompt 1: "Please adapt the readability of the provided text to the score range of 30 - 50 based on the Flesch-Kincaid reading scale".

Prompt 1 focuses on the reading ease scale that is widely used for evaluating text accessibility by educators. A specific reading score was selected for precise identification of the level of reading complexity/accessibility expected as an output.

As long as the model claimed its familiarity with Flesch-Kincaid statistics and responded positively to the inquiry on whether it can adapt the text to a specific score on the reading ease scale, it was expected that ChatGPT would simplify the reading in question by changing text and sentence length, amending word count, and rephrasing passive structures.

6.2.2. Review

The input text readability score equals 13, which is within the range of 0 – 30 on the Flesch reading ease scale. Texts with this score are described as "very difficult" to read. The grade level of the input text is identified as 22.9 (see Table 3), which means it is accessible to college graduates.

Prompt 1 requested ChatGPT to adapt the text based on the Flesch-Kincaid reading ease scale to the score range of 30 – 50, which would make the text accessible to college students. The selected range means that the input text needed to be simplified in terms of its accessibility. Table 4 below compares the Input text statistics and the three received outputs by ChatGPT (ChatGPT, January 15, 2024).

Table 4. Comparison of input and output texts accessibility on Flesch-Kincaid scale

Flesch-Kincaid parameters	Input text statistics	Output 1.1 statistics	Output 1.2 statistics	Output 1.3 statistics
Words	231	200	203	195
Sentences	5	5	8	6
Words per sentence	46.2	40	25.3	32.5
Passive sentences	40%	80%	12.5%	16.6%
Flesch reading ease	13	10.5	8.5	5.9
Flesch-Kincaid grade level	22.9	21.7	18.3	20.5

The data provided in Table 4 demonstrates that each ChatGPT output increased reading difficulty of the Input text instead of making reading more accessible. Word count amendments can be noticed in every output: from 231 in the Input text, the number of words changed to 200, 203, and 195 in every next text version accordingly. As for the number of sentences in the manipulated reading, there is no difference between the Input text and Output 1.1, as each

contains 5 sentences. To compare, there is an increase in the number of sentences in Output 1.2 (8 sentences) and Output 1.3 (6 sentences). The number of words comprising transformed texts reduced in all the outputs generated by ChatGPT from 40 lexical items in Output 1.1 to 25.3 in Output 1.2 and 32.5 words per sentence in Output 1.3. Passive sentences underwent remarkable transformations. Their number doubled from 40% in the Input text to 80% in Output 1.1, increasing the complexity of the reading. Regenerated texts in Outputs 1.2. and 1.3 contained a considerably lower percentage of passive sentences (12.5% and 16.6%, respectively). Reading ease score of the Input and Output texts under study remained within the same range: 0 – 30 points. Flesch-Kincaid grade levels of ChatGPT 3.5 Outputs vary between 18.3 and 21.7 and are similar to the Input text grade level (22.9), which means the text comprehension requires the competence of a college graduate.

Overall, the reading ease statistics comparison demonstrated that all ChatGPT outputs are more complex than the input in terms of their accessibility. It means that the AI model failed to produce the output according to the set parameters.

6.2.3. Iteration

Iteration appeared to be necessary based on the response to Prompt 1, where the output of the AI model under study did not match the user's expectations in terms of accessibility. Prompt 2 was designed for better clarity to ensure ChatGPT understands what aspects of the text need to be changed. It specified five amendments to be made: (1) text and (2) sentence length, (3) number of sentences and (4) number of words in those sentences, and (5) passive structures. These parameters were set based on the Flesch-Kincaid statistics tool. Apart from the list of required changes, Prompt 2 specified that the reading must be "simplified" instead of "adapted," as in the case of *Prompt 1*. *Prompt 2* also asked ChatGPT to amend the text for the level of college students instead of any specific range on the Flesch-Kincaid scale.

Prompt 2: Can you please simplify the following text by changing text and sentence length, number of sentences and words comprising them, and passive structures to make it accessible for college students?

Table 5 below compares the input text statistics and the three received outputs by ChatGPT (ChatGPT, January 15, 2024).

The data in Table 5 demonstrates the results of three attempts of ChatGPT to simplify the text based on the five parameters mentioned in Prompt 2. The three outputs differ from each other in terms of text complexity only slightly. Flesch's reading ease score increased from 13 points in the Input text to 21 – 22 points in the Outputs. Flesch-Kincaid grade level of the output varies between 15.5 and 16.4 points. This means the texts adapted based on Prompt 2 became more accessible than the ones based on Prompt 1 where the variation ranged between grade level 21.7

Table 5. Comparison of readability of ChatGPT outputs on Flesch-Kincaid scale

Flesch-Kincaid Statistics	Input text	Output 2.1	Output 2.2	Output 2.3
Words	231	173	173	151
Sentences	5	8	8	6
Words per sentence	46.2	21.6	21.6	25.1
Passive sentences	40%	25%	0%	33.3%
Flesch reading ease	13	22	21	21.6
Flesch-Kincaid grade level	22.9	15.5	15.6	16.4

and 18.3. The increase in reading accessibility might be attributed to a considerable reduction in overall word count from 231 words in the Input text to 151 – 173 words in the Outputs, an increase in the number of sentences (6 – 8 sentences per text) with 21.6 – 25.1 words per sentence, and manipulation of passive sentences the number of which varied between 33.3% to 0% in the AI generated output. However, despite improved reading ease score and grade level of the texts in all the three outputs, the accessibility of the reading remains within the same range as the Input text: 0 – 30 points. Hence, the texts manipulated by ChatGPT can be described as "very difficult" and are accessible to college graduates.

The reading ease statistics comparison of the three outputs based on Prompt 2 demonstrated that neither of the ChatGPT manipulated texts improved accessibility to the desired level despite the provided amendment parameters.

7. Conclusions

The paper presented an exploratory study of the performance of ChatGPT in text adaptation for international undergraduate students. Several prompts were designed to investigate the reliability of the AI model in terms of text accessibility evaluation and reading manipulation based on a set of parameters chosen by the researcher. The study also aimed to identify the prospects of improving user experience, i.e., assisting educators with teaching materials design for a particular level of student competency.

The results of the research demonstrated the need to double-check AI-generated material. Relying on ChatGPT for reading adaptation should be done cautiously, especially regarding text complexity assessment and output readability.

Reliability in assessing the reading ease by ChatGPT is a concern. The AI model is inconsistent with its results. Upon output generation, it provides a range of different responses, from descriptive to numerical data. Moreover, there is a discrepancy between regenerated outputs that place the text within different levels of reading complexity. In addition, both descriptive and numeric outputs indicated a higher level of text accessibility compared to the actual Flesch-Kincaid statistics. This tendency could mislead users regarding the complexity of the text.

The model outputs do not match the parameters set in the prompt. The first attempt of the AI model to simplify the text resulted in a higher level of reading complexity despite the precise numerical input provided in Prompt 1. Specifying manipulation parameters and detailing the prompts did not result in the expected level of accessibility of the manipulated text either. Multiple regeneration of the output did not improve the quality of the product, and the overall accessibility remained within the same range as the input text.

Overall, the contribution of ChatGPT to the text amendment process for educational purposes is questionable due to the multiple gaps identified by the current research. Those gaps include a lack of ability to tailor the text to different levels of students or potential limitations in addressing specific text amendment parameters even though Flesch-Kincaid statistics is included in ChatGPT training. The study showed that the model may have challenges that make its effectiveness less reliable. The model's dependence on human input is high. However, even the detailed guidelines provided to ChatGPT in the framework of the current study did not succeed to the expected extent.

Human involvement is crucial for maintaining the quality of educational content. While ChatGPT may have advanced language capabilities, it may not fully grasp the nuances of educational material or the diverse needs of students. Humans should provide the necessary oversight to ensure the adapted text is accurate and aligned with predetermined parameters. This could involve educators or experts reviewing and refining the output generated by ChatGPT to meet the specific requirements of a given educational level.

The gaps identified by the current research indicate that further investigation is needed to fully understand the model's capabilities and limitations in application to text amendment. Additionally, recognizing the value of human participation highlights the cooperative role that AI and human expertise play in modifying educational materials.

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Are You AI Ready? Investigating AI Tools in Higher Education via the Co-development of Interdisciplinary Student-Partnered AI Training Resources

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Abstract

This study explores the integration of Artificial Intelligence (AI) in higher education, focusing on its implications for teaching and learning. With AI tools rapidly gaining traction, the research emphasises the necessity of developing proficient AI literacy skills among faculty and students. Employing focus groups and thematic network analysis, the study uncovers faculty and student perspectives on AI's role in education, with both groups recognising its potential to positively impact all aspects of higher education, while also emphasising concerns about credibility and reliability of AI tool outputs, potential for bias, impact on academic integrity and assessment, as well as concerns about inclusivity. A significant outcome is the development of an AI capabilities matrix, tailored to align with the DigComp 2.2: The Digital Competence Framework for Citizens. Overall, it contributes to the discourse on AI's integration in higher education, setting a foundation for integration and further research on this topic.

Keywords: *Artificial Intelligence Integration; AI Literacy; Interdisciplinary Collaboration.*

1. Introduction

Since November 2022, there has been a notable increase in the use of AI (artificial intelligence) tools in higher education, sparking concerns about its impact on teaching and learning. This

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period saw significant public engagement with AI, exemplified by the OpenAI ChatGPT tool reaching 100 million users within two months of its launch (Crace, 2023). Several scholars have emphasised the need for AI training for faculty and students, highlighting the importance of understanding AI's capabilities, limitations, and interdisciplinary nature (Casal-Otero et al., 2023; Luckin et al., 2022). They also stress the importance of addressing ethical, social, and legal issues associated with using AI tools in higher education. The DigComp 2.2 framework, updated in 2022, reflects the evolution of digital skills to include AI by focusing on AI competences and interaction skills. In April 2023, an interdisciplinary team of faculty, staff, and students from two Colleges in an Irish university, came together to collaboratively work on a 21-month project (University College Dublin, 2023) with the following objectives:

1. Critically evaluate the current use of high-profile (e.g. ChatGPT, Copilot, Gemini) AI applications within the two Colleges, using the DigComp 2.2 competences framework (Vuorikari et al., 2022).
2. Co-design an AI digital capabilities matrix for the contextualisation of 'AI readiness' training resources for all disciplines in the university.
3. Collaboratively co-develop and design 'AI readiness' training resources for both faculty and students; pilot the resources; evaluate, refine and revise based on feedback – all of which will take place in 2024.

This paper reports the findings and outputs from the first of three phases of the project, initiated in April 2023.

2. Literature Review

A Rapid Realist Review (RRR) was conducted to explore how artificial intelligence is being integrated into higher education (Population). The primary aim of the RRR was to uncover the underlying mechanisms and contextual factors (Interest) that influence the successes and challenges of AI integration in higher education, in order to inform the development of ‘AI readiness’ training resources for faculty and students (Context) (Saul et al., 2013; Smela et al., 2023). To capture recent developments, it was decided to focus on peer-reviewed articles, conference papers, reports, and grey literature with publication dates since November 2022. To examine the included studies, a realist approach was applied with the goal of identifying the mechanisms (e.g. perceptions about AI, rate of technology adoption, pedagogical shifts) and contextual factors (e.g. institutional culture, policies, and resources) that influence both positive and negative outcomes of AI integration. The findings of the RRR would inform focus group discussions faculty and students and subsequent development of ‘AI readiness’ training resources for both.

2.1. Insights

The literature on AI in higher education primarily addresses the challenges and possibilities of integrating large language models like ChatGPT and GPT-4, consistently emphasizing the need for AI literacy among faculty and students (De Fine Licht, 2023; Luckin et al., 2022; Nazaretsky et al., 2022; Neumann et al., 2023; Pisica et al., 2023). Key concerns identified include maintaining academic integrity (Lin et al., 2023), addressing biases in AI models (Liang et al., 2023), as well as exploring AI's potential to transform teaching and learning through personalized approaches and inclusivity(Chan, 2023; Cooper, 2023). The role of AI in specific fields like medicine (Harrer, 2023), its implications in scholarly research (Alasadi & Baiz, 2023), and the importance of developing comprehensive AI integration policies (Farrelly & Baker, 2023), guidelines (Inamorato Dos Santos et al., 2023) and need for further research (Laupichler et al., 2022) are also explored.

A notable omission in the literature is a thorough exploration and identification of specific methodologies and curricular strategies to train higher education students in how to use AI effectively and ethically. Although the importance of AI literacy is frequently acknowledged, there is a lack of in-depth discussion about how educational institutions can practically implement training programs or incorporate AI education into existing curricula. This is a significant gap as AI technologies rapidly evolve and become increasingly relevant in various professional and academic contexts.

3. Research Methodology

Focus group methodology is a qualitative research technique that involves interactive group discussions led by trained moderator(s) to explore participants' perceptions and attitudes. Thematic network analysis was used for data analysis, as described by Attride-Stirling (2001). This method systematically organizes data into basic, organizing, and global themes, as detailed by Braun & Clarke (Braun & Clarke, 2006, 2022), allowing for a structured understanding of complex qualitative data and revealing underlying patterns and narratives. The goal is to discern and interpret relationships between themes for data interpretation.

The study involved three student focus groups and three faculty focus groups across various disciplines, with a total of 20 students and 17 faculty members. Faculty focus groups were conducted by colleagues who are experts in qualitative research, and student focus groups by trained students who were partners in the project. The sample was diverse, including both undergraduate and graduate students, and faculty from different academic and professional fields, providing a comprehensive range of perspectives on AI's role and impact in higher education.

4. Results

Students expressed a mix of optimism and concern towards AI, recognizing its utility but were also apprehensive due to their limited understanding of its full capabilities. They pointed out the inconsistencies in how AI is portrayed by individual lecturers and across different academic disciplines in the university. While showing interest in AI tools, students expressed caution against over-reliance, particularly wary of ethical issues like unintentional plagiarism or potential for academic misconduct through a lack of knowledge. They advocated for a balanced integration of AI in the curriculum, emphasizing that it should complement rather than replace traditional teaching methods. Students emphasised the need to provide a consistent approach and structured AI education and training, which would help them understand AI capabilities, limitations, and ethical use. It was also recommended that there be consistent updates in AI training materials provided, considering the continuous evolution of AI. Finally, students made it very clear that there is an urgent need to develop ethical guidelines and policies governing the use of AI in higher education, which should focus on issues of plagiarism and academic misconduct, particularly with regard to summative assessments.

Faculty identified a significant knowledge and skills gap in AI, necessitating urgent training to address the perceived AI skills deficit. They recognised AI's potential to positively impact pedagogical practices, e.g. quickly creating updated teaching materials, and task efficiency in areas like grant writing. Concerns were raised about AI's accuracy, reliability, and implications for equality, diversity, and inclusivity in higher education. Ethical issues and academic integrity were identified as significant challenges and concerns. Concerns were also raised about the stigma prevalent against faculty who disclose the use of AI tools in their work. Recommendations included open discussions on AI and urgent training for faculty to bridge AI knowledge gaps, establishing policies for ethical AI use, and guidelines to ensure equitable AI integration without disadvantaging any student group e.g. students not able to fund premium access to popular AI tools or students whose first language is not English.

The discussion within the focus group emphasised the significant disparities in student and faculty knowledge and skills about AI. This discrepancy was further emphasised by the varying levels of understanding and engagement across different academic disciplines, highlighting the need for a comprehensive and interdisciplinary AI capabilities matrix. The development of this matrix is crucial in providing a contextual framework for the implementation of interdisciplinary 'AI readiness' training resources. The AI Capabilities Matrix serves as a guide for the ethical and appropriate use of AI tools in academic settings, with the flexibility to adapt to different learning environments. It encompasses key factors such as the identification of misinformation, avoidance of plagiarism, evaluation of AI bias, and ethical practices when using AI tools. This approach aligns with the aim of defining suitable and ethical applications of AI in higher education, ensuring the matrix's relevance and effectiveness in a range of educational contexts.

The AI Capabilities Matrix as detailed in Table 1 presents a comprehensive and structured approach for faculty and students to identify and enhance their AI competencies in a systematic manner.

Table 1 AI Capabilities Matrix cross-referenced to DigComp 2.2 AI Competences Framework

DigComp 2.2 Competence Area	AI Capabilities	Example Activities to Develop AI Capabilities
2.1 Identifying needs and technological responses	Recognising situations where AI tools can assist or augment human abilities.	Brainstorming activities where AI could help in academic studies and research.
2.2 Innovating and creatively using technology	Thinking creatively about how AI can be applied to innovate processes or solutions.	Design workshops focused on developing new and innovative AI applications.
2.3 Identifying digital competence gaps	Conducting self-assessments to identify personal gaps in AI knowledge.	Completing 'AI readiness' questionnaires or skills checklists.
3.1 Developing digital content	Using AI to generate content while applying critical thinking to evaluate output.	Using AI writing assistants to draft essays or study notes.
3.2 Integrating and re-elaborating digital content	Curating, synthesizing, and revising AI-generated content to meet academic standards.	Reviewing and editing AI assignment drafts to maintain original voice.
3.3 Copyright and licenses	Applying proper attribution and citations when integrating AI outputs.	Following academic citation standards when using AI sources.
3.4 Programming	Building technical skills to train, customize, and optimise AI systems.	Completing beginner AI coding tutorials focused on machine learning.
4.1 Protecting devices	Taking measures to prevent misuse of AI systems.	Learning security best practices for deploying AI apps and bots.
4.2 Protecting personal data and privacy	Considering privacy and ethical implications of training and using AI.	Examining AI bias, transparency, and data collection policies.
4.3 Protecting health and well-being	Avoiding overdependence on AI and maintaining human knowledge/skills.	Setting guidelines on responsible time spent using AI tools.
4.4 Protecting the environment	Considering the environmental impact of developing and running AI systems.	Researching energy usage, carbon footprint, and sustainability of AI.
5.1 Solving technical problems	Troubleshooting errors and imperfections when using AI systems.	Correcting an AI chatbot that gives incorrect responses.
5.2 Identifying needs and technological responses	Evaluating the limitations of AI systems and appropriateness for specific tasks.	Analysing whether AI or human effort is better for a task.
5.3 Creatively using digital technologies	Exploring ways to use AI to enhance creativity rather than replace it.	Using AI to generate creative writing or art ideas as a starting point.
5.4 Identifying digital competence gaps	Seeking training and development opportunities to improve AI skills.	Enrolling in AI courses and workshops to expand capabilities.

5. Discussion

AI has the potential to greatly change the learning and teaching experience in higher education, but it also presents new challenges that must be tackled. All focus group participants expressed the need for targeted training and clear guidelines on using AI tools within higher education. To successfully integrate AI in higher education, a comprehensive set of capabilities is necessary, including a fundamental understanding of AI models and tools, critical thinking skills, and ethical considerations, especially concerning academic integrity. The AI Capabilities Matrix will serve as the foundation of an 'AI readiness' training curriculum for faculty and students. The resources will be developed in a self-directed, multi-modal online format, structured in four units as follows:

1. **Introduction to Generative Artificial Intelligence (GenAI)**: Serving as a non-technical overview, this unit will define key AI-related terminology, major GenAI models and tools, and outline foundational GenAI competencies that need to be employed when deciding whether or not to use GenAI in an academic context.
2. **GenAI tools**: This unit will offer an overview of a number of GenAI tools, including their features, capabilities, and offer step by step guidance to first-time users of GenAI tools.
3. **Learning and teaching with GenAI**: This unit will focus on how to use generative AI to support and enhance teaching and learning. This will include an introduction to GenAI prompts, outlining best practices for prompting, with a wide range of exemplars for use in an educational context.
4. **Important considerations before using GenAI**: This unit will include examples of how to integrate GenAI into every-day practice, including a consideration of its potential and limitations, while emphasising use of GenAI as augmentation over replacement of personal effort. It will also detail how to perform fact-checking and improve evaluative judgment of GenAI tool outputs.

This structured approach not only prepares faculty and students to effectively use AI, but also encourages considered and ethical use of AI, recognising its potential and limitations, while emphasising critical evaluation of generated outputs. By developing a curriculum that progressively builds from basic AI concepts to advanced application and critical analysis, the resources aim to equip faculty and students with the necessary skills and knowledge to successfully navigate the evolving landscape of AI in education.

6. Conclusion

The findings and outputs of phase 1 in this study lend an insight into the issues arising around the integration of AI in higher education, accentuating its diverse impacts and potential for both

positive and negative outcomes. The findings highlight a broad spectrum of perspectives, ranging from AI's practical application in everyday academic tasks, ability to personalise learning, foster student engagement, enhance educational inclusivity, to its ethical and practical challenges. Notably, the literature emphasises the urgent need for effective AI literacy among faculty and students, while focus group insights reveal somewhat similar concerns and aspirations among faculty and students related to AI's role in higher education. The proposed AI Capabilities Matrix provides a valuable tool for understanding and integrating AI in higher education curricula. The study's limitations, primarily its small sample size and the rapid evolution of AI technologies, point towards the need for constant adaptation of training resources to stay current, and the need for ongoing research in this area. Overall, this research marks a significant step in understanding and shaping the integration of AI in higher education, laying the groundwork for future developments in this rapidly evolving field.

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Beyond the Machine: Human-AI Collaboration in Jewelry Design

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Abstract

Creativity is a widely debated topic, as this concept is arguably the quintessence of Humankind. Artificial Intelligence constitutes a radical and unprecedented change because it disrupts this prerogative. The article analyzes the relationship between human creativity and Artificial Intelligence in jewelry design higher education. The hands-on research experience is described in terms of results, limitations, and opportunities. Integrating AI into the design process is not limited to mere technical assistance. Still, it is a dialogical collaboration in which AI becomes a creative partner that may support and amplify the designer's idea. In this context, designers behave as interpreters mediating between their vision, aesthetic, sensitivity, and the outputs of the software, which has to be coached and guided in a process of iterative dialogue.

Keywords: *Jewellery Design; Creativity; Artificial Intelligence; Higher Education.*

1. Myths, Machines, and the Human Mind: Navigating the Evolution of Creativity

But fiction has enabled us not merely to imagine things, but to do so collectively. We can weave common myths such as the biblical creation story, the Dreamtime myths of Aboriginal Australians, and the nationalist myths of modern states. Such myths give Sapiens the unprecedented ability to cooperate flexibly in large numbers.

Harari, 2015

The engine of innovation, artistic expression, and understanding of the social and cultural fabric: creativity, imagination, and, more generally, abstract thinking have played a crucial role in the history of humanity's evolution and its distinction from other living species, enshrining a key position in its evolutionary process (Harari, 2015): these capacities have enabled *Homo Sapiens* not only to survive but also to thrive, build complex societies and cultures, and become the dominant species on the planet. Imagination and abstract thinking are those abilities peculiar to humans to conceive ideas, develop concepts, and figure out scenarios that have no immediate

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or direct physical counterpart in reality: this, therefore, means not only thinking about abstract concepts such as time, morality, or justice, but also the ability to imagine and prefigure objects, situations, or worlds that do not exist or have not yet existed. According to Yuval Noah Harari in his "Sapiens: A Brief History of Humankind," it is this very ability of ours to believe in shared stories, myths, religions, and ideologies that underlies our ability to cooperate in extended groups: it is these abstract narrative constructions based on imagination that have enabled humans to cooperate in a structured manner and vastly greater numbers than other living species, overcoming the limitations imposed by immediate interpersonal relationships. Imaginative abilities have thus been crucial to humankind's distinction and evolutionary success, enabling it to construct and navigate complex social and cultural realities unique to the animal kingdom. Artificial Intelligence now threatens to subvert this uniquely human prerogative to think, create, and imagine. Indeed, the introduction of Artificial Intelligence, especially in design, crafts, and applied arts in general, has thus ushered in an era of transformation, opening up new creative and technical possibilities. However, this disruptive innovation has also fueled debate about its role within creative processes and possible ethical implications (Mahadevan, 2018), such as replacing machines in activities that are not only practical but also speculative and creative, like art practices (Chatterjee, 2022). From the first industrial revolution onward, the role of technology, intended as *'machina*,' the machine, has been predominantly confined to the practical dimension, that is, to aspects related to the physical realization of objects, to mass production, and contrasted with *'manus*,' the expert hand of the artist or craftsperson that conferred uniqueness, preciousness, and harmony with its intervention (Bolton, 2016; Cappellieri et al., 2021). With the introduction of Artificial Intelligence, this debate has expanded: technology is breaking the boundaries of the physical dimension of artifact making, creeping into the imaginative skills that have always been the unique prerogative of humans. Recent research has opened the discussion around the role of AI and Generative AI in relation to creativity and art, focusing on the relationship between human intellect and the machine (Mazzone & Elgammal, 2019). This topic raises fundamental new questions: how is human creativity positioned in this new context? How can AI coexist with, complement, or even enhance human creativity in design? What skills will the new professionals working in design need to have? What impact will it then have on education?

2. Methodology

2.1. Structure and brief of the workshop

The research explores how integrating Artificial Intelligence in design education, with particular application to jewelry design, impacts the creative process and roles. The research was conducted through a month-long workshop experience in the Accessory Design Studio at the Master's Degree Program in Name of the Degree Program at the Name of the School of Name

of the Institution. The workshop involved 37 international students, 1 professor specialized in jewelry design, and 1 Ph.D. student as tutor of the activity. The brief of the project was to create a capsule collection that embodies the concept of the Greek binomial *Kalos Kai Agathos*, that means "beautiful is also good." This concept challenges the students to explore the contemporary notions of beauty today while integrating principles of sustainability and ethics into their design process. The target audience for this collection was Generation Z (GenZ), a demographic known for its strong values and desire for products that align with their beliefs. In particular, this is a generation whose shopping behavior is largely influenced on the one hand by digital technology and on the other by social factors (Turner, 2015; Kowalska et al., 2020). The methodology to be followed during the workshop to satisfy the requirements of the proposed brief included specific goals, i.e. concept exploration with concept statement exploring the brief; design integration and development including a mood board, target and lifestyle, sketches, technical drawings, material board, a physical prototype, and advertising board; sustainability research and ethical considerations; focus on GenZ. Students were asked to choose and integrate AI tools into their design process. The workshop included initial lectures on the project brief, contemporary interpretations of jewelry design, meta-design, and digital fashion, including suggestions on AI tools to experiment with in the design process. However, the AI tool integration process preferred learning-by-doing and free exploration methods.

2.2. Data analysis process

To conduct the analysis, a continuous observation process was activated through the conduct of lessons and project reviews. At each lesson, students participated in individual reviews with professors, showing their progress and explaining the design process used. Moments of independent individual work were promoted and conducted with continuous monitoring of the activity. Furthermore, the students were asked to produce a final report on the integration of the AI tools which was used to analyze the research results. In particular, specific questions were asked to the students, useful for arguing the report and collecting useful data: How did you integrate AI into your design process? Which AI tool? Why did you choose them? What was the positive feature of using them? Which was the negative one?. The analysis of the research results involved the evaluation of the design outputs, according to criteria of relevance to the design brief, autonomy of the design process, and originality of the concepts, and the analysis of the reports highlighting the AI tools used, role within the design process, limitations and opportunities of the tools, specific comments from students. In the following paragraph, the main results will be presented.

3. Results

The workshop produced 37 capsule collection proposals related to the *Kalos Kai Agathos* concept co-created with the support of different AI tools. Among the 37 reports produced by the

students, 5 were not taken into consideration for the analysis as they had partial or missing information on AI. Furthermore, one student expressly declared that did not use AI in the design process and was consequently excluded from the evaluation of the reports. In total, 31 reports exposed interesting results on the integration of AI tools into the design process. The students integrated 25 different AI tools into their design process, primarily using ChatGPT and Photoshop AI Beta. In particular, the tools identified are shown in Table 1.

Table 1. AI tools that emerged from the report submitted to the students. The table shows the name of the AI tool with the corresponding number of students who used it. The total number of students is 31. Source: created by the authors (2024).

CHAT GPT	27	PHOTOSHOP AI	11	MICROSOFT BING	3
ILLUSTRATOR AI	1	NOMAD	1	MITO DESIGN STUDIO	1
PROME AI	1	KHROMA	2	MIDJOURNEY	4
APPFLAIR	1	PIXEL CUT	1	GENCRAFT	1
GENTIMING.AI	1	DALL-E	3	ADOBE FIREFLY	1
PEBBLEY	2	LOOKA	1	VIZCOM	1
REMOVEBG	1	HYPOTENUSE AI	1	IMMERSE	1
RUNWAY	1	AI IMAGE ENLARGER	1	LEIAPIX	1
ZYRO	1				

3.1. Uses of AI tools emerged from the analysis

The students used ChatGPT especially in the ideation phase, favoring its conversational aspect to implement the initial brainstorming process and collect data on trends, competitors, and the target audience. Some of them stated how it supported their decision-making and allowed them to explore different design alternatives. They particularly appreciated "*the ability to engage in a dynamic conversation allowed for a more nuanced exploration*", the ability to "*expand my thinking and quickly understand a familiar concept*", or the fact that "*it helped me to get new ideas while I was mentally stuck*". Some non-native English-speaking students used it to help correct grammar and improve the project description. Although ChatGPT was considered an essential tool for exploring and carrying out research for the project, critical issues emerged relating to the truthfulness and timeliness of the information produced by the AI, often limited to the data with which it is trained. The students highlighted how the "*importance of grasping directions*" among the alternatives that the tool proposes emerges, underlining how the designer and creatives "*must adjust and confirm the information that it gives us*". This result is close to the discussion proposed by Verganti et al (2020), according to which the designer's activity, in relation to that of the machine, would be oriented more towards sensemaking, underlining the importance of leadership and decision-making, changing design practices.

3.2. Limits and Opportunities of AI tools

The students bring out a precise awareness around the limits of the AI tools, especially regarding the biases of the data it uses to produce answers regarding the lack of "*human touch*" in the answers and in understanding the emotional aspects of the project. Furthermore, some of them

appear concerned about the possibility of standardization of the proposed results and support the priority and essential role of the designer in the creation of the project: "*AI tools might lead to a potential reduction in the human touch and intuition essential for artistic expression in fashion design.*", "*it has limitations in generating truly creative and novel ideas. For the artistic aspects of fashion design, human creativity remains essential.*", "*The answers given to the prompts are not always specific, therefore giving general information sometimes useless*". The students also highlighted how many of the difficulties in obtaining the desired output, particularly when using Midjourney, DALL-E, or Photoshop's generative fill, were due to the learning curve of the programs, and that with more practice they would have acquired greater naturalness in writing prompts: "*I was pleased with the result, while in others, less so. This variation is also due to my limited knowledge of using them to their full potential.*", "*Ensure to invest time in understanding these tools to maximize their effectiveness and minimize potential pitfalls.*", "*managing prompts input to get desired results can be a daunting task".*

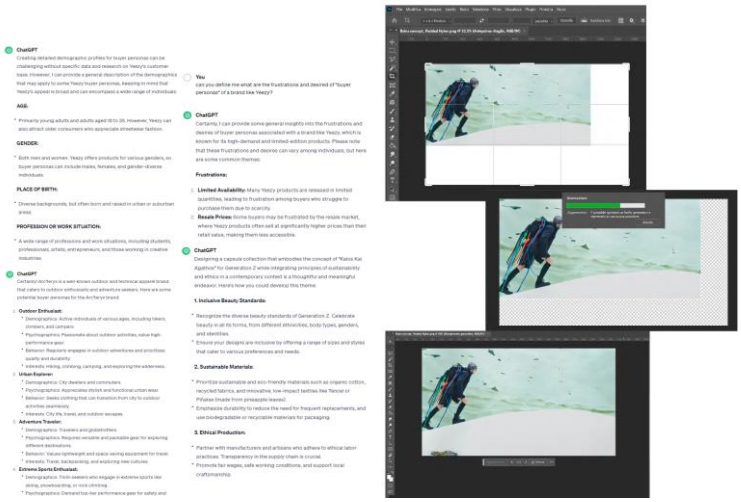


Figure 1. Example of a workshop student's combined use of ChatGPT and Photoshop AI Beta. In particular, the two tools were used respectively for the brainstorming and research stage, and for the editing of the ADV, i.e. for the beginning and end of the design. Source: images provided by the student in the final report of the workshop (2024).

4. Discussion

4.1. A Conversational Co-Creative Process

In ancient Greece, dialectics was the art of dialogue, of discussion. The dialectical method was based on structured dialogue between two or more people with different opinions. For Socrates, dialectics was a research method based on dialogue that he used to draw out personal thoughts

and positions from his students (Giannantoni, 2005). For Plato (Migliori, 1990), it was the tool par excellence of philosophy, being the privileged way to go back from the manifold to the unity of the Idea, which is the origin and final goal of knowledge: that cognitive procedure that allowed access to the essence of things, grasping the universal ideas beneath the multiple determinations of the real world. The dialectic approach thus allowed a higher truth or a better solution to be reached by synthesizing different perspectives. Dialectics thus constituted a method aimed at structuring an argument and a useful tool for seeking truths. Dialogue was the preferred tool for comparing different and sometimes opposing ideas. Through this tension between the parties, it was possible to explore and define abstract concepts, seek solutions or answers to complex questions, and enrich knowledge. Conversation, constructive confrontation, dialogic tension, fusion of different perspectives, collaboration, and iterative processes oriented toward effective solutions also underlie the relationship between human creativity and artificial intelligence. Although widely misunderstood as an autonomous creative entity, AI acts as a collaborative partner within the creative process. Images and ideas are not born "from" AI but "with" AI in a co-creative journey that merges human intelligence with machine computational capabilities. This synergy emphasizes the importance of the role of the designer, who is not just a creator but also a sort of *educator* for the AI software. In this co-creation process, the designer thus takes a proactive role, engaging in AI training to achieve coherent content and direct a given aesthetic. In this perspective, the AI is an evolved extension of the artist's palette. In this iterative dialogue, the workshop students challenged the AI on content and aesthetics, training the AI to recognize and replicate different styles in line with their visions. The designer's training of the AI software is not merely a technical act but an iterative creative process: they add their stylistic inputs and preferences into the system using prompts and images, and this process allows the AI to "learn" and develop an aesthetic in line with the sensibilities of its human trainer. The result is a hybrid output blending human aesthetics with AI's precision and processing power. The co-creation, therefore, is not unidirectional but appears as an ongoing dialogic tension between the designer and the software: designers gradually provide feedback on the outputs generated by the AI, moving closer to their original vision but embracing the unexpected. Indeed, the co-creation process involving Artificial Intelligence is characterized by high unpredictability. The diversity and uniqueness of AI-generated responses can enrich the creative process by introducing unplanned elements. This constant iteration allows for progressive refinement of the AI's creative capabilities, leading to results that are increasingly in line with the designer's content expectations and aesthetic sensibility.

4.2. Integrating Creativity and Technology: The Evolving Role of Designers in the AI Era

Interpreter, but also moderator, of this dialogic process, straddling the physical dimension of the real and the intangible world of the digital proper to AI: the figure of the prompt designer emerges as a possible key player in this iterative process. These creatives have the role of formulating textual prompts and inputting images that guide AI toward results that are as

specific and timely as possible, incorporating style, tone, and creativity. The prompt designer sits at the intersection of the technology analytic approach to technology and the synthetic approach to creativity, combining technical and creative skills: in fact, they must not only be familiar with the language and capabilities of AI but also be familiar with the design method, the logic of the reference system, in terms of physical and aesthetic constraints. Creating prompts becomes a design process in its own right: it is not just about providing instructions but about expressing concepts, emotions, and visions through a language the AI can interpret and transform into output. Prompt designers must be able to manage a dual point of view: seeing the world through the filters of AI to understand and predict how it can interpret and transform the input provided while maintaining their creative vision.

5. Conclusions

The paper analyzes the relationship between human creativity and artificial intelligence in higher education in jewelry design. It first highlights the privileged role of creativity and abstract thinking in the evolution of humanity. It identifies the introduction of artificial intelligence as a radical change precisely because it disrupts the prerogative. The research investigates how the introduction of this technology has impacted the world of jewelry design and its implications in higher education. The results highlighted how the iterative conversational aspect with AI tools such as ChatGPT is preferred, where human language intersects with the artificial one to generate creative alternative solutions. Having a co-assistant on the design project can push the limits of the human mind and provide enhanced design exploration. The limits of AI tools also emerge, especially in the possibility of standardizing the results and in the difficulty in the relationship with the machine itself, which involves a refinement of the language used to construct the prompt. The integration of AI into the design process is not limited to simple technical assistance; it is an actual collaboration where the AI becomes a creative partner that can amplify and enrich the designer's vision. In this context, designers behave as interpreters able to mediate between their vision, their sensibility, and the software outputs that must be coached and guided in a process of iterative dialogue. This new paradigm raises fundamental ethical questions about authorship, the creator's identity, and the nature of the creative process itself. In a world where AI plays such a central role in creation, what does it mean to be a designer? How is human creativity perceived and valued? These questions open up further research for an interdisciplinary field of inquiry involving technology, art, philosophy, and sociology.

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Bridling, Taming and Riding the AI Beast

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Abstract

When ChatGPT was broadly released in the fall of 2022, university faculty and administrators struggled to evaluate and predict AI's impact on higher education. They also faced the immediate need to create policies for its ethical use in academic settings, as well as devise ways to incorporate AI into daily teaching and learning. This article offers the description and results of a teacher-led student group incorporating AI into a learning experience using three distinct projects. Generally students found the use of AI, used in a thoughtfully prescribed manner, in filling knowledge gaps, as a thought partner, and in analyzing original L2 writing, as a positive tool in their learning. It is recommended that higher education instructors design learning and assessment experiences using AI to enhance the learning process.

Keywords: *Keywords: AI, ChatGPT, language learning, thought partner, prompt writing.*

1. Introduction

Bridling, taming and riding the artificial intelligence (AI) beast to benefit and advance student learning has been and continues to be a bit of a wild adventure in higher education. When a major AI release occurred in fall 2022 in the form of ChatGPT, it sent university administrators and faculty scrambling to evaluate and predict its impact as well as create and implement policies for its ethical use in academic settings. At many institutions of higher learning instructors were largely left to their own devices when it came to its use and implementation in the classroom. AI systems analyze large datasets and generate content with great speed and relative accuracy based on the input or prompts by the user. A variety of computer assisted learning tools have been incorporated into the classroom across the decades, and yet the introduction of large model machine learning technology has raised concerns to the next level, especially regarding its use in educational settings.

The incorporation of AI into the classroom has certainly been controversial in nature. Alharbi (2023) notes, "As AI-powered digital writing assistance goes beyond vocabulary and grammar

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to more sophisticated and "human-like" help, then language educators and researchers may have reservations about the authenticity of students' submitted writing" (p. 2). Alharbi (2022) also notes that as AI is incorporated into learning experiences there are likely to be a range of accessibility, abilities, perceptions and reactions. One of the common ethical concerns is that it has become increasingly difficult to detect plagiarism in AI-generated content submitted as original student work (Eaton, 2021). Owing to this difficulty, Godwin-Jones (2021) suggests that educators find creative ways to assign credit and design tasks that blend AI-generated material with original student effort and analysis. Sumakul et al. (2022) suggest that when deciding to incorporate AI in the classroom both teachers and students must engage in a collaborative effort, essentially investigating and co-designing for the best possible outcome. Ranalli (2021) recommends that learners be given opportunities to critically analyze AI-generated material to determine its usefulness and validity. Raising awareness about the limitations and biases, as well as the generation of potentially invalid content helps establish a healthy relationship with this type of technology. Educators should both acknowledge the amazing aspects of AI and its generated content along with opportunities to discover the drawbacks, in order to establish a balanced approach to the incorporation of AI into the learning environment. It is important to note that while AI can be used to develop students' writing skills, Huang and Wilson (2021) state that it should play a supporting, not leading role. Pellet and Myers (2022) suggest that students record their experiences and encounters specifically with writing tools as a reflective practice.

Seasoned instructors understand that students will use emerging technology regardless of their effectiveness or ethics. According to Otsuki (2020), educators are responsible for adapting existing learning and assessment methodologies to allow students to use AI tools in a collaborative fashion. AI tools are being used throughout the world in the workplace in a variety of professions. Otsuki (2020), Hellmich et al. (2021), and Carvalho (2022) all agree that appropriate guidance in the use of AI tools is needed and it behooves educators to enhance students' digital literacy in both educational and professional settings. Fredholm (2019), Lee (2020) and Sumakul et al. (2022) noted significant improvement when teachers mediated the learning process and provided training on the use of computerized learning tools.

2. Research Questions

With every AI update there is an opportunity for educators to respond with dread, excitement or indifference. Being a part of the vanguardian group incorporating AI into the classroom and in education administration can be risky, exciting and frustrating. Harkening back to the analogy of a bridle, this tool, when properly used by the horse's rider, serves to give directional control to the left or right, as well as forward and reverse. Bridling an entity that is inherently unpredictable, offers a semblance of control. In my role as an instructor of Spanish for Business Professionals as well as English as an additional language, I felt motivated to hop in the corral

as it were and see what benefits I might experience by incorporating AI into the language learning classroom. By thoughtfully designing projects and setting specific parameters around its use, I planned to pose the following questions to study participants after the completion of several group assignments utilizing ChatGPT:

1. How well did ChatGPT serve as a thought partner?
2. What were the advantages/disadvantages in using ChatGPT?
3. What results were found after analyzing and validating information produced by ChatGPT?
4. Was ChatGPT helpful as a grammar tool?
5. What is your attitude about using AI in the academic environment?

3. Methodology

I have engaged AI in the classroom in a number of ways that have served to introduce this technology in cautious and reasonable ways. Incorporating the use of AI as a thought partner, to fill knowledge gaps, to assist with organizing projects, and in analyzing original L2 writing has shown AI's potential to help students expand their knowledge base, use their time more effectively, and better develop and use their critical thinking skills. The learning objective of the first project in this study was for participants to work in groups to use their knowledge and skills to develop a well-rounded diversity, equity and inclusion event highlighting aspects of specific regional cultures in countries where Spanish is the predominant language. When prompted by the participants, AI provided the template for such an event. Participants then generated prompts to discover what cultural content might be generated by AI. They were instructed to validate the content with outside refereed sources.

The second project of this study tasked participants with using AI to evaluate a short essay that the students had originally produced in the target language (Spanish) without outside assistance, during a face-to-face exam. Participants entered their essays into ChatGPT and then prompted it to evaluate the essay, looking specifically for the accuracy of grammar, spelling, syntax, and vocabulary. The students evaluated the AI-generated suggestions for patterns in what ChatGPT determined to be mistakes in the target language. Participants then reported the patterns as a type of formative assessment and created personal language goals based on the AI-generated feedback, paired with their personal evaluation. By doing so, both participants and the instructor benefitted from and engaged in an assessment and evaluation of the original writing sample in the target language. Study participants responded to a Google form survey about their experiences in using and evaluating content produced by AI.

The third project was conducted in an Advanced Oral Communication course designed for international students whose first language is not English. The language objective of the overall

project was to become familiar with and practice point/counterpoint debate protocol, pragmatics and suprasegmentals. Participants used ChatGPT to help generate content and verify structure for the debate topic of The Right to Know vs. The Right to Privacy.

4. Results

Thirteen students (11 females and 2 males) enrolled in a Spanish for Business Professionals course participated in the first and second projects and completed a survey regarding the experience. Seventy percent of the participants had never used ChatGPT prior to the start of the project, which was conducted roughly one year after the AI platform had become widely available. When asked how well AI assisted in planning a cultural event, 84% of the participants noted that it generated a helpful timeline and outlined a series of recommended activities, but 62% felt that the recommendations were vague. Some students postulated that it might be owing to a general lack of published information on the more obscure cultures chosen, while others questioned and revised their original prompts to gain further information.

As shown in Figure 1, when asked about the advantages of AI as a thought partner, 61% of the participants indicated that AI helped them generate content that they otherwise would not have thought of on their own and 54% indicated that it saved them time by gathering relevant content. Eighty four percent of participants indicated that AI helped them organize the structure of the project and 54% said that AI helped guide the group discussion.

One of the parameters of the project was for participants to use outside resources to verify AI-generated content. Based on their findings, 53% of the respondents reported that they felt AI generated questionable content. Part of the design of the group project entailed the participants discussing the validity of the AI generated content. Seventy seven percent indicated that the team members felt comfortable in questioning the generated material and 46% felt comfortable questioning the usefulness of the content in the overall project. When asked about their experience with prompt writing, 38% of respondents felt it was complicated to create prompts that would generate the content they were seeking and more than 60% of participants noted that they had to submit more than one prompt to generate useful information. Participants shared that they had to specifically describe the types of tasks that they wanted AI to perform. Eighty five percent of participants also noted that while academic language was not necessary, thorough and more detailed wording generated more satisfying results.

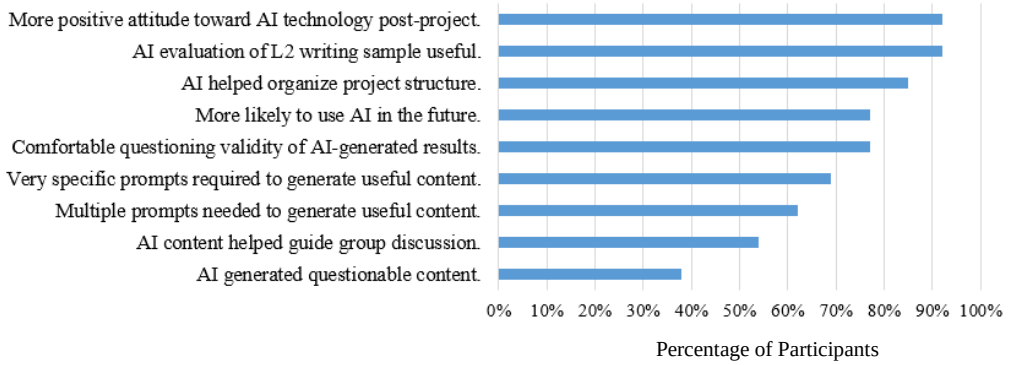


Figure 1. Summary of AI Project 1 Survey Results. Source: Despain (2024)

In the second project, participants in the study used AI to review an original paragraph that they had written in the target language without a computer or any outside assistance during a face-to-face proctored exam. After inputting the paragraph into ChatGPT with a prompt to correct the grammar, spelling, verb tense, written stressmarks and word choice, etc., 39% of the participants noted spelling errors, 23% found mistakes in their use of written stress marks, 23% highlighted subject/verb agreement issues, 30% noted their overuse of subject pronouns, 31% had verb tense issues, 39% recognized sentence structure errors and 77% identified word choice suggestions. Study participants tracked and recorded patterns of errors identified by AI and made notes for future compositions. Based on their experience using AI, 92% of the participants indicated that they had a more positive outlook regarding AI technology and when asked if they would likely use AI as a thought partner in future classes and assignments, when authorized, 77% indicated they would. Based on their experience using AI in the class, 66% of the participants indicated they would use AI to evaluate target language content they create in the future. When asked if professors should incorporate the use of AI in the learning process, 77% of the participants had a favorable response.

In the third project, conducted in an Advanced Oral Communication course roughly four months after ChatGPT became widely available, all participants (5 females, 4 males) reported a positive attitude regarding the use of AI in preparation for a debate. Authorization was given to use ChatGPT as a thought partner, to clarify and generate material as well as anticipate possible counterpoints. The participants, all graduate students in various academic fields, acknowledged the specific parameters of the project and noted the significant amount of time saved on the portion of the assignment that was not directly related to the learning objective, namely generating and organizing content on a topic unrelated to course content, allowing more time to be spent on practicing the task of presenting, backing up facts and opinions, listening for and acknowledging opposing viewpoints, firmly taking a cooperative stance and employing suprasegmentals to accurately convey a message.

5. Discussion

The purpose of this study was to gauge the experience, interest and response of participants in the use of AI. With the capabilities of AI expanding at an incredible rate, it is imperative that instructors make deliberate decisions regarding its use in the academic setting. The in-class design of these three highlighted projects was intentional. As the researcher, instead of assigning the investigative process with AI as a homework experience, it was essential that I observe and supervise participants as they engaged with ChatGPT, which, for the majority of the participants, was their first authorized opportunity in an academic setting. One of my first observations related to the participants' attitude about using AI as they began projects #1 and #2. The majority of participants expressed uncertainty and questioned the ethical use of AI regardless of instructor-authorized use. On the other hand, one student was visibly excited about testing out the capabilities of AI, and shared with the participants the fact that their roommate, who was in a STEM field, had been highly encouraged to use AI in several courses. They noted that the field in which they were majoring had very strict and punitive no-use policies in place for all Humanities and Social Sciences based major courses. Another student shared about their parent's use of AI on a regular basis in their employment.

Generally speaking I was able to witness both the excited discovery at how ChatGPT responded to prompts as well as the vocal skepticism and questions that came with experimenting with new technology. After observing and receiving the participants' feedback from the three different projects it became apparent that it would benefit students in higher education to obtain additional instruction and opportunity to better learn how to construct effective prompts and to uncover the various capabilities of generative AI as a thought partner, organization tool or evaluator of originally work in a target language and to discuss ethical use parameters in the academic setting.

Limitations in this study could be addressed in future research by increasing the number of student participants, by assessing faculty knowledge and attitudes regarding the use of AI and by expanding the types of academic projects incorporating AI.

6. Conclusion

While the introduction and expansion of AI technology has generated robust conversations about its value and ethical use, specifically in the academic circles, it cannot be denied that societal trends indicate its acceptance and broad use in professional venues. It has been shown that using AI in guided learning experiences as a thought partner, an assistant for organization purposes, a filler of gaps in knowledge and in evaluating original L2 writing are all viable tasks that can be incorporated into the classroom without pushing ethical boundaries. When students are guided through and document the process, and are given opportunities for critical analysis of generated content, they develop a balanced mindset about what AI can and cannot produce

as well as the value of what it produces. It is evident that the skill of prompt writing can and should be taught in a variety of academic settings so that students can more effectively harness the valuable aspects of AI and manage it in ways that are productive and ethical in academic and professional settings. Mindfully bridling technology and designing constructive ways for its use in the academic arena provides a smoother riding experience for students as they transition into a professional setting.

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Project for the introduction of a materials library within a conventional library of a university degree in architecture

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Abstract

This communication presents a recent and unprecedented teaching experience in the degree of architecture in a polytechnic university related to the training of its students, which incorporates the library as a mixed centre of resources on materials. Its aim is to overcome the gradual separation of new students from the analogue world in favour of the digital world. The aim of the experience is to implement a materials library in the library, as a teaching resource for self-learning outside the classroom, oriented towards subjects in the field of Architectural Technology. It is an initiative with potential results of interest to higher education professionals, involving the library, the collaboration of subject teachers and a link between the digital and analogue worlds. The project is laborious and will be rolled out over several years, but the preliminary results are promising.

Keywords: *materials library; degree in architecture; university library*

1. Introduction

The university degree in Architecture in Spain is characterised by the inclusion of many subjects oriented towards buildin technologies. These technologies have evolved considerably since the end of the Second World War in the 20th century and this is reflected in the large number of new materials that have appeared on the building market since then.

Traditionally, the students who entered these studies came mainly from families already professionally related to the building sector and their previous practical knowledge on materials and the processes of execution in building was sufficient to complement the theoretical teachings they received at the University. The current situation is different and the background of the students no longer guarantees this previous knowledge. Society, and

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therefore also the University, has fully entered the era of digitalisation, which has had an impact not only on the profile of students, but also on the development of higher education.

Within this framework, the initiative was developed to set up a materials library oriented towards building materials, within the University Degree on Architecture at E.T.S. Arquitectura del Vallès (ETSAV) of the Universitat Politècnica de Catalunya (UPC). A materials library is a collection of selected materials to facilitate the learning process about their characteristics, properties, attributes and uses. In a materials library, physical samples of different materials are collected, which will be exhibited to their specific public according to classifications established by the institution that gives life to it (Dent, Moryadas, and Beylerian, 2005). The overall objectives of this initiative were thus diverse, but concurrent:

- Extend the traditional educational role of university libraries as centres for printed documents, incorporating a a collection of samples of building materials, for consultation and loan, as an additional academic resource to support teaching, both for the lecturer in the classroom and for the student in self-study.

- Bring the analogue world of building materials in contact with the digital world through remote consultation of bibliographic documents linked with building materials.

- Make up for the previous deficiencies of university students of architecture in terms of analogue information on building materials, which often prevent them from recognising, discussing and applying them on their educational issues.

- Encourage students to be able to substantiate and support their architectural proposals developed and presented in the classroom, not only by means of drawings, reasoning and models, as is usual, but also by providing samples of the specific materials that would actually be used in the projected building (Bonwell & Eison, 1991).

2. Theoretical framework

Traditionally, some University Polytechnic Schools had collections of real samples of materials, generally deposited in showcases only for exhibition, but inaccessible directly to students. These collections have decayed partly due to lack of maintenance and people in charge, but also partly because the digital networks are providing texts, images and videos of great quality quickly, free of charge, of universal access at any place and at any time.

On the other hand, building products companies are promoting a renewal of their products, based on innovation in order to adapt their performance to the new demands of sustainability, efficiency and digitalisation. This divergence between the greater diversity of the commercial offer of materials and the loss of physical presence of materials in higher education curricula can lead to a partial ignorance of the future prescriber. Any education training for design and

construction must deal jointly with sensorial aspects, information aspects, knowledge aspects and application criteria aspects (Pedgley, O.; Rognoli, V.; Karana, E., 2016).

The choice of architectural materials has never been greater and architects use materials coming from around the world in innovative ways as never before. Borch, Keuning & Kruit (2004) edited a book that catalogues 200 different architectural surface materials. Each material is shown on the right-hand pages via a full-colour picture, which gives the reader the impression that is standing right in front of the real material, and on the left-hand pages is shown applied examples by architects and a description of the characteristics of the material.

The materials information aspects have experienced a growth in volume, which has been managed through databases whose access on line is free of charge in university libraries. The knowledge aspects are being developed within specific university subjects, where aspects of the anatomy of materials and their expected performance are addressed; anatomy requires images and static models for understanding and performance requires sensorial experience or simulators. The application criteria aspects are trained in the project workshops, where the aspects of suitability, contingency and adaptation to the environment come together; the student must learn to establish, in each case, the prescription that best integrates them in a timely manner. In the short term, the learning of all these aspects is based on the resolution of cases and the corresponding public critique in the classroom. In the medium term, work experience guided by mentors, complete the training of the future professional.

This polyvision of university education suggests to create a materials collection as an educational resource where the tangible and intangible aspects of the building materials are interconnected, in order to give complementary support to the development of the three aspects mentioned above. Robison & Shedd (2017) argue the importance of the availability of collections of shared things in learning communities. Accessibility to these collections raises the knowledge status of users. A materials library of building materials is a valuable resource for dialogue between designers, teachers, students and guilds; by having direct contact with the sample, the vocabulary and organoleptic aspects of the material can be better comprehended (Bonwell & Eison,1991) (Rognoli, V.,2005). It also allows active self-learning by relating and associating the materials with the senses and with their actual application (Hegger, Drexler & Zeumer, 2017).

The term "materials library" could also include content provided by augmented reality if a link is established between digital content and physical samples (Riemer, Schellhammer & Meinert, 2018). Lyons (2007) argues for the importance of knowing the characteristics of materials in order to understand their contribution to building systems. Many of these properties are not evident to the senses without testing the materials in laboratories. All this arguments focus on the project for the introduction of a materials library within the conventional library of a university degree on architecture.

3. Referents

A case study of materials libraries was undertaken in order to learn about their functioning, both the common and unique aspects of each library (Arboleda, 2023). Following an online search, many cases from around the world were identified and analysed. The compiled information was then entered into a series of fact sheets identifying name, website, location, consultation interface, information available for each material and classification of the materials.

3.1. Classification on focus

On the basis of the above, a first classification of the cases was established based on its main focus:

- Materials libraries with a focus on innovation: they specialise in collecting recent materials, which are making their debut and which presents innovative and evolving properties (Peters, S., Drewes, D., 2019). They also offer annexed spaces for experimentation, exhibition, workshops and discussion rooms, where scholars can congregate.

- Materials libraries with a focus on sustainability: they specialise in collecting materials that, due to their origin and manufacturing processes, are considered sustainable (Peters & Drewes, 2019).

- Materials libraries with a focus on innovation: they are located within a higher research environment with the aim of being a bridge between academia and the industrial corporations. They are supported by research and development groups within the institution to which they belong. Their collections promote joint training, research and innovation campaigns.

- Materials libraries with a focus on education: they are aimed at collecting basic and conventional materials in order to provide a first approach to young professionals in training. They are the common basis from which other more specialised collections can be developed in the future (Hegger, Drexler & Zeumer, 2017).

3.2. Identifying variables of a materials library

The specific identity of each library results from the combination of:

- type of primary user to whom the collection is addressed,

- access that this user has to the materials samples and the associated digital information

- resources, public or private, with which the materials library is developed. According to Jansson (2013), the availability of these resources strongly influences the services provided by the library: guided tours, professional consultancy, institutional consultancy, etc.

In that sense *MaterialConnexion*, one of the most extensive collections of materials in the world with over 20 years of presence, is a private materials library focused on users who are already active in the professional environment. Its main resources comes from the fees that its subscribers pay to access its comprehensive database that feeds the constant flow of information that is displayed in all the media channels in which this materials library has a presence (books, web channels, showroom, etc.)(Addington & Schodek, 2005).

3.3. How to house and exhibit the collection

At the moment, there are several dimensions in which the materials library can be displayed:

- Physical dimension: The user has the possibility of interacting directly, and in a tangible way, with each material and with the information that accompanies it, usually printed. In a direct way, those properties that can only be perceived face-to-face can be appreciated (Hegger, Drexler & Zeumer, 2017).

- Virtual dimension: It allows providing all kinds of digital content on each material, very useful in research or suitability assessment activities. This type of library can be updated very quickly, is remotely accessible and allows its own information to be linked to other data available openly on the global network (Spector & Ifenthaler, 2010).

- Hybrid dimension: It allows adding the complementary potentials of materials displayed both physically and virtually.

3.4. The taxonomic classification of samples

In the materials libraries there is no actually a shared standard for taxonomic classification; each materials library adapts its taxonomy according to the speciality of its samples collection: nature of the material, physical and/or chemical properties, function of the material, and form of the material or manufacturing process (Dantas & Bertoldi, 2016). A collection of materials in a user-friendly order makes it much friendly for the user to navigate and consult those (Peters & Drewes, 2019).

One of the references close to this project is MATERFAD, a materials library located in Barcelona and with delegations in Latin America, with 15 years of social presence. A face-to-face interview was held with its managers to know their organisation first-hand and learn from them. One of the pieces of advice that came out of these conversations was to strictly delimit the information associated with each sample of material because its management can devour a large amount of resources.

4. Proposal

4.1. Origin of the samples

There are already samples of materials scattered around the School of Architecture, without any order or classification, which can potentially be reused for this materials library project, and it is therefore planned to initially collect these samples and add them to the materials library in formation. Once this first internal compilation stage has been completed, the academic community will have to decide on the profile of the new materials to be incorporated according to the specific orientation of the courses taught by the curricula.

4.2. Taxonomic classification

In this case, the project materials library is part of the university library, which already has its own classification system (Joudrey, Taylor & Miller, 2015). The challenge is how to interface with the taxonomic classification already in place in the building industry, such as CI/SfB (RIBA cpd.com). At the moment, this conflict has not been tackled head-on, but it has been decided to continue with a classification specific to the building sector, as is already the case with other new things collections on loan in the university library.

4.3. Location

Actually, the physical space for the location of the materials library is inside the room library of the School of Architecture, housed in rolling chests named by the material nature so that the samples can be easily transported, which is useful for the student, the librarian and the teacher in different exhibition environments. In the future it will be necessary to have a better display, capable of visually displaying the samples and at the same time facilitating self-loaning with the help of a smartphone.

4.4. Augmented reality

One of the goals of this materials library is that each sample of material is linked to the information available about it in the university library itself. This linkage should enable the conventional library to be fostered as a useful tool for self education and learning, both for present users and online visitors. This alignment should facilitate the possibility of continuously updating and expanding the information collecting data available online, fostering interactive and collaborative learning (Scoble & Shel, 2016).

4.5. Development of the project

The entire development of the project has been carried out in collaboration with the students because of the educational potential of participating in its evolution.

1- Collection of the samples already available but dispersed, taxonomic classification, photography and deposit in the wheeled chests.

2- Labelling of the samples and referencing in the library catalogue, so that they can be borrowed and linked by QR code to the associated virtual content.

3- Edition of the virtual contents linked to each sample: books, articles, videos, patents, doctoral theses, applications, companies, etc.

4- Development of the specific platform for exhibition and lending.

5- Presentation of the materials library project to the university community. Initial validation by means of interviews with students, teaching staff, researchers, librarians, etc. The intention of the validation is to know the needs and expectations of the different users in order to have a global vision of the resource offered and the most convenient way of structuring the search and the information.

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User Designed Inquiry: An effort to reconceptualize teaching and learning at a US university

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Abstract

This paper explores the adoption of a user-designed curriculum at a medium-sized research, residential university in the US. Two cases of faculty in health and engineering engaged in pedagogical changes towards a user-designed environment are explored. Insights generated include the need to leverage existing good practice while setting clear institutional goals for what constitutes innovation, need for student input in process of shifting pedagogical approach, and diversity of size/discipline contexts in which user-designed courses can operate. The features and challenges associated with user designed inquiry are discussed in light of these initial efforts.

Keywords: *Universal Design for Learning; Competency Based Education; Backwards Design; User-designed Inquiry*

1. Introduction

Higher education is beset with an array of problems as it confronts the destabilization by market-forces, disruption from alternative providers, and deteriorating public trust in the institutional sector, particularly in the United States (Vyolaris, 2023). Illustrative of the shift in markets and market-providers, IBM recently announced a plan to train 2 million learners over the next three years in AI, with a focus in underrepresented communities, all at no cost to the students (Fore, 2023). And in response, higher education is ill-suited to quickly adapting to this changing landscape, with numerous and overlapping committee structures, faculty governance related to policy and process changes and a tendency toward maintenance of the status quo.

There are certainly outlier institutions that are comparably more nimble in responding to market-changes, particularly the need to maintain and increase enrollments. Arizona State University has taken up residence in Los Angeles, Carnegie Mellon University moved into Silicon Valley over twenty years ago and recently Hawai'i Pacific University moved into Las Vegas, as a few illustrations of substantial institutional change. Too, a cadre of non-traditional institutions have arrived on the national scene in the past 15 years and have rapidly increased their market-share

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of students, including Western Governors University, Southern New Hampshire University, Purdue University Global and the University of Maryland Global Campus. Some of these have been added onto existing institutions while others are startups or foundationally reorganized institutions (such as SNHU) that are unrecognizable from their previous iterations. Yet these are newsworthy because they are so atypical, as most institutions remain locked into a geographic footprint and mindset.

In addition to the external threats, the internal ones are equally problematic The uneven quality of university-based pedagogical practices is widely known, though now receiving greater scrutiny after the COVID-19 pandemic. The pandemic forced most residential institutions into fully online instruction for an extended period of 1.5 to 2 years, which resulted in the unintended consequence of having courses brought into the homes of students and under the peering eyes of tuition-paying parents. Parents, witnessing the repetitive droning of lectures to blackened zoom boxes in a less-than-ideal situation of compulsory online teaching added to the already diminishing trust of the public in higher education. Too, the complications of having to navigate computer access and quiet space to work with siblings and other family members was cited by students as having a deleterious effect on their academic progress, and thus, their motivation (Means, 2020). In a sense, the pandemic exposed what is widely known within the higher education sector; that the core business is often overlooked, operating in a *set-it-and-forget-it* mode driven by institutional efficiency rather than the quality of user/student experience.

Despite an industry tendency to under-attend to core work, the importance of instructional practice and classroom climate cannot be overstated. A study of nearly 23,000 students in community colleges in California participating in courses such as mathematics, reveals that "clear explanations of the grading process, precise guidelines on the accommodations made for late work, explicit encouragement for students to seek help and guidance on where to find support, and fostering student belonging through collaboration with peers and demonstrated support and reassurance by faculty members" were not consistently in place in these critical, gateway courses (Blake, 2023, *Fostering Belonging*, para. 1). This absence has led to significant failing/withdrawal rates, undercutting much heralded institutional goals to promote equitable access.

2. Lehigh University Commits to Pedagogical Change

The macro-shifts in markets and subsequent changes in academic programs provide a context for our work, though our focus is on the internal workings of the core business of our university; namely, teaching and learning. Lehigh University recently adopted a new decade-length strategic plan called *Our Future, Our Lehigh*, which includes a significant investment in redesigning its pedagogical practices across all academic and student-facing units. Lehigh is a research-intensive, residential university of approximately 7,000 students, roughly 5,000 of

whom are undergraduates, that has diverse academic programs organized into five colleges: engineering, arts and sciences, business, health and education. The strategic plan emerged from a one-year self-study wherein many faculty, staff, students and leaders noted a yawning gap between the expectations of flexibility and personalization in courses and the reality of rigidity and compliance that pervades the educational program at Lehigh, not unlike most of its peer-institutions in the US.

2.1. Five Part Model of Lehigh's User Designed Inquiry (LUDI)

We introduce the concept of *User Designed Inquiry* to build a student-centered, inquiry-driven, and competency-based learning environment. Our approach is anchored in the following areas: (1) universal design for learning (UDL), (2) competency-based education (CBE), (3) backward design (BD), (4) innovative approaches to assessment and instruction (3rd wave tech, e.g., AI, VR/cobotics), and (5) redesigning internal research capacity for evaluating instructional effectiveness. This initiative recognizes that no singular intervention will move Lehigh from good to great with regard to teaching, but rather that an intentional approach that blends a student-oriented and user-designed curriculum, is needed (Supiano, 2023). Too, iteration is built into our design concept as we create an internal data analysis shop that will provide continuous, rapid and specific data referencing student performance--not student perception--as a centerpiece of the reconceptual effort.

Universal Design for Learning (UDL) is an educational approach designed for learners' diverse needs, interests, and experiences by providing multiple means of engagement, representation, and action and expression (Hitchcock et al.,2002; CAST, 2018). It serves as the foundation of our UDI model, upon which the other two pedagogical concepts are built. According to UDL, there is no "standard learner" (Gronseth, et al., 2020), as learners' neural networks are unique (CAST, 2018), and learners vary in their learning processes. The Center for Applied Special Technology (CAST) developed the three core principles of UDL in 2018: provision of 1) multiple means of engagement, 2) multiple means of representation, and 3) multiple means of action and expression. UDL emphasizes fostering effective networks and recruiting interest by offering individual choice, relevance, and authenticity while minimizing learning threats and distractions. UDL suggests strategies to sustain effort and persistence, such as highlighting goals and objectives, varying demands and resources, and promoting collaboration and community. The ultimate goal of UDL is to develop expert learners who are purposeful, motivated, resourceful, knowledgeable, strategic and goal-directed—all of these layered into the experience of learning such that the executive function skills are critical takeaways to promote continuous learning.

Competency-Based Education (CBE) aligns seamlessly with UDL, emphasizing the mastery of specific, well-defined competencies as the primary goal of education. CBE focuses on clearly defined learning objectives, creating different ways of demonstrating that performance, and

builds connectivity between students' tacit knowledge and the academic learning of a course while measuring performance outcomes. Compared with traditional education, CBE focuses on measuring the learning outcomes and addressing fundamental shortcomings of the traditional model (Gruppen et al, 2016). CBE emphasizes the mastery of skills and abilities, rather than fixed learning time, by promoting learner-centeredness while ensuring that all students succeed. It serves as a gateway to UDL by providing a framework in which student agency and choice are aligned with specific learning goals. This allows for greater alignment between the content being taught and the needs and interests of individual learners.

Backward design (BD) serves as the assessment structure behind this integrated model. It is a pedagogical framework that complements both UDL and CBE by emphasizing the importance of starting with the *end-in-view* and designing a curriculum and learning toward those ends. In BD, educators begin by identifying the desired learning outcomes or goals they want students to achieve (Wiggins and McTighe, 2005). They then work backwards to determine the most effective instructional strategies and assessments that will support those goals. By starting with a clear understanding of the desired learning outcomes, educators can ensure that their instruction is focused and intentional. This approach helps create a coherent and meaningful learning experience for students, ensuring that their learning is relevant and connected to real-world applications.

In *User Designed Inquiry*, UDL, CBE, and BD create a synergistic ecosystem that fundamentally shifts the way that Lehigh faculty approach their course development and instructional practice. UDL ensures that the learning environment is accessible, engaging, and responsive to diverse learners. CBE ensures mastery of meaningful knowledge relevant to individual learners and course domains while BD maintains strategic alignment between learning outcomes, competencies, activities and assessments. Innovative approaches to assessment and instruction embedded in this system offer a range of immersive learning experiences like collaborative activities, technology-augmented activity, and experiential applications that enrich the learning environment.

We collaborate with faculty from different colleges to integrate the *User Designed Inquiry* (UDI) model into curriculum redesign and instructional practice. We evaluated the current curriculum design based on their departmental expecations and assisted faculty in redesigning their syllabi, class activities, and performance assessments towards providing learners with a more inclusive learning environment, increasing their engagement in learning, while orienting them to real-world applications with learning competencies that have applicability beyond academia.

2.2. Two Cases for Implementation of Lehigh User Designed Inquiry (LUDI)

We explore how the practice of two faculty members, in different stages of their professorship, have benefited from adopting LUDI in the 2022-23 academic year. The first case is of a junior faculty teaching a cross-listed course with students ranging from freshman to senior engineering students, and therefore with substantial differences in academic and professional behaviors, skills, and knowledge. The second case is about a teaching faculty with extensive experience in a related industry who organically implemented UDL principles in an introductory seminar class with over two hundred students. Both cases incorporate different types of technology to address student engagement and establish trustworthy ways for each learner to communicate with and request assistance from their professors.

2.2.1. Public Health Course

One of our cases is from a graduate-level public health course with 10 students. Certain issues permeated the faculty's desire to redesign her course, including the need for a hybrid format, addressing flagging student engagement, and a lack of student grasp for course expectations. Following the BD process, we assisted the faculty member in identifying desired results for this course reconceptualization, finding what knowledge and competencies learners should master and take-away following the course.

The faculty first connected different competencies with learning outcomes and related objectives, while articulating acceptable evidence of mastery. At this stage, we encouraged her to allow learners to express their understanding in multiple ways, including using an online, asynch wiki program, concept maps, reading alternatives, and multi-modal presentation formats. Learners were encouraged to choose a learning pathway that best fits their aptitude and experience while gaining insights about how to understand their metacognition. Last, the faculty member included multiple ways of introducing and connecting knowledge through inquiry-based, problem-based learning, which led to perceived increases in student engagement on the part of the faculty member. After this revised course launched, we observed the class, interviewed students, and continually met with this faculty to make minor revisions. At the end of the semester, this course received positive feedback and comments; a lot of students mentioned the flexibility of choosing readings and ways to present their understanding. They reported that this approach helps them understand the content and demonstrate a learning competency through performance assessments.

2.2.2. Computer Engineering

The other case is from the computer science and engineering department. A faculty member in this case provides a foundational, introductory course in computer engineering to over 200 first-year students. Different from the previous case, this faculty has applied UDI naturalistically rather than with intention. The faculty recognized that some students came with advanced

computer programming skills and/or Advanced Placement credit in computer science from secondary school. He engaged learners in a self-assessment of their capacity and allowed them to choose a learning group based on previous experience with computer science. He also invites students to switch groups freely based on their preference during the semester, thereby accelerating or decelerating their learning through assessment and performance data. By continuously adapting feedback from learners, he optimizes the course with personalized assessments calibrated to their prior learning, improving their engagement with the course and their learning outcomes.

While we collaborated with him, we assisted this faculty with integrating different competencies into this course and making the course better support learners' personal development for career and academic development. While this work is still in progress, as we are now developing a competency model for his course. This competency model not only would include technical skills and workplace expected behaviors, but it would also list personal skills and collaboration skills as important competencies to be developed throughout the delivery of their course.

3. Insights and Implications for LUDI

Our proposal aims to foster User Designed Inquiry (UDI) through continued professional development of faculty in a discursive environment. Lehigh faculty are given an array of resources, including 1:1 coaching, observation/feedback sessions, online asynchronous learning in our UDL/CBE/BD flip book, bi-monthly on campus meetings and special events/conferences designed to illuminate the pedagogical concepts along with opportunities to make curricular and instructional changes. In designing the Lehigh UDI learning environment for faculty and staff, we explicitly acknowledge principles of user-design and universal design to create multiple portals and pathways for faculty-as-students. This has led to over 100 faculty and staff participating in the socializing discourse over the first 6 months of our LUDI plan implementation.

Certain insights are offered in terms of the two cases in this paper—health and engineering, namely. First, the reconceptualization work was introduced in the case of the health faculty but already present with the engineering faculty member. This is an essential piece such that those engaging in a related pedagogical reform effort need to make space for existing practices that resonate with a chosen model while also setting a clear standard for what shift is desired. Assuming that ‘nothing is happening’ can demoralize those who are already making a substantial effort, even when they do not label that effort using recognized pedagogical theory. Too, the effort to be innovative in university education too often has an ‘anything goes’ quality, such that the term *innovation* itself is a vapid proxy for an ambiguous, if inarticulate, difference. Rather, making a break with the traditions of institutionally driven pedagogical practice towards user-focused design offers a clear path for the kinds of teaching and learning that we believe is

innovative, as it fundamentally alters the learning environment and recognizes the sovereignty of the learner in this new relationship.

Second, in both cases, the inputs of students and their subsequent behaviors and activities both before the reconceptualization and during/after, are crucial datapoints that also need attention. Both faculty made adjustments at all stages of implementation and remain in a continuous process of development for these courses and in their teaching. That this is a journey is obvious from their work and it thus requires sustained attention and a supportive context to allow for the experimentation that inheres within this approach to reach fruition. Students were not uniformly supportive of the LUDI changes when they first began the course, for example. They had adopted a passivity in their learning through their work at Lehigh to date and carried this dyadic, teacher-focused expectation into the reconceptualized course. Attention and support for learners in this context is also important as they too are experiencing a shift in the traditional learning environment, albeit one that centers on their learning and development rather than institutional efficiency.

Third and finally, the two courses present a range of participants, from 10 in health to over 200 in engineering. That the work was carried out in these varied environments speaks both to the value that it adds to a learning environment but also to the applicability across classroom type. Many faculty will hear 'user-designed' and assume that course sizes must be dramatically reduced to make such changes. This is not true. Even in large learning environments, such as courses in the hundreds of students, choice of motivation, engagement and performance can be introduced while smaller, collaborative groups—as was orchestrated in the computer engineering course—can be organized. Just as UDL prescribes that there is no one-size-fits-all curriculum, there are a myriad of venues and means by which a user-designed curriculum can take root if that is the intention of the faculty.

The challenges associated with the shift to a user designed inquiry model are manifold, though a few are of immediate concern. First, the user-focus is somewhat at odds with a teacher-centric model such that some faculty will position this change as a threat to their expertise and pedagogical orientation. That they are not being called upon to 'give students knowledge'--a deeply held belief among many faculty that is foundationally flawed–is seen as a threat to their sense of purpose. Too, the expectation that this pedagogical shift creates more work for faculty is real and one that we attempt to alleviate by offloading some of the course revision and implementation work. Yet, we also see the work of changing practice is not limited to documents, syllabi and course outlines, but must be lived and experienced by the pedagogue. Thus, user designed inquiry does require work, though the intellectual work of changing how faculty see themselves and their purpose is really the essence of this change. Lastly, detractors to this approach have asserted their demand for proof that user designed inquiry is better than traditional teaching and learning. The literature, some featured herein, suggests otherwise as moves to invite student engagement, choice and agency lead to improved performance. And yet

the demand for 'local proof' remains, a task that we are reorienting towards in next year's iteration of user designed inquiry.

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Less Anxious, More Confident: the Use of Playful Pedagogy to support student learning of quantitative methods

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Abstract

This paper presents findings from an evaluation of the Manchester Metropolitan University's Q Step Centre's uses of playful pedagogy to decrease undergraduate students' anxiety and increase confidence when working with quantitative data. Students studying social science degrees often associate themselves as 'Non-STEM' due to previous bad experiences of maths, therefore, when students enrol onto a quantitative methods module this causes anxiety amongst the students. Through incorporating playful pedagogic techniques and bringing elements of fun to teaching sessions, this reduced anxiety and increased confidence in the learners, thus creating data confident social science graduates.

Keywords: *Quantitative; Statistics; Pedagogy; Playful; Undergraduate*

1. Introduction

STEM vs Non-STEM

Secondary school Mathematics is considered a key factor when developing students' confidence to pursue a degree and career in STEM related subjects (Cannady et al, 2014), with MacDonald (2014) arguing that due to students' past experiences of mathematics, people create non-STEM identities where those that lack STEM skills accept that it is a part of who they are, and share this identity with others holding the same perception. As part of this identity, students establish attitudes towards their identity (Smith and Hogg, 2008) that can affect educational outcomes. This divide is not new, with CP Snow's "The Two Cultures" (1959) identifying that intellectual's conception of the skillset required for science and maths, and the skillset required for literacy are mutually exclusive. In particular, we can see this today within the discipline of Sociology with the dichotomy between quantitative and qualitative research methods. The majority of students that come to study Sociology at university, have often studied A-level Sociology due to its direct pathway to the degree, where research methods over privilege

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qualitative research. Furthermore, Sociology is often branded as a Bachelor of Arts and based within the humanities subjects, which Snow (1959) would refer to as the 'literacy' culture, so when students come to university and enrol onto a quantitative methods unit, this creates anxiety due to their association between maths and statistics from the creation of their negative dispositions through bad experiences from school (Onwuengbuzie et al, 2003; Katz, 1993).

Anxiety

Negative dispositions towards numbers come from previous poor encounters with mathematics (Katz, 1993) that leads to the lack of confidence to engage with numbers in everyday life (Chinn, 2012; National Numeracy, 2016). Onwuegbuzie et al (2003) identifies that nowadays, more students are required to participate in statistics and quantitative methods; this has seen statistics anxiety increase by up to 80% in graduates. In particular, the Nuffield Foundation funded 15 Q-Step centres in the UK, to increase quantitative skills due to a national shortage, which meant more social science degree programmes would include more quantitative methods. Students see statistics as 'maths', which triggers negative attitudes due to their previous negative experiences (Onwuengbuzie et al, 2003), especially as most students have a two year 'maths gap' that they acquire between ending compulsory maths and starting university (Scott Jones and Goldring, 2014). Roberts and Saxe (1982) report students having high levels of anxiety when arriving at their first statistics lesson therefore, it is our job in higher education to create a supportive space where students feel confident and comfortable to learn statistics, especially those that identify as Non-STEM (MacDonald, 2004).

Theoretical Model

Tapia and Marsh (2004) identified four components of their attitudes to mathematics inventory that has been used worldwide across different age groups to measure attitudes towards maths (Afari, 2013; Majeed, Darmawan and Lynch, 2013; Lim and Chapman, 2013). We use these four components to understand how they contribute to shaping our students' attitudes and dispositions towards statistics.

Enjoyment

Enjoyment comes from students having a fondness for their classes and engagement in tasks that is supported by fun teaching that creates excitement for students (Kalder and Lesik, 2011; Coltman and Whitebread, 2008). A sense of enjoyment through pedagogy can emit emotions of interest and joy (Gray, 2013) that can later create fondness of those tasks (Kalder and Lesik, 2011). Therefore 'playful pedagogy' is crucial for students enjoyment of tasks and for their academic progression, with Rodarte-Luna and Sherry (2007) identifying the use of humorous cartoons and gimmicks decreasing anxiety amongst students.

Confidence

Lack of confidence in working with numbers can come from maths anxiety which can impact students succeeding in further studies (Onwuengbuzie et al 2003) and avoiding situations where maths is involved (Chinn 2021). The complication arises as students see quantitative methods as maths, therefore it is important for us to untrain this thinking and to increase students' confidence when working with numbers to not allow it to impact their further studies. Kalder and Lesik (2011) believe confidence arises when students can successfully deal with and complete tasks.

1.1. Teaching Styles in Higher Education

Teaching in universities has long been characterised by didactic approaches to teaching and learning (Biggs 1999, Ellsworth 1997). This approach is formal and reinforces a clear power dynamic between teacher as 'expert' and student as 'novice'/learner. Formality, authority, and privileged knowledge are therefore constructed and performed within teaching spaces; in this model the teacher is the 'sage on a stage' (King, 1993) and the experience can passify students. Universities have shifted away from the most stringent version of this model, with many decentring approaches whereby the teacher becomes the 'guide on the side' (King, 1993), the classroom 'flipped' (Van Alten et al, 2019) and the student positioned as an active agent in their own learning. Of course, formality and power differentials remain and can be reinforced by teaching spaces (such as lecture theatres), the increasing numbers of students in universities and teachers who lack skill and/or confidence. Often students may experience 'pockets' of 'flipped' approaches alongside more didactic ones. Moreover, these approaches place a great emphasis on students to be agents in their own learning and there is an assumption that by 'flipping' teaching spaces one will automatically create engagement and therefore success. Such emphases are problematic for students who bring educational 'baggage' to the classroom, such as maths 'anxiety' or stereotypes of specific subjects (Scott Jones and Cain, 2024). School maths curricula (Scott Jones and Goldring, 2014) is not learner-centric at UK KS3/4 (in contrast to KS1/2) and the STEM/Non-STEM identity dichotomy (Snow, 1959) reinforces the authority (and power) of the teacher. Sociology students encountering introductory statistics often feel 'anxious' and this is a barrier to learning that they bring to the classroom (Meyer and Land, 2005). They can be disengaged before they really have an opportunity to encounter a non-didactic approach to teaching and learning. Such students may view the lecturer as a STEM 'authority' and seek to see them as a 'sage' and not 'a guide', replicating former patterns and reinforcing stereotypes. 'Playfulness' is a pedagogic counter to this which introduces the decentring of classroom power dynamics through 'play' as a creative and exploratory activity, alongside 'playfulness' as an ethos that stresses informality, creativity and fun (Brown and Vaughan, 2010). This should be contrasted with 'gamification' (Dicheva and Dicheva, 2017) which emphasises 'gaming' and competitive activities to create 'fun' and engagement. Whilst

play and playfulness is well researched in primary settings; there is less research on it within post-16 settings. Often it is falsely conflated with 'gamification' but also because the pedagogic commitment to 'play' requires a shift in whole-programme planning and teaching, including, curricula, delivery, support, spaces and assessments. 'Play' and 'Playfulness' is a fundamental aspect of learning (Colarusso, 1993) that blurs the formal-informal boundaries and through this, students' relationships with teachers; students' agency can be reoriented away from 'anxiety' about statistics towards a positive view that can facilitate confidence and competence with statistical analysis.

2. Methods

The dataset contains two measures: one a newly designed statistics anxiety measure, adopting terminology from the originally Danish HFS-R measure (Nielsen, 2018; 2021), alongside a measure of students' views of Quantitative Methods (Williams, 2008). Both measures used commended techniques, creating a latent construct through a series of statements. Statements were Likert-style response systems, with anxiety being 4-points and confidence being 5-points; following reliability and validity testing.

The sample consisted of undergraduate social science students at Manchester Metropolitan University. Students studying Criminology or Sociology completed the survey voluntarily whilst studying their statistics modules at Levels 4, 5 and 6. Statistics modules at Levels 4 and 5 are compulsory, whilst level 6 is optional. Despite all Level 6 students being surveyed, an explanation for the significantly lower proportion in comparison to 4 and 5 is arguably due to the lower population of students opting to study at statistics at level 6 (Rosemberg et al, 2022). Given the need to avoid socially desirable responses, students were provided the option to complete during a session or at home. All responses were anonymous and it was made clear to students that they could not be identified nor did the survey have any implications on their grades. Students consented to take part knowing that upon submission of responses, their data could not be retrieved to additionally protect their identity. At the time of completion, all students were studying modules ran by the Manchester Met Q-Step Centre.

3. Findings

Table 1 shows the overall participation rate of students. 67.5%, are Level 4 students (*n*333), followed by 20.7% Level 5 (n102) and 11.8% Level 6 (*n*58). The total participants are 493 (*N*493), with percentages totaling 100%.

Table 1: Participation in the evaluation

Level of Education	Percentage *(frequency)*
Level 4 students	67.5% (*n*333)
Level 5 students	20.7% (*n*102)
Level 6 students	11.8% (*n*58)
Total	**100% (*N*493)**

3.1. Confidence

Figure 1 illustrates the correlation between the perceived impact of teaching style on confidence in studying quantitative methods and the corresponding academic year of students. The responses to the question "Has the teaching you have received on these modules improved your confidence in studying quantitative methods?" where a higher score indicates stronger confidence. The data reveals a coherent progression in confidence levels as students advance through academic years. Starting at Level 4 with a mean confidence score of 35.93, there is a consistent rise to 39.57 at Level 5, followed by a further increase to 43.58 at Level 6.

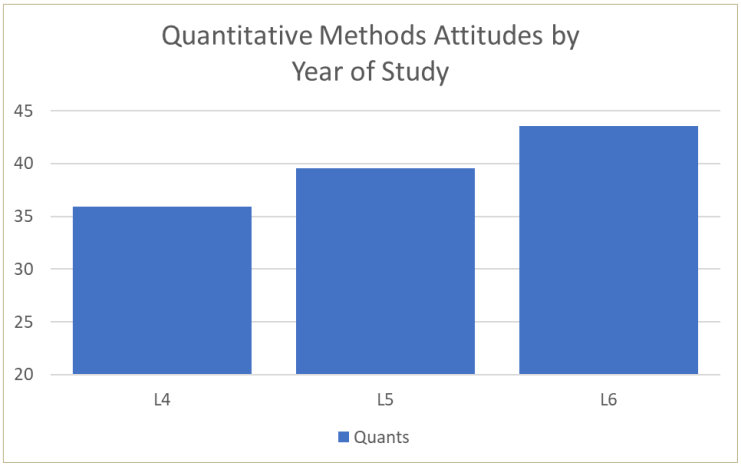


Figure 1: Confidence studying quantitative methods

3.2. Anxiety

Figure 2 illustrates students' anxiety of working with quantitative data. In the initial year (Level 4), the mean value is 45.78, with a notable reduction in anxiety at Level 5 to 43.65, followed by a further decline to 38.34 at Level 6. These findings emphasize a relationship between the advancement of academic years and the prevalence of statistics anxiety coinciding with an increase in confidence levels.

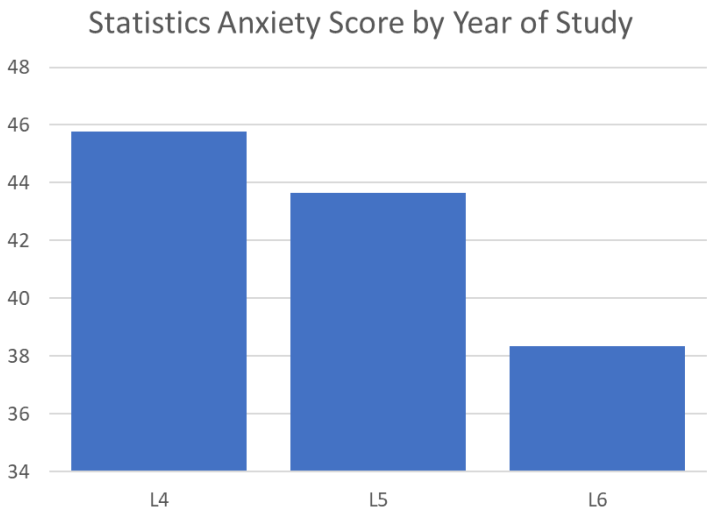


Figure 2:Anxiety working with quantitative data

3.3. Pedagogy

Interviews were conducted with students to better understand the reasoning behind their answers.

Participant one: *'Generally, I think they really standout, the way they teach.'*

Participant two**:** '*I think if there was no fun in it from the day one…a lot of people would have walked. I don't think they would have stayed.'*

Participant three: *I found that the teaching was really fun. You could get a lot of giggles. And I suppose that makes learning something quite enjoyable for anybody. If you have a laugh and a giggle while you're doing it.'*

4. Discussion

The findings presented in this paper suggest that by using playful pedagogy and making learning fun and engaging decreases anxiety and increases confidence amongst undergraduate social science students when working with quantitative data across all three year groups. As Colarusso (1993) highlights, the notion of play is a fundamental aspect of learning that allows students to focus on the fun being had in the classroom in relation to statistics, rather than their anxiety. Enjoyment through pedadgogy can create emotions of enjoyment and interest that can later create fondness of tasks (Gray, 2013; Kalder and Lesik, 2011), further helping to reduce anxiety and increase confidence (and therefore competence) in quantitative methods amongst social science students.

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Time management and absenteeism: studying the students through machine learning

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Abstract

Absenteeism in higher education is a problem that may involve institutional, economic, social, and individual consequences. The present work aims to analyse whether the way students manage their personal time could be an explanation for absenteeism rates. Authors used machine learning based methodology, combined with explainable artificial intelligence methods. This allowed them to design a two-levels analysis, it is to say from a global, and an individual perspective. Factors such as repeating a course have the most negative impact over class attendance. On the contrary, being able to submit an assignment before the deadline has the most positive impact over class attendance. The kind of academic career, the place of living or the hobbies has also influence over the absenteeism.

Keywords: *Absenteeism; Higher education; Support vector machine, Explainable artificial intelligence, Shapley additive explanation, Time management.*

1. Introduction

Absent is always in the wrong, he who is. Absenteeism is often linked to poor academic performance and high drop-out rates. This has consequences in terms of wasted time and economic resources, as well as the need for continuous review of education policies in both schools and higher education institutions.(Abadzi, 2012; Keppens, 2023; Miller, 2023).

To address absenteeism, it is crucial to identify its underlying factors. Sahin et al. (2016) identify five socio-economic sources: familial factors, administrative and teacher-related factors, factors related to the organization of the school, the student's own factors, and external environmental factors such as transportation. At the individual level, the main causes of absence are common health problems, early class schedules, stress, and depression (Şahín 2023). Other factors that

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may contribute to absenteeism include the student's organization, teaching and learning methodologies, course characteristics, and external factors (Triado-Ivern et al. 2020). Ramchander (2017) explains that homework load is a factor that can contribute to absenteeism. Students may be absent to prepare for tests, assignments, or group work, particularly on the days leading up to a test or on the day of the test itself.

It should be noted that the above is not an exhaustive list of the factors contributing to absenteeism. Other causes of absenteeism require further investigation. This paper analyses one factor related to students: their time management and how the latter affects their absenteeism. Other variables will also be considered within the study. To do so, we begin with the previous findings of Porras et al. (2023), who examined time management among first-year students of *"Administración y dirección de empresas"* (ADE) and *"Finanzas y contabilidad'* (FICO) degrees at a Spanish university. The study identified four explanatory factors. The current study includes additional academic and personal variables of the students, such as extracurricular activities, maintaining a positive mood, and exercising.

The objective of this work is to utilize machine learning techniques to identify the regression model that best fits the data and analyze it using explainable artificial intelligence (XAI) techniques. This will enable us to quantify the weight of the variables studied in the final model and provide a global explanation of student absenteeism. Then, we can identify the factors that positively influence attendance and those that negatively influence absenteeism. The use of XAI models enables analysis at the individual student level, facilitating personalized guidance.

2. Methodology

2.1. Dataset

Porras et al. (2023) identified four factors related to students' time management: their perception of their own time management, the amount of time spent on unproductive tasks, their ability to complete tasks with a deadline, and their use of tools to help with time management and organization. Variables in Table 1 have been added to the above to expand the set and identify additional factors that may influence absenteeism. The selected variables were adapted from Neill, J.T.'s (2016) original questionnaire to gather background information on students, including their academic background, other activities, living environment, and physical and mental health.

2.2. Regression analysis

After combining the variables into a single dataset, the data is split into training (75%) and test (25%) subsets. A regression analysis is then conducted, with the number of classes attended by the student as the dependent variable and the remaining variables as independent variables. The

regression is performed using the Caret. package in R.(Kuhn et al., 2020). The following regression methods are employed: Random Forest, Stochastic Gradient Boosting, Neural Network, eXtreme Gradient Boosting, Partial Least Squares, Support Vector Machines with Linear Kernel, The lasso, Bagged CART and Cubist. All methods were cross-validated with 10 folds and default parameters. The root mean square error (RMSE) was chosen as the metric to assess model accuracy.

Table 1 Variables added to the study. Source: Own Elaboration

Variable	Values
Repeater	New student (1) or Repeater student (2)
Genre	Male (1) or Female (2)
Degree	ADE (1) or FICO (2)
Baccalaureate	None (1), General (2), Humanities and social sciences (3), Arts (4) ,Science and tecnology (5)
Scholarship	No (1) or Yes (2)
Residence	Family home (1), On its own (2), Student residence (3) ,Shared accommodation (4)
Academy	Attend an academy (2) or not (1).
Work	Working (2) or not working (1).
Sport	Participate in sports (2) or not (1)
Languages	Study languages (2) or not (1)
Cultural	Participate in cultural activities (2) or not (1)
Other	Perform other activities (2) or not (1)
None	Do any activity (2) or not (1)
Fitness	Very Low (1), Low(2), Normal(3), High (4),Very High (5)
Optimism	Very Low (1), Low(2), Normal(3), High (4),Very High (5)

2.3. Explainable artificial intelligence.

Machine learning and artificial intelligence models are often treated as 'black boxes', where input variables are introduced, and a result is obtained without knowledge of the process in between. This lack of transparency, explanation, and interpretability can be addressed using explainable artificial intelligence models. In recent years, XAI models have been developed rapidly, providing insight into these gaps (Vilone & Longo, 2021). Angelov et al. (2021) identified six XAI methods: feature-oriented models, global models, concept models, surrogate models, local pixel-based methods, and human-centric methods. This work will use the feature oriented SHapley Additive exPlanation model (SHAP), introduced by Lundberg and Lee (2017), which employs coalition game theory to calculate the contribution of each feature to the final model. The main concept behind SHAP is to compute Shapley values for each variable in the set to be interpreted. Each Shapley value represents the impact that the associated variable has on the prediction.

To achieve this, we will use the DALEX library (Law Biecek, 2018) in R, which implements various XAI models, and the shapviz library (Mayer, 2024) to visualise the outcomes. This will enable us to analyze both the complete model and individual instances, in this case, students.

3. Results

Table 2 shows the RMSEs obtained by the different regression methods with the test set. The methods produced similar results, with the Support Vector Machine with Linear Kernel, Random Forest and Bagged CART trees performing the best.

Table 2 RMSE of used methods. Source own elaboration.

Method	RMSE
Random forest	4.917
Stochastic Gradient Boosting	5.144
Neural Network	5.602
eXtreme Gradient Boosting	6.032
Partial Least Squares	5.097
Support Vector Machines with Linear Kernel	4.869
Lasso	5.079
Bagged CART	4.980
Cubist	5.165

Figure 1 illustrates the three variables that carry the most weight in explaining absenteeism across all three methods: whether the student is a repeater or not, factor 3 (which relates to the ability to complete assignments on time), and grade. The remaining variables vary across the methods, but the influence of time management factors and the performance of other activities can be observed.

It is important to determine whether the variables have a positive or negative impact on class attendance. To achieve this, we analyzed the values obtained by applying SHAP in the best model, Support Vector Machine Linear Kernel, as shown in Figure 2. Each point in the figure represents a student, and the color spectrum represents the original value of each variable.

The data shows that being a new student increases the likelihood of attending class, while repeating a year drastically decreases attendance. Additionally, students who are better able to complete assignments on time (Factor 3) are more likely to attend. The grade level indicates that FICO students are more likely to attend class than ADE students. The type of residence appears to have an impact on attendance rates, with students living at home more likely to attend classes than those living in halls of residence, and those more likely to attend than those in shared accommodation. Additionally, there is a gender disparity in attendance rates, with males attending more frequently than females. In the sample, it is evident that only a small number of

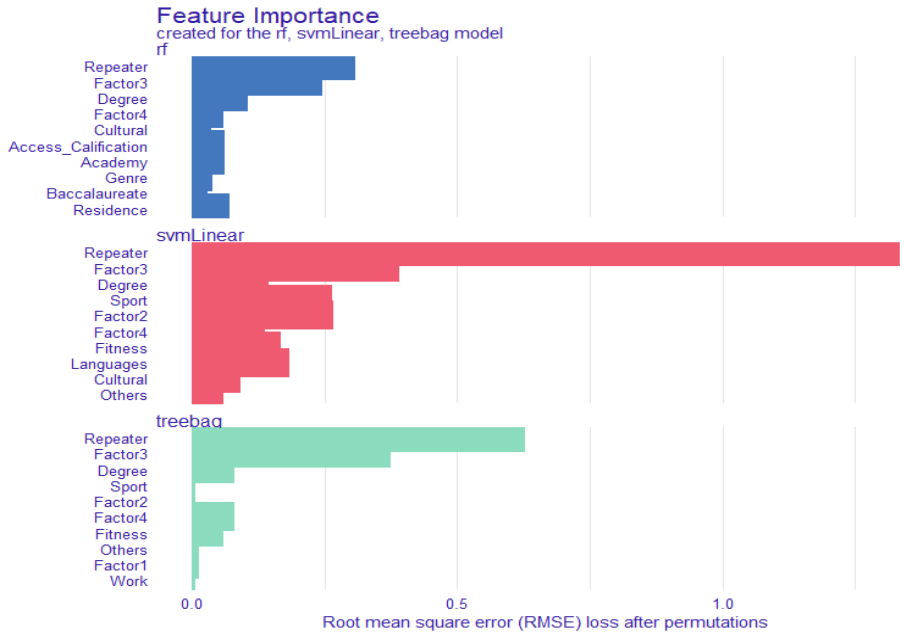


Figure 1 Top 10 variables for each model. Source own elaboration

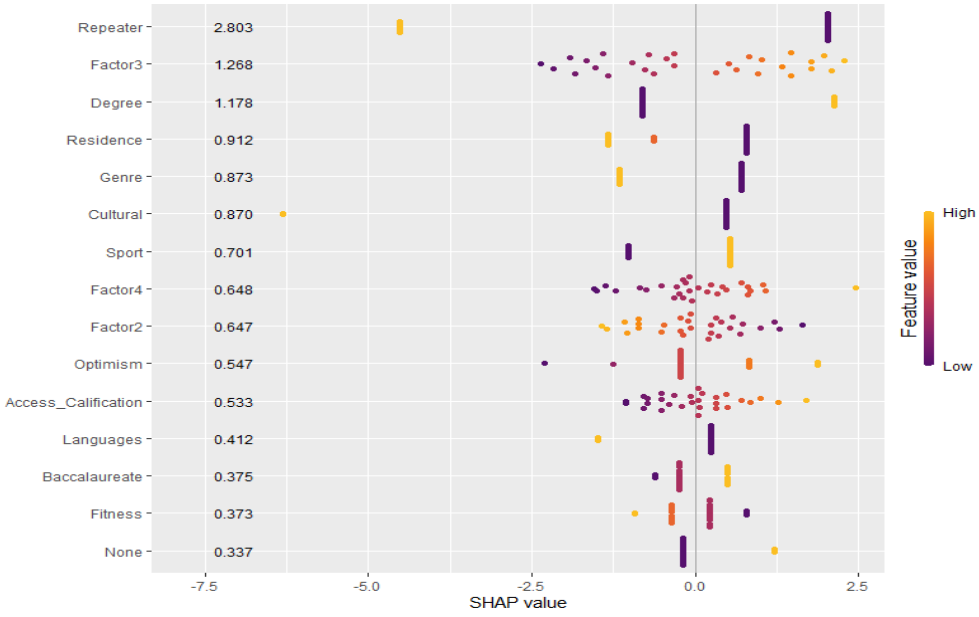


Figure 2 SHAP values for SVMLinear. Source own elaboration.

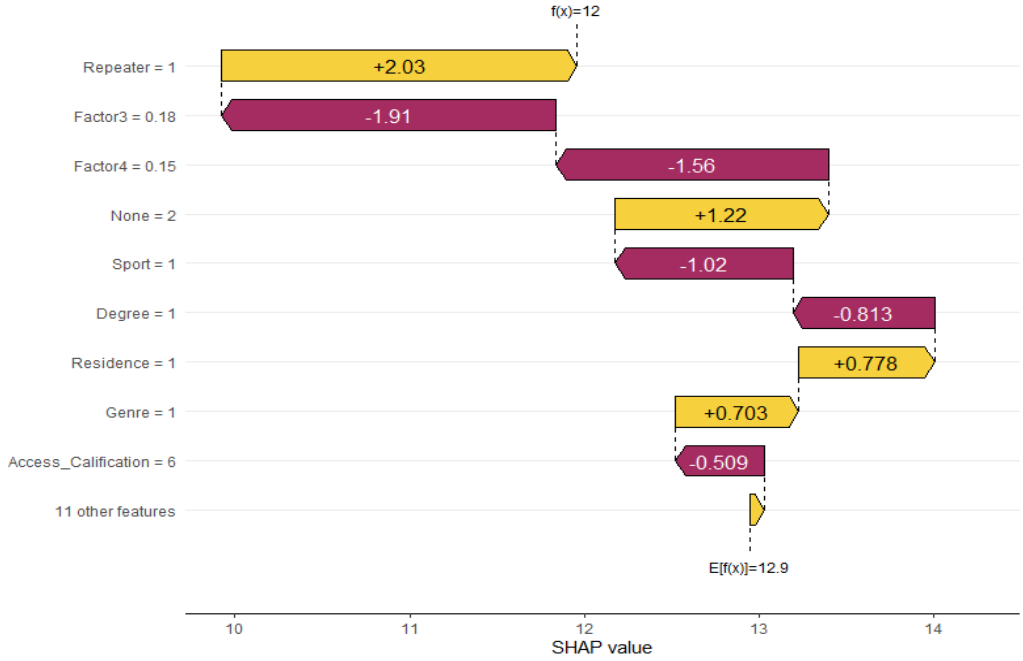


Figure 3 SHAP values for one student. Source Own Elaboration.

students participate in cultural or language activities. However, these activities do have an impact on attendance, as those who do not participate are more likely to miss classes. Unlike other activities, practicing sports has a positive effect on attendance. However, this contradicts the fact that students who attend classes are more likely to consider themselves in poor or normal physical shape. Regarding time management, it can be concluded that using time management tools (Factor 4) and avoiding unproductive activities (Factor2) positively affects attendance. Students who have achieved higher grades in previous stages are more likely to attend class, while those with lower grades are less likely to attend. Attendance is also influenced by mood, with higher levels of optimism increasing the likelihood of attendance.

The practical implications of the proposed methodology's ability to analyse individual factors affecting a student's attendance are significant. It allows for focused work on the student's weak points, optimising available resources and achieving results in a shorter period. This results in economic savings and enables students to better manage their time in the short term. This leads to a more efficient use of academic resources and improved academic performance, potentially reducing the dropout rate. Figure 3 displays the profile of a new student in ADE with an entry mark of 6. The student does not use time management tools and struggles to complete homework on time. Additionally, they live in the parental household and do not participate in any extracurricular activities, resulting in an attendance range of 10 to 14 classes.

4. Conclusions

This paper analyses absenteeism in higher education from the perspective of time management and other variables.

A machine learning methodology has been presented that allows for the analysis of the factors involved in absenteeism at two levels. At a global level, this enables high-level decision-makers such as center directors or deans to make informed decisions about measures to fight absenteeism. At the student level, personalized monitoring can identify areas for improvement to prevent absenteeism.

The analysis of data using this methodology concludes that absenteeism cannot be solely explained by time management. This study showed that the three most influential factors affecting attendance are repetition of a course, the ability to complete assignments on time, and the field of study. Family factors, such as place of residence, practice of other activities, or optimism, have a relatively minor influence on the decision to attend classes.

Speaking of time management, all factors except for the student's perception of their own time management have been shown to affect attendance. The ability to complete tasks on time is the most significant factor in time management.

Future research will analyze the impact of time management and attendance on academic performance.

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Elementary Pre-service Teacher's Perceptions of STEM-Integration in the Classroom: An Experiential Approach in a Mathematics Methods Course

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Abstract

In this study, we depict preliminary results of the implementation and integration of science, technology, engineering, art, and mathematics (STEAM) activities in a mathematics methods course within a teacher preparation program in the US. We used an experiential learning approach as an instructional method to expose and engage Elementary Pre-Service Teachers in a series of STEAM activities. We followed a mixed-method approach to observe if there were any changes in the EPSTs self-confidence and perception of abilities, value and enjoyment, performance and effort expectancy, and their social and behavioural attitude toward the integration of STEAM. Data show that after engaging in STEAM activities, the EPSTs depict a higher level of confident and preparedness to integrate STEAM activities in their future lessons. In addition, EPSTs recognized the value of integrating STEAM within their lessons as a strategy to develop conceptual understandings in topics related to mathematics and science.

Keywords: *Elementary Pre-service Teachers; STEAM; Experiential-Learning.*

1. Introduction

Elementary pre-service teachers (EPSTs) —which are college students in preparation for becoming teachers in the elementary level—often depict an understanding of how to use and integrate technology in their daily life. Some of them considered themselves expert in how to play and use advance video games, smart devices, or applications. However, EPSTs need to receive preparation into how to expand the use of technologies with the integration of other subjects like mathematics, science, engineering, and arts, which are barely connected in teacher preparation programs (Stohlmann et al., 2012). EPSTs receive preparation in science and mathematics methods, but there is a lack of STEM (science, technology, engineering, and mathematics) preparation, integration, and implementation at the elementary level.

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In USA, most teacher preparation into STEM take place with a focus on middle or high school students, and barely with elementary students. In fact, even standardize tests for subjects like science, takes place late in elementary (i.e., 5th grade). However, for middle and high school students to develop a mindset toward STEM, they must be exposed and engaged to ideas and experiences since their elementary education. This is a difficult task to achieve considering that elementary teacher preparation programs do not focus their training in developing teachers with a STEM expertise. Most elementary specializations are concentrated in areas like bilingual or special education, early childhood, or English as a Second Language (Sutcher et al., 2019).

In the study presented here, we depict preliminary results of the implementation and integration of science, technology, engineering, art, and mathematics (STEAM) activities in a mathematics methods course within a teacher preparation program at a USA university. We used an experiential learning approach as an instructional method (Kolb, 2014) to expose and engage EPSTs in a series of STEAM activities to foster inquiry, team-work, creativity and productive-struggle to develop their self-confident, value, performance, effort, and behavior toward STEAM. We considered a mixed-methods approach with the intention of observing if there are any changes in the EPSTs self-confidence and perception of abilities, value and enjoyment, performance and effort expectancy, and their social and behavioral attitude toward the implementation and integration of STEAM in their future elementary classrooms.

Despite that the study we are presenting here is still a work-in-progress, preliminary results show that after experiencing and engaging in STEAM activities, the EPSTs depict a higher level of confident and preparedness to integrating STEM activities in their future lessons. Similarly, EPSTs feel that learning how to use and integrate STEAM would increase their productivity. Also, EPSTs feel that experiencing with STEAM deep their understandings about the relations of the fields, and that is worth their time and effort. In addition, EPSTs recognize the value of integrating STEAM within their lessons as a strategy to develop conceptual understandings in topics related to mathematics and science.

2. Theoretical Perspectives

2.1. Characteristics of the Acceptance and Use of STEAM in an Experiential Teaching and Learning

Experiential Learning (EL) is a method of instruction originally implemented in workplaces to provide professional development to employees in different fields (Murphy et al., 2014). It was later integrated into education with the intention of extending its potential for both instructors and learner (Kolb, 2014). EL is more than a simple pedagogy, is a holistic philosophy where experiences play a central role in the development of conceptual understandings (Bartle, 2015; Fry et al., 2009; Kolb & Kolb, 2009). Within the study presented here, we considered the

theoretical lens of the experiential learning theory (ELT) to enhance several teaching characteristics in elementary pre-service teachers (EPSTs). According to Kolb (2014) the ELT is defined as a process where "knowledge is created… as result [of being exposed] to grasping and transforming experiences" (p. 41). ELT establishes that teacher's role changes from direct to facilitating the learning process by guiding the learners into a process of inquiry and discovery (Kolb & Kolb, 2009). This makes learning a "continuous process in which students bring their own knowledge, ideas, beliefs and practices – at different levels – [for the purpose of expanding and developing] their understanding and interpretation of new information" (Bartle, 2015, p. 2).

In this study we engaged EPSTs in experiential learning as a method of instruction with the ultimate goal of developing their awareness and experiences in science, technology, engineering, arts, and Mathematics (STEAM), while enhancing their self-confidence, value for STEAM, performance and effort expectancy, and their behavioral and social attitude toward it.

Within the experiential learning theory lens we adopted, we focused in observing several specific characteristics that would help, support, and enhance elementary pre-service teacher's abilities and skills to integrate and implement STEAM-related tasks within their own instructions. As mentioned above, these characteristics are the EPST's self-confidence, value, and enjoyment on STEAM, effort and performance expectancy, and the EPST's behavioral and social attitude toward the use and integration of STEAM. These characteristics are rooted in the acceptance theory of Venkatesh et al. (2003), which we adopted to better understand the EPST's attitude and perceptions toward STEAM. The Venkatesh's theory, also known as the unified theory of acceptance and use of technology (UTAUT), has been used across different disciplines (e.g., science, engineering, technology, and mathematics) to better understand how humans — in this case elementary pre-service teachers— behave and accept not just technologies, but also ideas and innovative approaches, and how open they are to adopt them (Abbad, 2021). In this study, we strove to show the EPSTs different strategies to teach mathematics while integrating STEAM in their lesson plan and future instruction.

3. Methodology, Participants, and Data Analysis

In the study presented here, we followed a mixed-method approach to capture the EPST's perceptions and mindset to accept, use, and implement STEAM-related activities within their lesson plans once they become elementary teachers. All the above while engaging and exposing the EPSTs in experiential learning (Bartle, 2015) STEAM activities in what we have called "learning-by-doing". Participants of this study were 53 college students in an elementary teacher preparation program at a southcentral USA Hispanic-Serving Institution (HIS), from which 11% where male, and 89% females. Although this study is still on-going, data to be presented here was collected during the Spring and Fall 2023, when the EPSTs enrolled in a

mathematics methods course in which one of the researchers was the instructor of record. To maintain consistency, each semester the EPSTs were engaged in five different STEAM activities: haciendo tortillas de maiz (Making corn tortillas), robotic for math with finch robots©, building an engineering object-measurement tool, and creating circuits with makey-makey©. The five activities were implemented throughout each academic semester (i.e., about 14 weeks) in approximately every 2-3 weeks each respectively. Within each activity, the EPSTs were engaged in a series of pre and post discussions and reflections to foster understandings and make connections with the mathematics topics that was been lecture (e.g., fractions, geometry, ratios, velocity).

To capture the EPST's perceptions and mindset toward STEAM, a pre and post survey were administered before and after they were exposed to the activities. The final instrument used was an adapted-combined version of other instruments developed by Abbad (2021), Gado et al., 2006, and Ensign (2017). The adaptation consisted in specifically targeting EPSTs, and excluding items that were not aimed to measure the characteristics intended to be observed in this study. In total, the survey was composed of a demographic component (i.e., age, gender, student's status, program of study, STEM experiences), one rating (1-10) question, and 22 liker-scale questionary ranging from 1 to 5, where one corresponded to completely disagree and five completely agree.

In addition, semi-structured, open-ended interviews (Zhang & Wildemuth, 2009) were conducted with a small sample of EPSTs who volunteer to be interviewed. The interviews were intended to gain deeper understandings of the EPSTs perceptions and mindsets toward STEAM.

It is important to mention that we are still collecting data during the spring 2024 semester, for which we are intended to depict here preliminary results of the quantitative component of the study. We have performed a descriptive statistic (Kaliyadan & Kulkarni, 2019) of the data and will analyze the raw data by performing a paired t-test (Marshall & Jonker, 2011) of the results. For the interviews, all the data will be transcribed. We will be following a double round in-vivo coding process (Saldana, 2014) to obtain the main themes mentioned by the EPSTs.

4. Findings and Conclusions

In this section we are depicting raw data, recalling the study is still a work-in-progress. We will be focusing on the quantitative component. However, it is our expectation to have finalized results of both components (quantitative and qualitative) by the time of the HEAd Conference. Below we depict descriptive statistics of the data we have collected.

Table 1. Demographic Characteristics of Elementary Pre-Service Teachers

Characteristics	*n*	%	Total
Gender			
Female	47	89%	53
Male	6	11%	
Age			
19-20	14	26%	53
21-22	23	43%	
23-24	7	13%	
25+	9	17%	
Program of Study			
EC-3 (Early Childhood - 3rd Grade)	7	13%	53
EC-6 (Early Childhood - 6th grade) generalist	9	17%	
Bilingual Education	28	53%	
ESL (English as a Second Language)	5	9%	
Special Education	4	8%	
Student Classification			
First Generation College	34	64%	53
Non-First Generation	19	36%	
STEAM Experience			
Minimum (2 courses or less)	6	11%	53
None	47	89%	

From table 1, there are several important aspects that can be highlighted. First, most of the EPTSs were females. This could be potentially important, since historically there has been a shortage in females in STEM, particular in minorities populations (Fry et al., 2021). Many reasons could contribute to the above, but it could also be interpreted as that females are less confident to teach STEAM related topics, since they are studying to be elementary teachers, which nothing has to do with them be prepared to address STEM topics in elementary. Second, most of the EPSTs were in the bilingual program and had never taken a course related to STEM. These could potentially impact how the EPSTs responded to the questions in the survey, since they did not have any previous experience with STEAM activities.

Because the study presented here is an on-going, work-in-progress and the space limitation of this proposal, we are focusing on sharing preliminary raw data of the quantitative results only. We have randomly selected two items from each measured characteristic (See table 2) to be shared. In the table below (see Table 3) we organized the data for each item, depicting a combined responds for answers as "completely agree or agree" and "completely disagree or disagree" for pre and post survey responses, recalling the survey was a liker-scale from 1 to 5, where 1 represented completely disagree, and 5 completely agree.

Table 2. Sample of Questions by Measured Characteristic.

Characteristic	ITEM Question
Self-confident and ability	2. I am confident I can integrateSTEM/STEAM (e.g., robotics) for teaching in elementary.
	6. With my current experience in STEM/STEAM, I feel prepared to integrate related concepts and tools (e.g., robotics) within my lesson plans and future teaching.
Value and enjoyment of STEAM	7. Children should learn STEM/STEAM related concepts (e.g., Robotics) in Elementary.
	10.Students would conceptually learn mathematics if STEM/STEAM related concepts (e.g., Robotics) are used for teaching elementary mathematics.
Performance and effort Expectancy	13. Using STEM/STEAM (e.g., robotics) in teaching and learning elementary mathematics would help me to accomplish my teaching goals quickly.
	15. If I use STEM/STEAM (e.g., robotics) in teaching and learning elementary mathematics, I will increase my chances of getting a raise once I get a teaching position.
Effort Expectancy	17. My interaction with STEM/STEAM related tools like robotics would be easy for me to become skillful at using it.
	18. Integrating STEM/STEAM related tools like robotics in my elementary mathematics lessons would be easy for me.
Social Influence and Behavioral Intention	21. If my future colleagues integrate STEM/STEAM related tools like robotics within their lesson, I will probably use it in my teaching and learning of elementary mathematics too.
	22. I would use STEM/STEAM related tools like robotics in my teaching and learning once I become a teacher.

In table 2 above we intended to provide the reader with a holistic idea of the instrument as whole. Unfortunately, becuase of the limitations in space, we coud not share the full instrument, which will be share to the conference audience for their review and use.

From table 3 above, it can be noticed that in every item the EPST's responses positively increase from the pre to the post implementation. It is important to mention that the above does not means they are all statistically significant—we will be performing a t-test once all the data is collected during Spring 2024, which will shared in the conference. But at least, we can make some inferences based on the raw data. For example, item 2, 6 & 17 shows that EPST's confidence to integrate some STEAM ideas in their lessons, improve. This is relevant since, the ETPS's mindset toward STEAM has positively shifted. In addition, in items 7, 10 & 22, the EPSTs depicted comprehension about the importance of engaging elementary students in STEAM activities to support and promote conceptual understandings beyond simple lectures, same as the EPSTs were exposed in an experiential learning approach (Kolb & Kolb, 2009).

Table 3. Raw data of selected survey items.

#	Pre		Post	
	Agree or Completely Agree	**Disagree or Completely disagree**	**Agree or Completely Agree**	**Disagree or Completely disagree**
2	60%	11%	74%	6%
6	21%	42%	72%	2%
7	81%	0%	91%	2%
10	53%	6%	79%	0%
13	53%	2%	85%	2%
15	40%	0%	70%	4%
17	47%	17%	70%	0%
18	34%	15%	64%	2%
21	75%	0%	87%	0%
22	79%	2%	85%	0%

Also, items 17, 18 & 22 showed the EPSTs see the use and integration of STEAM activities as something that would help them to better perform in their future teacher responsibilities and to achieve their teaching goals. This is relevant because the EPTS depicted to be inclined to accept the presented STEAM ideas as new ways of approaching their own future pedagogies (Abbad, 2021).

Elementary Pre-service Teacher that participated in the study, were barely exposed and engaged to any structure STEM/STEAM activity during their teacher preparation program. We decided to change this, because as researcher, we recognize that for young elementary scholars to develop a STEAM mindset, they need to be exposed to it since a very young age, rather than later when they get to middle or high school. We understand that there are many more relevant aspects that need to be said and shared. These will be presented for both components (i.e., qualitative, and quantitative) during the conference presentation. In the meantime, the study is on-going. We will be collecting data this spring 2024, and we hope to expand the scope of the study by exploring other teacher preparation programs nation and international wide.

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The secondary-tertiary transition in mathematics: insight through personal journals in a math class

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Abstract

This study delves into the transition from secondary to tertiary mathematics education, a pivotal moment impacting cognitive, social, and cultural domains. Through personal journal analysis and using the theoretical framework of the "rite of passage", it investigates the experiences of first-year Architecture students at Politecnico di Milano. Text analysis confirms five prevalent themes described in the literature: instrumental/relational mathematics, structural differences between university and high school, adjustment process of self-regulation strategies, the development of a new identity as mathematicians, and social integration with peers. This research contributes to ongoing efforts in mathematics education, aiming to improve the overall transition experience and academic success of tertiary education students. In particular, the study sheds light on the complexities involved and shows as the journal practice can provide a deeper understanding of student challenges, perceptions, and adjustment processes.

Keywords: *Tertiary transition; journaling; mathematics; rite of passage; STEM.*

1. Introduction

The transition phase from secondary to tertiary (STT) mathematics education is that moment in which students enroll at university, entering a new world from a cognitive, social, and cultural point of view, and it's considered one of the major issues in mathematics education (Gueudet, 2008). The decreasing number of college students in the STEM area seems to be strongly influenced by the presence of at least one mathematics course, and, on the other hand, these courses also affect the percentage of dropouts and delays in obtaining the qualification (Gueudet, 2023). This leads to the inclusion of fewer and fewer scientific professionals in the working environment, thus also resulting in a social problem (OECD, 2022), as well as an educational and pedagogical one. Optimizing the success and adaptation of first-year students

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during the challenging transition from secondary to tertiary education requires a comprehensive focus on metacognitive factors, such as self-regulation (Zimmerman, 2000); these elements prove to be just as important, if not more, than addressing disciplinary gaps (Di Martino & Maracci, 2009). The phenomenon of STT education in mathematics is complex and multifaceted, and as such requires numerous theoretical lenses in order to be explored in its entirety (Di Martino et al., 2023).

The theory of the "rite of passage", brought into the field of mathematics education by Clark and Lovric (2008), highlights well how this passage is a real crisis, a shock that involves the whole person, cognitively, socially, emotionally, and culturally. From a cognitive point of view, one shock is certainly due to the different degree of depth required by university study compared to high school: there is a shift from instrumental to relational mathematics (Skemp, 1978). A change also occurs in the level of difficulty of the contents offered and in the time devoted to each one: entering the university world, in fact, also entails changing the cultural institution of reference (Artigue, 2004), and, consequently, certain paradigms that functioned in high school are not useful anymore, such as the learning methods and the organization of one's autonomous work (De Guzmán et al., 1998). The emotions that accompany this transition are powerful and sometimes all-embracing (Clark & Lovric, 2008). From a social point of view, integration into a new community with new people and new interpersonal interaction rules adds further uncertainty and fragility to a delicate period (*ibidem*).

Although the transition from secondary school to university is an area with many contributions and many testimonies of fruitful teaching experiences, still little work concerns the context of bachelor courses where mathematics is not the core discipline. This reality could show differences from all the aspects described before compared to studies conducted on "specialized" students (Di Martino et al., 2023). Often coming into contact with "non-specialized" students, the topic of transition to undergraduate mathematics education is of great interest to us; wanting to investigate more deeply this phase experienced by our students in the Architecture course at Politecnico di Milano, we decided to use a tool known in pedagogy for its metacognitive and self-reflection potential: the personal journal.

Journals are the repositories of thoughts and ideas, processed and clarified through writing or recording one's experiences (Killion, 1999). As technology has become pervasive in everyone's daily lives, journaling is often transposed to the digital realm in education (e.g., Morando et al., 2023), making writing and filing more accessible and easier for teachers to reference. However, in mathematics education journaling is not often used, probably because of the stereotype associated with "advanced" mathematics as predominantly instrumental (Skemp, 1978), neglecting the emotional and linguistic aspects that influence learning even in this discipline (Bardelle & Di Martino, 2012).

The primary aim of this article is to investigate the nuanced facets of the transition phase from secondary to tertiary education in our university students, employing the method of journaling, in particular analyzing the words used and their context. By delving into the reflective insights provided by students through journaling, we seek to gain a deeper understanding of their experiences, challenges, and perceptions during this crucial phase. This exploration aims to shed light on the complexities of these changes and provide valuable insights for educators and institutions to enhance support mechanisms and improve the overall transition experience for our students.

2. Methods and Research Contest

Our work focuses on the mathematics course held during the initial semester for first-year Architecture students at Politecnico di Milano. In addition to the basic mathematical concepts essential for their academic progression, the course also aims to introduce the logical rigor necessary for the training of an architect. This year the course was divided into two segments, each consisting of two modules, culminating in brief assessment tests. Before these tests, a deadline was set for submitting a personal journal, consisting of any type of written digital file about reflections on the lectures, for a total of four deliveries. We decided to use the Journal as a tool that serves a dual purpose: fostering metacognitive development among students and gaining insights into their experiences during the transition from secondary to tertiary education within an architectural mathematics classroom.

The course enrolled approximately 180 students, of whom 104 submitted at least one journal. To encourage participation, we made some of the learning objectives of this activity explicit (reviewing what was done in class, reflecting on their own difficulties and strategies to overcome them), and also offered extra points on the final grade. In order to avoid any sense of fear of being judged by their teachers, we assured the students that their contributions would be accessible only to a tutor (the third author) who would report the main demands and difficulties to the course lecturers anonymously. The lecturers, based on the reports received, had the opportunity to comment on what the students had written in their journals, intending to advise the students, suggesting additional or different teaching materials, or modifying certain aspects of the course such as the timing of the tests.

2.1. Text Analysis

We opted to use AntConc (Antony, 2023), a free corpus analysis toolkit designed for text analysis, to conduct an initial exploration of the content submitted by students. For this purpose, we decided to select only the contribution of those who handed in all four assignments, totaling 61 students. To facilitate the software's identification of each term, we found it necessary to exclude certain entries from the initial pool of the diaries: those handwritten by tablet and those

composed of photos of handwritten pages, resulting in a refined dataset with 216 journals turned in by 54 students. We systematically organized these contents into four distinct files, each including contributions corresponding to a specific assignment. This procedural arrangement facilitated the extraction of words that were present across all four files, thereby capturing the temporal evolution of language usage throughout the course.

After selecting a stop list of words to exclude – such as articles, conjunctions, etc. –, AntConc's "Word" function allowed us to sort the words according to their frequency. By configuring the "Range" parameter to 4, we were able to effectively isolate the words used in all four files created. This allowed us to choose the ones students used throughout the course and thus was representative of themes across the disciplinary topics covered in the lectures. Subsequently, more than 500 words were identified. We proceeded to select approximately 100 words with the highest frequency and another 100 with the lowest frequency. The seemingly unconventional choice of examining both high and low-frequency words was deliberate: our goals were, first, to discern typical STT themes within students' narratives, analyzing how they were declined in this environment, and second, to identify any new themes specific to the class group. This comprehensive approach facilitated exploring significant themes and identifying potential distinctive nuances conveyed by less frequently used terms. It provided a more comprehensive understanding of the students' narratives, allowing us to capture subtleties and unique perspectives embedded in the less common vocabulary choices.

To refine our focus, we found it necessary to exclude terms that, while longitudinally present throughout the course, were implicitly linked to assignment requirements (e.g., "*journal*"), as well as words from mathematics closely related to the course content (e.g., "*theorem*"). To identify the setting associated with the selected terms more accurately, we wanted to have an overview of the context of use as well; therefore, we used software features such as Collocate and KWIC, which select other terms related to the one under consideration or report the original sentences in which the word was so that the context can be deduced from reading them (Antony, 2023). This approach allowed us to exclude non-significative words such as "*mathematics*", which was frequently used even without deep insight. A low-frequency word that can serve as an example for understanding our selection process at this stage is "*to fill in*", which in Italian is often associated with the term "*gaps*"[1]; the latter term proved to be decidedly more interesting, and so the analysis of the term "*to fill in*" coincided, essentially, with that of the term "*gaps*".

Finally, we analyzed the remaining words in light of the STT themes, assigning - where possible - a category to each word. Among the various themes identified and studied in the literature, we selected five of them: the instrumental/relational mathematics view, the structural differences

[1] In Italian, "colmare" e "lacune".

between high school and university, the new self-regulation strategies needed to cope with new learning methods, the emotional aspect of acquiring a new identity as a university student, and the social aspect of integration with the peer group. The labels used were: "Instrumental/Relational" (I/R), "Structural differences" (SD), "Self-regulation" (S-R), "Identity" (Id), and "Social integration" (SI). It is important to emphasize that, obviously, such a categorization is in itself limiting and functional only to a preliminary analysis of the contents of the journals. It is worth noticing, our analysis allows that some words belong to more than one category. Those, even contextualized, seem to express messages belonging to different themes of transition depending on the kind of nuances the reader can grasp. For example, the sentence "I am *happy* that I did well on the test" can be interpreted as both "I am *happy* because I thought I was incapable and could not achieve such a result" (concerning more the theme "Id") but also "I am *happy* because I studied hard and my efforts paid off" (concerning more the theme "S-R"). Of course, these two interpretations are exaggerations, but they help us understand the wide range of the interpretive spectrum in which each term can be placed.

3. Data analysis

At the end of the first data cleansing, we selected 102 high-frequency words (min 37 - max 622), and 108 low-frequency words (min 4 - max 7). Then we employed the qualitative analysis described in the previous section to 155 words. Among these, 81% were removed because they were not significant terms (e.g., "*journal*", "*theorem*", "*mathematics*"). Finally, we employed the qualitative analysis of 28 words. We report in Figure 1 the selected words labeled according to STT themes with their frequency (in brackets).

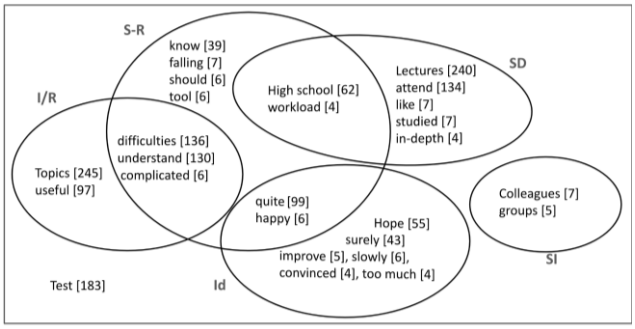


Figure 1. Classification of the selected words.

At first look, we can observe that the theme social integration (SI) is the least populated, while the most populated is the S-R one with 11 terms, some of which are in common with other themes. For clarity, in the following, we report a deep analysis of a few terms. If we take an analysis of the term "*useful*" (*u.*) and its context of use, we notice that for students it is associated only with practice moments during classes: "I find the practical session more *u.* than the

theoretical lectures", "we should do more exercises *u.* for passing the exam". This highlights how the view of mathematics is mainly instrumental: practice and repetition seem to be, for students, more relevant to pass the exam than theoretical explanations of concepts and methods. As a consequence, the term "*useful*" belongs to the theme I/R. The differentiation between hours devoted more to theory and others more to practice is typical of college mathematics but not of high schools, and this is one of the differences between the two cultural institutions that emerge: "the university *workload* is more demanding", "the *workload* of the course is more than what was done in *high school* and in less time", "I never covered this topic *in depth* in *high school*, I can't understand it". Therefore, "*workload*" is labeled both as S-R and SD. These changes seem to cause a negative atmosphere for some students: "I've *fallen* behind, I *should* practice more", "I *should* start studying as hard as my classmates if I want to pass the exam", which concerns the S-R theme. Other students mentioned the "*hope*" that the effort will pay off because they feel their journey is going ("*quite*") "*well*". As a result, these latter terms belong to the Id themes.

The only word that did not find a main category of reference was "*test*", a term that students used to talk about their experiences related to assessment. This moment is cross-cutting: if you have an instrumental view, the amount of exercise done in the short time before the test affects your confidence. The first university exam brings with it many anxieties because it is the first encounter with a new assessment method and the comparison with high school grades is still strong.

The theme that is certainly less represented is what we have called Social Integration, which indicates the process of settling and adjusting to a new peer group with new relational dynamics. This lack of representation, however, is quite justified when we think about a university lesson: we asked students to talk about the math course, and although they were "allowed" to express anything related to it – even their emotional and experiential world – occasions for socializing in class are rare, even if (we hope) students socialize with each other during breaks and outside. From the words analyzed, we can also see how some students independently create moments of discussion with *colleagues* ("I had a *c.* explain it to me"), sometimes through study groups ("We solved the exercise as a *g.* and confronted each other").

4. Discussion and conclusion

This work aims to help educators and institutions understand the complexities of this transition better: we saw how students include the themes that characterize STT in their texts (Clark & Lovric, 2008; Artigue, 2004; De Guzmán et al., 1998), a signal that these are still relevant and present even in students "not specialized" in mathematics (Di Martino et al., 2023). At a preliminary analysis such as the one we have presented here, no different themes seem to emerge from those already present in the literature, but this may be caused by a bias in our observation of the data: behind some of the terms may lie unexplored themes that are not identifiable through

this type of tool. The personal journal, however, turned out to be a great instrument for gaining insights into the students' academic journey overall, to understand in part what this new experience is for them and the emotional and social world it entails (Morando et al., 2023; Bardelle & Di Martino, 2012). Moreover, our study confirms and extends the previous research. Indeed, a tool like this makes it possible to create a partially informal communication channel with the class group, which, when it is as large as it is in university classrooms, itself guarantees a kind of "anonymity": the professor will most likely never associate my name with my face among the hundred-plus people in the classroom, and this makes me feel freer to express my opinions, feelings, and ideas. And we, as educators, can benefit from this to know in a more "real" way what our students are experiencing.

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Investigating the Variables Impacting the Research Interest Among Undergraduate Students in STEM Fields

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Abstract

This research delves into the determinants impacting the research inclinations of undergraduate students in Science, Technology, Engineering, and Mathematics (STEM) fields. Stemming from global concerns regarding a shortage of qualified STEM professionals, the study examines the dynamics surrounding the encouragement of STEM disciplines and career paths. Utilizing a survey of 472 undergraduate students, quantitative data was collected and subjected to statistical analyses to uncover significant variations in research interests based on factors such as gender, undergraduate discipline, motivations for pursuing STEM programs, and class attendance habits. The findings suggest a necessity to enhance the exposure of male students, particularly in engineering and technology subjects, to STEM fields. These insights contribute to a better understanding and approach to addressing challenges in fostering research interests among undergraduate students.

Keywords: *Educational Reform; STEM Education; Capacity Building; Higher Education; Undergraduate; Research Interest*

1. Introduction

Science, Technology, Engineering, and Mathematics (STEM) fields play a crucial role in today's globally competitive economies. Governments worldwide invest in STEM to drive economic growth and address real-world challenges (Creel et al., 2017). However, despite the merits associated with STEM education, an alarming pattern has emerged, indicating a substantial reduction in the level of student interest in STEM programs (Chen, 2021). This decline poses a serious challenge for educators worldwide who are grappling with engaging students and cultivating enthusiasm for STEM education and careers (Smith & White, 2022).

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Numerous studies in this context have highlighted the significance of students' research interests in STEM, asserting a direct correlation with their learning experiences (Krapp & Prenzel, 2011). Moreover, researchers agree that the research interests of students play a pivotal role in influencing their understanding of a subject, thereby serving as a precursor to the overall learning process (Ward et al., 2002). In addition, a study performed by Russell et al. suggest that enthusiasm plays a pivotal role in fostering interest in STEM research and pursuing higher degrees, emphasizing the importance of early exposure to such experiences (Russell et al., 2007). Research interests are often shaped by various pedagogical approaches, which include interactive learning environments and the integration of real-world applications into the curriculum. These approaches are found to stimulate student interest and engagement significantly (National Academies of Sciences, Engineering, and Medicine, 2016).

Given these insights, there is a necessity to delve into the dynamics surrounding the promotion of STEM disciplines and careers, considering the various influences that either stimulate or discourage student interest in STEM. For this, the current study explores the following research question:

- Which factors affect the research interests of undergraduate students in STEM programs?

2. Methods

In this study, we aimed to collect data on undergraduate students' research interests in STEM to assess how various factors affect their interests. This section discusses the data collection methods, tools, and quantitative analyses used in the study.

2.1. Survey Instrument

In an effort to examine the research interests of undergraduates, a questionnaire was designed to gather (a) demographic information regarding the students and (b) empirical data pertaining to their STEM-focused research inclinations. The interest in the research construct, as proposed by Bishop and Bieschke in 1994 is rooted in the social-cognitive model of interest development articulated by Lent and colleagues in 1994 (Bishop & Bieschke, 1994). According to Lent et al. (Lent et al., 1994), interest in research is shaped by various factors, including personal characteristics, environmental influences, research self-efficacy, and expectations regarding research outcomes. The survey was designed based on these theoretical groundings to incorporate measures that evaluate the research interests of students. Further, a five-point Likert scale (highly disagree to highly agree) was employed to evaluate six closed objects to explicitly measure students' research interests as listed in Figure 1. For each of these items, students were given response choices depending on the type of question. The survey instrument used was

approved by Qatar University's Research Ethics Board (QU-IRB 1721-EA/22) and was offered in English.

2.2. Participants

The survey was distributed to a randomly selected group of undergraduate students at Qatar University. Data collection took place in the year 2022-2023. The poll necessitated the acquisition of informed consent from participants and was totally optional, allowing individuals the freedom to withdraw at any point. The poll received responses from a total of 472 participants representing diverse undergraduate STEM disciplines. The demographics of the students comprising the sample size for this study are presented in Table 1.

Table 1. Student demographics. Source: By authors.

Variable	Sub-categories	Percentage	N
Gender	Male	43.9	207
	Female	56.1	265
Age Group	Under 18	2.1	10
	18 to 21	53.0	250
	22 to 25	40.3	190
	Over 25	4.7	22
Undergraduate discipline	General Science	14.0	66
	Engineering	65.0	307
	Medicine and Health Sciences	21.0	99

2.3. Data Analysis

2.3.1. Statistical Analysis

The data underwent analysis utilizing IBM SPSS Statistics (Version 29.0). The utilization of significance tests was employed to identify statistical variations in the research interests among different groups. The Shapiro-Wilk test was employed to assess the normality of the data distribution, aiding in the selection of either parametric or non-parametric significance tests. The Mann-Whitney U and Kruskal-Wallis H tests were utilized for data that exhibited skewed distributions.

2.3.2. Research Interest Score

This study employs the use of research interest score (RIS) as a metric derived from survey data to quantify and categorize the level of research interest exhibited by each student (Figure 1). The survey responses provided by students were categorized into dichotomous variables by assigning a value of negative, neutral, or positive to indicate low, neutral, or high levels of research interests, respectively. To derive a comprehensive measure, the scores of the six survey questions were aggregated, resulting in a single RIS that ranged from -6 to 12. The score depicted the comprehensive magnitude of each student's research interests in STEM areas. The descriptive statistics and reliability of the RIS measure is given in Table 2.

Table 2. Descriptive statistics and reliability of the Research Interest Score (RIS) measure. Source: By authors.

	Construct Reliability				Descriptive Statistics					
Variable	No. of items	Cronbach Alpha	Kaiser–Meyer–Olkin (KMO) value	p	Mean	Median	SD	Range	Minimum	Maximum
Students' Research Interests	6	0.739	0.757	<0.001	6.28	7.00	4.28	18.00	-6.00	12.00

N = 472

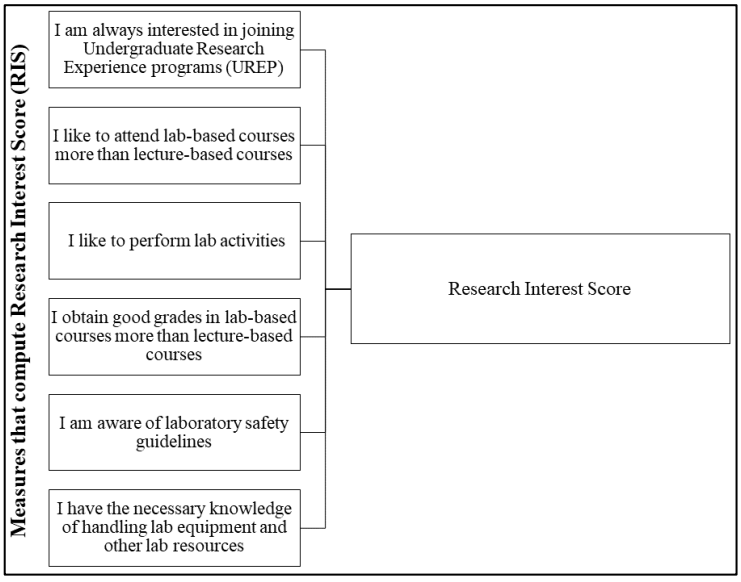


Figure 1. Specific research interest measures which compute the overall Research Interest Score (RIS) measure. Source: By authors.

3. Results

A statistical analysis using the Mann-Whitney U test was conducted to examine the differences in research interest between various sociodemographic and academic factors (see Figure 2). The findings of the study (Table 3) revealed a statistically significant disparity ($U = 30935.5$, $p = 0.017$) between male and female students, indicating female participants (mean rank = 249.74) to have higher research interests than male participants (mean rank = 219.55). Further, Kruskal-Wallis H test based on discipline revealed a statistically significant difference in RIS across students of different disciplines, $\chi2(2) = 276.11$, in general science group (see Table 4). The RIS in medicine and health sciences 263.94. Similarly, the RIS in engineering discipline is 219.14. The research interest of students in general science and medicine and health sciences is higher as compared to engineering discipline. Also, the Mann-Whitney U test showed a significant difference ($U = 16794$, $p < 0.05$) between Friends and Family motivation and Self-motivation in joining undergraduate STEM programs (see Table 3). Furthermore, the Mann-Whitney U test also showed a significant difference ($U = 31274$, $p < 0.05$) between responses with yes and no in skipping classes (see Table 3). These findings revealed that students who did not have a habit of skipping classes developed higher research interests as opposed to those who did.

Table 3. Independent-Samples Mann-Whitney U Test Summary for research interests based on gender, reason to join undergraduate programs, and habit of skipping classes. Source: By authors.

Measures	Gender	Reason to join undergraduate programs	Habit of skipping classes
Mann-Whitney U	30935.500	16794.000	31274.000
Standard Error	1465.609	1244.734	1467.104
Standardized Test Statistic	2.394	-2.402	2.584
p	.017	.016	.010

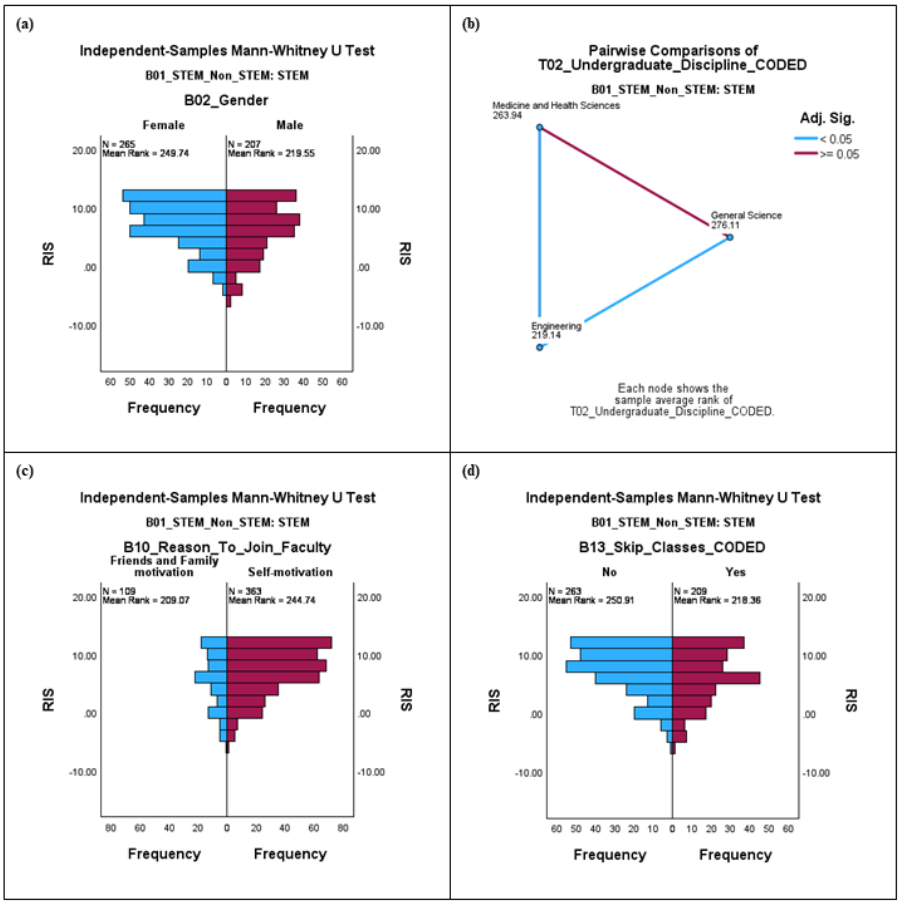


Figure 2. Significance tests for research interests based on students' (a) gender (b) discipline (c reason to join undergraduate programs (d) habit of skipping classes. Source: By authors.

Table 4. Pairwise Comparisons of Undergraduate Discipline. Source: By authors.

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Adj. Sig.[a]
Engineering-Medicine and Health Sciences	-44.809	15.713	-2.852	.013
Engineering-General Science	56.971	18.446	3.089	.006
Medicine and Health Sciences-General Science	12.162	21.604	.563	1.000

4. Discussion

The findings of our data analysis indicate the factors that impact the aspirations and research interests of undergraduate students in STEM are contingent upon the specific context. The findings of our study indicate that variables such as students' gender, undergraduate discipline, motivation for joining STEM programs and their habits of skipping classes were significant predictors of research interest in STEM disciplines of study. Our analyses of gender disparities in student aspirations and interests in research indicate that female students were more enthusiastic about research than their male counterparts. This outcome contradicts the conclusions drawn from the majority of prior research, which has demonstrated that males have a greater inclination towards research in STEM-related disciplines or professions (Delaney & Devereux, 2019). **The differential impact of** ~~Further,~~ discipline and motivation behind joining STEM being factors which influence research interests have also been discussed in previous literature (Laursen et al., 2010; National Academies of Sciences & Medicine, 2017). Absenteeism was an additional significant factor influencing students' research interests in STEM. This discovery is consistent with the outcomes of an extensive meta-analysis conducted by Marcus et al. (Credé et al., 2010), which concluded that class attendance is a robust indicator of the academic attributes and conduct of undergraduates. **The link between** academic attendance and grade point average (GPA) are ostensibly linked through the particular interests of students (Batres, 2011). There exists a positive correlation between increased student attendance and developed research interests, which can potentially facilitate the attainment of high grades in both attendance and GPA. As a result, it is imperative that educators and policymakers place a premium on increasing undergraduate research participation in STEM fields. Moreover, additional research on attendance could assist in determining whether it correlates with the attrition rate among undergraduate STEM students.

5. Conclusion

In conclusion, this study sheds light on critical factors influencing research interests among undergraduate students in STEM programs. The observed gender differences, disciplinary variations, and the impact of motivation and class attendance habits emphasize the multifaceted nature of students' engagement in STEM research. These findings provide valuable insights for educators, policymakers, and institutions aiming to enhance research interest and participation among undergraduate students in STEM disciplines and similar contexts.

The present study sheds light on crucial factors affecting research interests among undergraduate students in STEM programs, with observed differences across gender, disciplines, and motivational aspects influencing their engagement in STEM research. These insights are vital for educators, policymakers, and institutions striving to foster deeper involvement and enhance research interest among students. To further this goal, institutions

should consider implementing targeted mentorship programs that connect students with experienced researchers to inspire and guide their research endeavors. Additionally, developing workshops and seminars that focus on current STEM advancements can stimulate curiosity and engagement among students. Schools could also integrate more hands-on, project-based learning in the curriculum, which has been shown to increase interest in STEM by providing real-world context and applications of theoretical knowledge. By addressing these aspects, we can create a more stimulating educational environment that not only maintains but boosts student interest in STEM fields, preparing them for future challenges and innovations.

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What makes University Networks work? Exploring Success Factors and Development Needs

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Abstract

University networks have become a common approach to the implementation and management of projects both in research and higher education. However, the theoretical reasoning and empirical investigation of the determinants that make university networks successful is not yet consolidated. The present study thus takes an exploratory perspective in order to contribute to the debate on what is necessary to make university networks work. We draw on data from a nation-wide survey of German university networks and extract dimensions that have an impact on the stakeholders' perception of what contributes to networks' achievement: a working atmosphere that is rather cooperative than competitive, personal identification with the network, its institutional support and goal attainment. All of these aspects are discussed in the light of theoretical perspectives in order to further develop a theory-driven research agenda.

Keywords: *Networks; identification; cooperation; institutional support; goal attainment.*

1. Introduction

Establishing university networks for the joint acquisition of funding and implementation of projects has become a common management approach both in research and higher education (Goedegebuure, 2012; Gunn & Mintrom 2013; Rocha et al. 2018). The expectation towards such alliances among others is that they help secure a more efficient use of scarce resources, promote mutual learning, and become more competitive as a consortium that combines different sources of expertise. Nonetheless, many networks fall apart after the termination of the respective projects' funding period, even when a longer lasting cooperation had initially been intended. The analysis of university alliances and the determinants of their successful initiation and implementation is an emergent field of study (Fehrenbach & Huisman, 2022). The theoretical reasoning on the factors of success and failure thus is not fully consolidated. For research alliances, Fehrenbach & Huisman (2022) state that little is known about the interplay between network partners' motivations and the organisational set-up (governance structures,

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processes, etc.). The present study aims to address such gaps. It reports findings of a national survey of university networks in the field of higher education development in Germany. The analysis is explorative in nature, nonetheless, it aims at contributing to the pending theoretical conceptualization of university networks by identifying predictors of networks' success and their interplay. Theoretical perspectives that help resolve the diverse dilemmas of cooperation in networks (e.g., distrust between the partners, disbalance between investments and returns on investments, etc.) are needed. Preliminarily, we draw on perspectives that are inspired by social capital theory (e.g., adherence to norms of reciprocity; Putnam, 2000). The study focusses on university networks in the field of higher education and specifically on those that are engaged with higher education quality development. Therefore, the study particularly places emphasis on networks that jointly implement activities in management fields like quality assurance, academic development, internationalization etc. It does not involve networks of universities that implement joint degree programmes or other purely academic tasks.

2. Study Design

2.1. Sample

The data were drawn from a nation-wide survey of German universities that had hosted or participated in at least one university network between 2016 and 2022. The survey was implemented under a research project[1] which had set out criteria for what a university network actually is. According to these criteria, we define university networks as institutionalised alliances of universities which pursue the shared goal of contributing to quality enhancement and increasing higher education effectiveness. They are established on a lasting basis and have been initiated by means of (public) subsidies. The cooperation is based on agreements with regard to both the specific objectives of the cooperation, and the processes geared at achieving the shared goals. These processes relate to both the culture of the cooperation (e.g., working in a collegial spirit) at the management and operational levels, and the organisational structure (e.g., boards, responsibilities of the participating universities and their agents). Moreover, the network is visible for external stakeholders, e.g., through a web-page or other channels of communication (Merkt, et al., 2024). By means of a systematic desk research we retrieved 174 university networks that matched the above criteria and were (or still are) active between 2016 and 2022. Representatives of the operational level of the sampled networks were identified through a web search. They were invited to administer the online-survey and to pass the web-link to the survey on to their colleagues who had or still have an active role in the network. The field work was performed in May/June 2022, and the data were collected through an online survey. A reminder was sent out once, two weeks after the initiation of the survey. Respondents

[1] See acknowledgements.

from 62 different networks participated in the network which equals a response rate of 35.6% at the level of networks. The response rate at the level of individual stakeholders cannot be controlled, since the actual number of people that have an active role in the network is unknown. Thus the reported data do not claim to be representative for the entirety of university networks.

2.2. Methodological approach and research questions

University networks' success as such, and also the respectively relevant determinants can be interpreted as latent constructs which elude an immediate empirical observation or measurement: respondents may weigh the different aspects of networks' success differently, they may have different understandings of what contributes to a successful network, etc. We thus deliberately dispensed to base the analyses on theory-driven hypotheses and made preliminary assumptions instead, concerning the relative meaning of different (latent) aspects for the achievement or *success* of university networks (path diagram in figure 1). Since the study is exploratory in nature, we did not develop hypotheses to be empirically tested. Nonetheless, based on the notions of social capital we anticipated that aspects such as the extent to which respondents consider the working atmosphere as cooperative and reciprocal (latent variable *cooperation*). We further expected that 'success' is a function of the extent to which stakeholders can identify themselves with the network (latent variable *identification* in the path diagram in figure 1); of the level of *goal attainment*; and of the *institutional support* which the network enjoys by the superiors of the respective university. In order to analyse these latent variables in terms of their relative relevance for network success, we assigned indicator variables which is the observations that were performed by means of the survey. Table 1 displays the properties (specifications, descriptive statistics) of the latent variables' measurements. For the statistical analysis of the respective relationships between latent variables (direct, indirect, and total effects), we performed a partial least square (PLS) based structural equation model estimation with smartPLS software (Ringle et al., 2022). PLS modelling is less sensitive against violations of model assumptions, such as a small sample size or the normal distribution of the data (ibid.) and is thus appropriate, given the sample's properties.

3. Results

3.1 Measurement model

The measurement ('outer model' represented by the rectangles in the path diagram) specifies the relation between the latent variables and the respectively assigned indicator variables. The

Table 1. Properties of the variables in the model.

Latent construct	Measurement variables	Variable specifications (5-point Likert scale from (1) 'does not apply/do not agree at all' to (5) 'fully applies/fully agree')*	Mean / St.-Dev.
Success	innovation	'The network has a high innovative capability'	2.85 / 1.07
	overall	'All in all the network was/is successful'	3.15 / 0.86
	relevance	'Results are relevant for quality development'	2.91 / 1.08
identification	coop. again	'I would join the network again'	3.30 / 1.13
	enjoy work	'Generally, I enjoy working in the network'	3.27 / 0.96
	identify	'All in all, I can identify myself with the network'	2.87 / 1.20
	person. dev.	'The cooperation helped me progress personally'	3.13 / 1.07
goal attainment	new fields	'We were able to tap new action lines'	2.98 / 0.97
	solutions	'We developed solutions to practical problems'	3.20 / 0.96
	strategies	'We developed strategies for higher education'	2.88 / 1.11
	tentative	'The network has tentatively achieved its goals'	3.03 / 1.01
cooperation	needs	'Needs of staff members were appreciated by all'	2.71 / 1.02
	reciproc.	'Staff were eager to reciprocate support'	2.84 / 0.90
	relations	'Relationship: competitive vs. cooperative'	3.47 / 0.72
	support	'I had access to other staff's support at any time'	3.31 / 0.87
institutional support	adjust	'It was possible to adjust goals, when necessary'	3.10 / 0.87
	facilitate	'The network facilitated difficult projects'	3.02 / 1.14

* table 1 provides English translations of the German-language items that were used in the survey.

coefficients represent the effect of the latent construct on the respective indicator variable. All indicators take on desirable values. The additional tests for the evaluation of the measurement model's reliability and validity largely confirm its appropriateness. The values for Cronbach's α and for the composite reliability (ρ_c) are above the threshold value of .50 with the exception of the latent variable *institutional support,* implying the need for further elaboration The values for the average extracted variance (AVE) however, are confirming all constructs' validity.

3.2 Structural Model

For the evaluation of the structural model ('inner model', represented by elliptic shapes in the path diagram), we're assessing the path coefficients; the coefficient of determinantion (R^2) which is a measure of the amount of variance in the endogenous latent variables that is explained by the impact of the exogenous latent variables; and the effect size (f^2) as a measure of the relative impact of the exogenous on the endogenous variables (Hair et al., 2022).

The path coefficients in the model can be interpreted in correspondence with the β-weights in OLS regression models or as the relative contribution of an exogenous variable to the explanation of the variance in the endogenous variable(s). All path coefficients are statistically significant ($p < .001$).

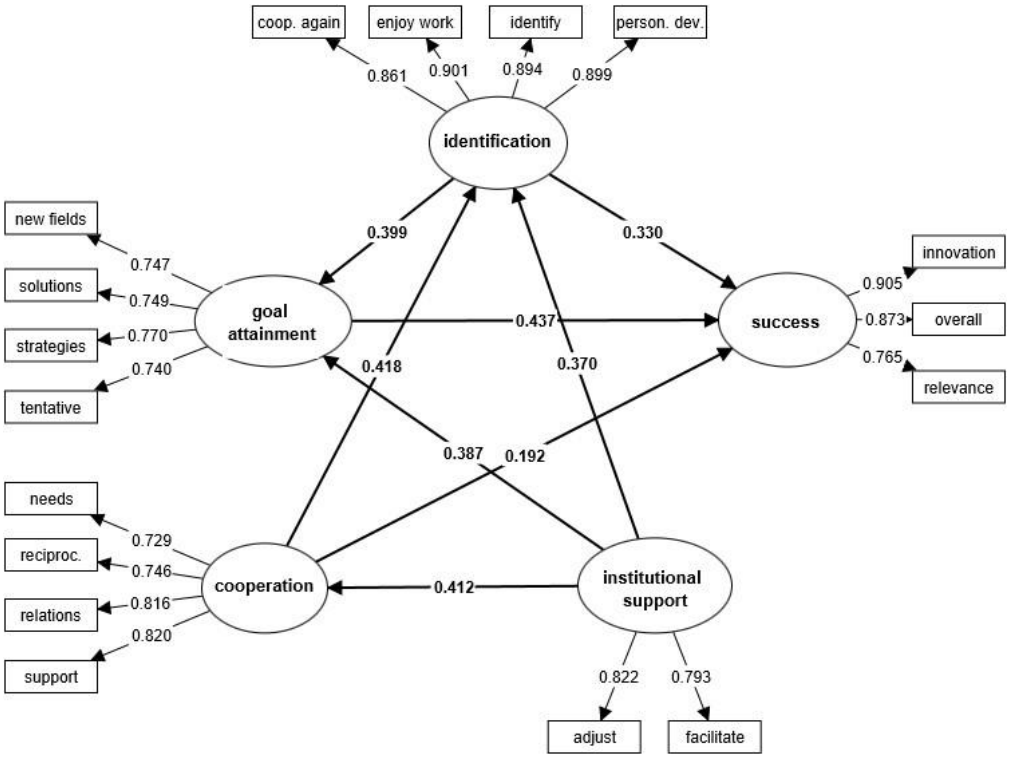


Figure 1. Path diagram of the estimated model (standardized coefficients).

The adjusted value for R^2 of *success* as the ultimate dependent (or endogenous) variable is .657 which means that almost two thirds of the variance in *success* are explained by the impact of variables that represent stakeholders' identification with the network (latent variable *identification*), their assessment of the working atmosphere in the network as cooperative (*cooperation*), and features of the network's ability to reach its goals (*goal attainment*). Additionally, indirect effects from *institutional support* over *cooperation*, *goal attainment*, and *identification* contribute to the R^2 value in success which means that a positively perceived institutional support contributes to a cooperative working atmosphere that supports the stakeholders' identification with the network.

All in all, the model in its current state contributes considerably to the explanation of what the relevant aspects of university networks' success are. Also the other endogenous latent variables are well explained by the assigned exogenous variables, with adjusted R^2 values of .432 for identification, .471 for goal attainment, and .165 for cooperation.

The f^2 test statistics confirms the effects of the exogenous on the endogenous variables (direct effects) as shown in table 2. Unsurprisingly, the strongest effect is the one of *goal attainment*

on *success*. Attaining an activity's goals is naturally an important aspect for stakeholders' appraisal of that particular activity as a successful one. However, all latent variables in the model exhibit medium size or at least small effects (Chin 1998) which means that they exhibit substantial explanatory power with regard to university networks' successful implementation.

Table 2. f^2 statistics for the latent constructs.

Latent constructs (direct effects)	f^2
cooperation => identification	.258
cooperation => success	.072
goal attainment => success	.346
identification => goal attainment	.216
identification => success	.169
institutional support => cooperation	.205
institutional support => goal attainment	.203
institutional support => identification	.202

3.3 Overall model evaluation

PLS modelling does not provide a simple overall goodness-of-fit indicator (Hair et al. 2021) which is why for an overall model assessment, the above outlined parameters need to be evaluated in their entirety. With regard to most of the parameters under evaluation, the suggested model performs well. Exceptions are measures of the internal consistency (reliability, validity) of the latent variable *institutional support* (Cronbach's α). With regard to all other parameters, also *institutional support* as a latent variable seems to be a meaningful aspect of university networks and their success. Nonetheless, the weaknesses with regard to the assigned indicators suggest the need for further elaboration of this particular latent construct.

4. Discussion

Notwithstanding an existing need to further elaborate on the model design, the current state of the analysis serves the purpose of the exploratory study very well. The estimated latent variables function as powerful predictors of the overall construct of university network *success*. In this sense, one can say that networks are more successful, if they manage to establish a working atmosphere that is perceived as a cooperative one. A rather cooperative than competitive working situation helps raising the *identification* with the network which is in turn contributing to its *goal attainment*. The role of *institutional support* in the sense of university leaderships that are actively backing the network and promote the achievement of the previously set goals, remains comparatively unclear. Most probably, this is due to the structure of the available data, in which the operational level constituted the actual target audience of the survey and not those respondents in management positions and with a responsibility for support provided by management levels to the actual implementation of the respective networks.

The identified latent constructs can also be related to already established theoretical concepts in order to contribute to a more theory-driven reasoning on university networks in the long run. *Cooperation* in the conceptualization we chose here, embraces the willingness of stakeholders from the different participating university network partners to provide reciprocal support. This notion provides an interface with social capital theory which can generally be seen as an appropriate perspective when social networks are involved (Putnam, 2000; 2001).

Identification may be further analyzed from a psychological angle, e.g., in terms of the theory of self-determination and autonomy (Ryan & Deci, 2017) which is centred around the concepts of the intentionality of and the motivation for a specific behavior or action. The authors differentiate between intrinsic and extrinsic motivation and interpret intrinsic motivation as a representation of self-determined action. Such type of action is meeting the psychological need for autonomy. In the case of the *identification* of actors with a university network, it would be worthwhile to analyse the level to which specific activities at the operational level of the network, can be attributed to such self-determination or in other terms, what specifically are the sources of the identification with the network. Respective knowledge may help fostering a working atmosphere that is conducive to staff *identification* and *cooperation*.

Goal attainment could be thought to be of noble social science theoretical descent, since it forms one of the four functionalities of social systems in the work of Talcott Parsons (1951). In the present understanding however, *goal attainment* is not meant as a process through which activities are mobilized with the aim of attaining a particular goal by different actors in a shared labor approach. It is rather meant as the outcome of such processes, in the sense that solutions to problems have been found jointly, strategies have been developed, new fields of activity have been identified, etc., as is implied by the indicator variables that form this particular latent construct.

Nonetheless, when exploring the conditions under which university networks are able to achieve their previously set goals, one could still take a structure-functionalist perspective for further inquiry into the determinants of university networks' successful acting. In the same vein one could finally look at the role of *institutional support* or its meaning for the establishment of a well-functioning working level and its relation. Finally, it can be concluded that university networks are a complex phenomenon that requires taking a multidimensional perspective that combines actor-centred approaches (e.g., cost-benefit analyses by individual and corporate actors; social networks) with rather system-theoretical perspectives (e.g., universities as organisations; governance arrangements).

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A Taste of Research: Preliminary Insights from an Undergraduate Research Training Cadetship Project in a Western Australian University Offering Experiences Outside the Classroom

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Abstract

This paper assessed the impact of a Student Research Cadetship Program aimed at providing undergraduate students with extracurricular research opportunities within the School of Medical & Health Sciences at Edith Cowan University. This preliminary evaluation, comprising two studies, explored the outcomes, benefits, and challenges experienced by students and academic staff. Study 1 analysed outputs from cadetship projects between 2016-2023 (n= 80 students; 42 academics). Notably, cadets contributed to over 60 research outputs, with 30% of cadets transitioning to postgraduate studies following competition of the program. Study 2 focused specifically on the 2023 program, highlighting positive impacts on academic staff and cadets, showcasing improved skills, heightened confidence, and increased career aspirations. Despite challenges in resource allocation, the program has gained traction, offering valuable research experiences for students and enhancing research outputs. The program serves as a model for other disciplines, emphasising the need for sustained institutional commitment and resource allocation.

Keywords: *undergraduate research experiences; research training; research cadetship program.*

1. Introduction

Australian universities have long acknowledged the provision of undergraduate research training opportunities as an important strategy to ensure student advancement (Boyer Commission, 1998). Despite the endorsement of an enhanced teaching-research nexus by numerous Australian higher education institutions, reports have drawn attention to the

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insufficient allocation of resources to sustain these aspirations (Brew & Cahir, 2014). Offering students authentic opportunities to engage in research training as extra-curricular, work-integrated-learning (WIL) activities benefit not only the students themselves but also the researchers they work with, and the universities at which they study (Miller et al., 2022). Offering such opportunities to currently enrolled students is commonplace (for example: Carson et al., 2018; Hanauer et al., 2017) and such initiatives have reported being associated with many benefits. Students exposed to real-world research projects outside the classroom have been reported to build key employability skills such as critical thinking and communication, whilst learning about important ethical processes (McLaughlin et al., 2020). Such students are also reported to be attracted to postgraduate studies and research careers through developing and enhancing their research, collaboration, and networking skills (Stanford et al., 2017), whilst contributing to research outputs (Mass-Hernandez et al., 2022). Encouraging students to develop positive attitudes and appropriate behaviours as researchers helps promote a culture of undergraduate research, embedding the drive for evidence-based practice (Brew & Mantai, 2017). Furthermore, students build skills in interpreting research results, understanding how knowledge is constructed and that assertions require supporting evidence (Stanford et al., 2017). For academic staff, the benefits of supporting undergraduate research include the personal satisfaction from mentoring students and helping them develop new skills (Stanford et al., 2017) whilst improving their academic promotion prospects (Dolan & Johnson, 2009). The benefits to universities include better student retention and increased enrolments in higher degree by research (HDR) degrees (Moore et al., 2008), alongside increased publications that increase visibility in the research community (Stefanucci, 2019).

While providing undergraduate students with extracurricular research training opportunities has many reported benefits for students, researchers, and the university, it requires support from academic staff and enticing academics into this sphere requires adequate support and resources (Brew & Mantai, 2017). Such programs can present challenges and the establishment of an undergraduate research culture may be hindered by insufficient structural, financial, and administrative resources (Brew & Mantai, 2017).

At Edith Cowan University (ECU), the School of Medical & Health Sciences (SMHS) established a Student Research Cadetship Program in 2016, based on the 2006 University of Wollongong Library Professional Cadetship model, with the aim of providing extra-curricular research opportunities for students interested in getting a 'taste' of research beyond their curriculum-based units. Such opportunities, described as "research-based scholarly experience/tasters" (Brew & Mantai, 2017, p. 562), were intended to fulfill the strategic goal of "building it's HDR program…to support a strong and distinctive community of research students who will succeed in their research careers" (ECU, 2022, p. 14), whilst increasing the volume and quality of research outputs and increasing HDR student numbers and completions (ECU, 2022). SMHS offers >40+ courses across the disciplines of public health, occupational

safety and health, exercise and sports science, exercise rehabilitation, paramedicine, speech therapy, occupational therapy, biomedical science, and dietetics. Some of these courses (but not all) offer opportunities for students to engage in a fourth year of study (Honours) whereby they undertake a yearlong research project, but this is limited to small numbers of high-achieving students. All SMHS students undertake one or two inter-curricula research units, but studies have suggested that undergraduate students tend to dislike these units and have difficulty relating them to their future careers (West & Maier, 2017). Students completing research training units of study in SMHS typically note similar experiences (e.g., UTEI report for HST2122, 2023-2).

SMHS is one of the largest and most research-intensive schools at ECU, leading cutting-edge research through research centres such as the Exercise Medicine Research Institute, the Nutrition and Health Innovation Research Institute and the Centre for Precision Health. SMHS generated half of ECU's research income between 2018-2022 and has established strong research collaborations across all ECU schools, nationally and internationally (Sim, M, personal communication, 24 April 2023). This strong research presence provides many excellent opportunities for student involvement in the School's annual Student Research Cadetship Project. This paper presents a preliminary evaluation of the SMHS Student Research Cadetship Program, shares details of the Program characteristics, and describes the outcomes, benefits and challenges experienced from the perspectives of students and researchers who engaged with the Program.

2. Methods

2.1. Overview of cadetship program

The SMHS Student Research Cadetship Program was established in 2016 and aimed to increase student engagement in research as an extra-curricular WIL experience whilst assisting academics to enhance research outputs. In this program, a research cadet is defined as a student who is engaged in a research training program, with their participation guided by experienced researchers or mentors. The Program is coordinated by a team of SMHS academics without any financial or administrative support from the university. Academic staff were invited to develop a brief expression of interest advertising a discrete element (or 'mini-project') of their research that could be undertaken by a student (research cadet), to a maximum of 180 hours to be completed in a six-month period (typically between April-October). Typically, a myriad of 'mini-projects' are put forward, incorporating a wide range of research activities that may include systematic literature reviews, laboratory-based activities, participant recruitment, data collection, data analysis and synthesis. These 'mini-projects' were ratified by the school Executive Team before being advertised to eligible students. Students enrolled in undergraduate or Master by Coursework degrees, with a Weighted Average Mark of at least 70%, were sent a

personalised email, inviting them to submit an application (or applications) for the advertised mini-projects, comprising a resume and statement of intent. Students enrolled in research degrees (e.g., Honours, Master by Research, PhD) were not eligible to apply as they were already engaged in research training. Researchers assessed the student applications they received and selected those with the best fit to their project, subsequently adopting the role of 'supervisor' to the student. Once this relationship was established, researchers and students (now cadets) worked together for the duration of the mini-project. When the Program ran between 2016-2021, students completed a feedback form at the end of their cadetship. However, since 2022, a research symposium has been conducted at the end of the year, whereby cadets present their research experience to academics and fellow cadets engaged with the Program.

Two sub-studies were conducted to investigate the outcomes, benefits and challenges experienced by students and academics engaging with the Program. Human Research Ethics Approval (HREC #: 2023-04229) was obtained from Edith Cowan University.

2.2. Study 1: Cadetships (retrospective outcomes for cadets and supervisors)

Academics who had supervised cadets in previous years were requested to provide feedback on various research outputs resulting from the project, such as abstracts, grants, and publications. A search of student records identified those student research cadets who had subsequently enrolled in postgraduate studies at ECU. This presented a chance to document comprehensive, archived data from the Program's inception thus capturing the progression of cadets into higher-degree research (HDR) or further graduate studies. A descriptive analysis of documented trends was conducted based on self-report from academics and student enrolment records.

2.3. Study 2: Evaluation of the 2023 Program

A purposive sampling strategy was implemented, targeting all academics (n=12) and student cadets (n=20) who had been involved in the SMHS Student Research Cadetship Program throughout 2023. Academics and students not involved in the 2023 program were not invited to participate. Participant recruitment was conducted via email, and informed consent was obtained at the commencement of the survey via Qualtrics. The survey was based on Lopatto's 2007 study of undergraduate research experiences. Academics were asked to identify the skills and attributes they perceived their cadet had developed during the course of the project; the cadet's contribution to any research outputs; and their willingness to supervise the cadet as a potential post-graduate student. Similarly, the Cadet Survey asked them to identify the skills and attributes they thought they had developed; the research outputs they had contributed towards; and their intentions regarding enrolment into postgraduate study. Data were cleaned, aggregated and analysed descriptively through Qualtrics functionality.

3. Results

3.1. Study 1: Cadetships (retrospective outcomes for cadets and supervisors)

Between 2016-2023, 80 students and 42 academics had been involved in the Cadetship Program. Approximately three-quarters of students were female (72.5%, n=58) and the majority (91.25%, n=73) were enrolled in undergraduate degrees at the time of completing the Cadetship Program (Table 1.).

Table 1. Demographic information. All descriptive statistics represent sample n (percentage).

n	**80**
Gender	
Female	58 (72.5%)
Male	22 (27.5%)
Degree Enrolled	
Undergraduate	73 (91.25%)
Post-Graduate (Graduate Certificate)	1 (1.25%)
Post-Graduate (Master by coursework)	6 (7.5%)

3.2 Cadetship research project outputs

Academics reported that, during their cadetships, students had been tasked with performing literature reviews, data collection and analysis, drafting of manuscripts, reports, and grant submissions. Since 2016, 14 journal articles have been published based on findings from research projects to which cadet students had contributed, with an additional 20 manuscripts drafted for journal submission (Table 2). These manuscripts had included students as listed authors or named within the acknowledgement sections. In additional to journal articles, students had been involved in the development and submission of reports to state and national bodies (n=3), book chapters (n=2), and grants (n=2). Lastly, 24 students had contributed to abstract submissions to conferences or had directly attended and presented at conferences during their cadetships. All information regarding the publication and submission of articles, reports, conference abstracts have been confirmed at of 26/01/2024.

After completion of the cadetship, 24 students (30%) enrolled in postgraduate degrees including those focusing on research and course work (Table 3.).

Table 2. Research output information. All descriptive statistics represent sample n.

Research Output	Total
Published Journal Articles	14
Drafted Manuscripts	20
Published Books	2
Published Reports	3
Grant Submissions	2
Conference Abstracts/Presentations	24

Table 3. Post Cadetship Enrolment Information. All descriptive statistics represent sample n (percentage).

Degree Enrolment Post Cadetship	
Honours	2 (2.5%)
Masters	21 (26.25%)
PhD	1 (1.25%)

3.3. Study 2: Survey results 2023

The survey was completed by four academics and six cadets who completed the Cadetship Program in 2023.

Academics (n=4) who participated in the 2023 Research Cadetship Program represented diverse disciplines such as teaching and learning; medical science; biomedical science; and allied health. Notably, three out of the four surveyed academics were early-career researchers. The reported research outputs attributed to the cadets by academics encompassed data analysis and presentations. Additionally, half of the academics expressed their willingness to mentor their cadets as postgraduate research students.

In the assessment of skills and attributes refined by cadets during the Cadetship Program, 75% of academics reported the students demonstrated heightened confidence, enhanced oral communication skills, and a deeper grasp of knowledge construction. Furthermore, a significant proportion of academics expressed ‘agreement’ regarding their cadets' improved comprehension of the research process, adherence to ethical standards in research, and proficiency in written communication. Additionally, 50% of academics noted advancements in cadets' capacity for independent work, assumption of responsibility, and proficiency in result interpretation, and noted they would be prepared supervise the student if they expressed an interest in postgraduate research.

Upon completion of the cadetship experience, six cadets completed the survey. The majority of student cadet participants either 'agreed' or 'strongly agreed' with various statements in the survey assessing the positive impacts of the Program. Notably, 67% of respondents expressed "*an enhanced understanding of their career path*", while the same percentage (67%) agreed that they "*acquired skills in reading and comprehending primary literature*". Additionally, all participants (100%) considered felt they had "*learned how to deliver effective presentations*". Furthermore, 83% of respondents acknowledged "*improvement in their writing skills*" and "*gained self-confidence*", while a similar percentage (83%) recognised "*a better understanding of how to work independently*". Lastly, 67% of cadets indicated that they became part of a learning community through their participation in the program. Noteworthy was the future academic aspirations of the cadets, with 83% (five out of six) planning to pursue postgraduate studies, while one student intended to engage in postgraduate coursework**.**

4. Discussion

Since its inception in 2016, the SMHS Student Research Cadetship Program has successfully fostered student engagement in research as an extracurricular Work-Integrated Learning (WIL) experience while simultaneously aiding academics to enhance their research outputs. By inviting academics to propose discrete elements or research mini-projects for student involvement of up to 180 hours of research training, the Cadetship Program has provided valuable hands-on research experiences for undergraduate students, such as performing literature reviews, data collection and analysis, drafting of manuscripts, reports, and grant submissions, which may not all be featured in typical undergraduate degree curriculum. With over 100 students benefiting from the SMHS Cadetship Program to date, some have also had the opportunity to present their work at external conferences and therefore translate their research experience beyond the actual research project with which they were engaged.

This preliminary research study has presented a retrospective analysis of student research cadet outcomes alongside the perspectives of current cadets and their academic supervisors. The retrospective outcomes data (Study 1) revealed that the cadets contributed to over 60 research outputs and 30% have enrolled in postgraduate studies at the University, benefiting the students in terms of improved employability outcomes (McLaughlin et al., 2020). The results from Study 2 suggested the Program's positive impact on both students and academic supervisors. The majority of academics reported perceived improvements in cadets' skills, highlighted as beneficial in previous research, including heightened confidence, enhanced communication abilities (McLaughlin et al., 2020), and a deeper understanding of knowledge construction (Stanford et al., 2017). Of note, three of the four academic supervisors were early career researchers, demonstrating the importance of the Cadetship Program for them to 'cut their teeth' as a research supervisor in the supportive environment of the Research Cadetship Program. Notably, having been exposed to research projects outside the curriculum of their current course

and having worked on key employability skills, 67% of cadets felt they had developed an enhanced understanding of their career paths, and 83% planned to pursue postgraduate studies, a documented outcome of such opportunities (Stanford et al., 2017). Moreover, two of the four supervisor participants indicated their willingness to supervise their cadet in postgraduate studies. This suggests that a Cadetship Program can assist academic supervisors to get to know a student before committing to their formal supervision in a postgraduate program. Likewise, the Cadetship Program provided students with an opportunity to sample life as a research training student prior to committing to a higher degree by research. The strengths of this study are that we were able to draw on and ratify several years of retrospective data regarding the research outputs/outcomes and postgraduate enrolments from academic sources. This study is not, however, without limitations. The small and non-random sample size of Study 2, limited to program participants only renders the results ungeneralisable to a wider population. Moreover, the reliability and validity of the data collection instruments were not subject to scrutiny. Moving forward, completion of end of program surveys by academic supervisors and cadets will be a requirement to access a certificate of completion which students can add to their resume further enhancing their employability. For supervisors this will include specific details of the outputs/outcomes contributed to by the cadet. Furthermore, while the SMHS Students Research Cadetship Project has been sustained over a number of years (since 2016), the evaluation of the project has not been consistent over the years largely attributed to the voluntary nature of the program's management, hence we acknowledge the data presented here is preliminary.

Implementing a student research training cadetship project is not without challenges and it is important to acknowledge the lessons we have learned: (1) The program needs support from the School leadership team if not overseen by a senior academic; (2) The Program relies on academics who are willing to mentor research cadets, and who have the time and energy to do so; (3) A robust evaluation process is essential to ensure outcomes are measured and reported consistently; and (4) The provision of adequate support is crucial for sustaining and expanding programs like the Student Research Cadetship Project, including allocating resources to facilitate effective mentorship, research infrastructure, and administrative support. Moving forward, a concerted effort should be made to secure the necessary resources and institutional commitment to uphold the integrity and impact of such valuable experiential learning programs.

The SMHS Student Research Cadetship Program has thus far proven to be a dynamic platform facilitating meaningful research experiences and fostering academic research aspirations among participating students. Our preliminary findings underscore the potential replicability and scalability of the SMHS Student Research Cadetship Program to other disciplines and universities. The success witnessed in enhancing self-reported student engagement and fostering valuable research experiences prompts us to consider sharing our model as a noteworthy exemplar. While acknowledging its effectiveness within the medical and health sciences domain, caution is warranted in assuming universal applicability across diverse fields of study.

To ascertain the generalisability of our model, there is a need for deliberate trials in other academic domains, paving the way for an evidence-based expansion. We advocate for a call to action in future research and collaborative endeavours, encouraging institutions and researchers to trial similar programs in their respective disciplines.

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Continuing Digital Higher Education Teaching in the post COVID-19 Era: A Qualitative Survey on Success Factors

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Abstract

The COVID-19 pandemic has forced higher education institutions (HEIs) worldwide to a rapid transition to digital higher education teaching (DHET), which can now be considered implemented. Digital technologies have already found their way into teaching and are the new normal. The future of DHET envisages a mix of digital and face-to-face teaching. In this contribution, a qualitative survey is analyzed to identify the success factors necessary for continuing DHET in the long term. Eleven success factors were defined and grouped into the categories of technology, human, and organization. The results show that the successful continuation of DHET requires an even stronger focus on significant success factors as part of the socio-technical approach.

Keywords: *Digital Teaching; Success Factors; Higher Education Institutions; Post COVID-19 Pandemic; Digital Transformation; Qualitative Study.*

1. Introduction

Digital technologies are capable of transforming the environment in which organizations operate (Osmundsen et al., 2018). This induced digital transformation is gaining attention in all areas of business and life. In higher education institutions (HEIs), digital transformation impacts the learning and teaching environment with digitally enhanced teaching methods. It enables autonomous, flexible, and more collaborative teaching concepts (Benavides et al., 2020). Before the COVID-19 pandemic, discussions on digitization in teaching were ongoing, but full-scale digital higher education teaching (DHET) had never been fully adopted (Tesar & Sieber, 2010). Throughout the pandemic, traditional face-to-face teaching gave way to online education. Lasting changes in HEIs are excepted, making a return to previous practices increasingly unlikely. DHET appears the new normal (Rapanta et al., 2021) because technologies are an integral part of the educational environment (Norberg et al., 2011). Therefore, DHET represents a large area of research. One research focus is success factors (SFs) that represent "those few

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things that must go well to ensure success for a manager or an organization" (Boyton & Zmud, 1984). So far, research into the SFs for DHET has focused primarily on its implementation. SFs for implementing DHET before and during the COVID-19 pandemic have been widely examined in the literature (Alqahtani & Rajkhan, 2020; Cheawjindakarn et al., 2012). However, there is a lack of knowledge about SFs from the perspective of teachers if DHET has already been introduced and is to be continued. Although HEIs around the world are returning to on-campus teaching, future concepts envisage a combination of face-to-face and online teaching (Imran et al., 2023). The knowledge gained during the pandemic should therefore be preserved and applied in the future. This article contributes to it by answering the following research question: *What are the SFs for continuing DHET in the post-COVID-19 era?* The aim is to accumulate the teachers' knowledge and experiences from interviews on how to successfully continue DHET free from pandemic restrictions. In this way, fields of action are revealed, and it is made transparent what needs to be promoted by HEIs to ensure that teachers are still willing to conduct DHET.

2. Research Method

In the investigation of SFs, consulting teachers is primarily appropriate because they play a crucial role in shaping the future of DHET. Intending to provide detailed and in-depth insights, a qualitative study design was followed. In the data collection phase, teachers from a single German HEI with experiences in DHET were asked to participate in an interview. The sample shown in Table 1 comprises 21 respondents, 8 of whom already had experience with DHET before and 13 of whom during the pandemic. The interviews were led during the COVID-19 pandemic, so they were conducted by telephone or video conferences. A semi-structured interview guide with key questions was used. First, information about the interviewees was collected, followed by two questions on SFs for the continued use of DHET: *(1) Will you voluntarily continue to use and actively promote DHET once the COVID-19 pandemic has ended? (2) What conditions and requirements have to be met for DHET to be further used?* These question types encourage to provide open and detailed responses.

A qualitative content analysis was applied to the open questions. The text excerpts extracted from the transcripts underwent organization and paraphrasing. In total, 50 statements were analyzed. Within these statements, analogous or identical basic sentences were collated and categorized into SFs, following an inductive approach. SFs were formulated iteratively until the entire content was captured in this way (Mayring, 2014). The SFs were then inductively assigned to superordinate categories. The categorization of the SFs and categories were elaborated and discussed among all authors of the contribution. A partial inter-coder agreement test was carried out.

Table 1. Sample Description. Source: Own survey.

Characteristics (N)	Gender	Age	Job activities	Department
	Male (13)	20-30 (6)	Teaching (4)	Linguistics and literature (2)
	Female (8)	31-40 (5)	+ Research (16)	Cultural and social sciences (6)
	Not stated (0)	41-50 (3)	+ Board work (1)	Mathematics and informatics (1)
		51-60 (2)		Legal studies (1)
		> 61 (1)		Education and cultural studies (2)
		Not stated (4)		Business economics (4)
				Human sciences (4)
				External (1)
				Not stated (0)

3. Findings

This qualitative study focuses on identifying SFs for continuing DHET after the pandemic. Before presenting these findings, an overview of the teachers' intentions regarding DHET is given. The majority of the respondents are positively disposed towards continuing DHET. 19 out of 21 respondents specify to continue DHET even after the pandemic is over. One respondent excludes this option completely and intends to return to traditional face-to-face teaching, while another person is still undecided. Among the proponents of DHET, 10 teachers add they can only imagine DHET in a mix with face-to-face teaching: "*I am absolutely convinced that this is the future of teaching in higher education, with blended learning formats, with face-to-face and online teaching*" (Interviewee 3) and 4 respondents emphasize the continued use of DHET as an enhancement of traditional teaching with digital elements: "*I am switching to digitally supported face-to-face teaching*" (Interviewee 6). The majority acceptance of DHET among the interviewees reinforces the consideration of SFs for continued use. 11 SFs for continuing DHET were identified, which could be assigned to 3 categories: Technology-related SFs refer to all hard factors associated with technical requirements. Human-related SFs focus on softer aspects that go hand in hand with the attitudes of teachers. The organization-related SFs refer to strategic, structural, and procedural factors of the HEIs driven and managed by the HEI management. The results are shown in Table 2 and described in the following using quotes from the interviews.

Reliable Internet connection. The interviewed teachers consider the Internet connection as a prerequisite for data transfer. This is not possible if the quality of the Internet connection varies from area to area. For example, one teacher observed that students from rural areas have much greater Internet connection problems than students living in urban areas. Another interviewee states that DHET should offer equal opportunities for all students: "*It is not in the spirit of a course that those who have better connections are preferred and others who do not have them only have access to a third or half of the lecture*" (Interviewee 2). Thus, the reliability of the Internet connection is an identified SF.

Table 2. Success Factors. Source: Own survey.

Category	Success Factors	N
Technology-related	Reliable internet connection	4
	Available hardware	7
	User-centered application software	3
	Scalable application software	3
	Wide range of application software	3
Human-related	Digital mindset	3
	Efficient exploitation of teaching material	2
Organization-related	Digital-ready HEI policies	7
	Provided support services	11
	Allocated resources	4
	Encouraged collaboration	3

Reliable Internet connection. The interviewed teachers consider the Internet connection as a prerequisite for data transfer. This is not possible if the quality of the Internet connection varies from area to area. For example, one teacher observed that students from rural areas have much greater Internet connection problems than students living in urban areas. Another interviewee states that DHET should offer equal opportunities for all students: "*It is not in the spirit of a course that those who have better connections are preferred and others who do not have them only have access to a third or half of the lecture*" (Interviewee 2). Thus, the reliability of the Internet connection is an identified SF.

Available hardware. Alongside the Internet connection, hardware that meets the requirements of teachers and students is also needed. One interviewee summarizes: *"But overall, the digital equipment of the students is simply the decisive factor"* (Interviewee 4). That includes laptops, tablets, webcams, and more. In addition, the hardware on the campus is also important. Either missing equipment has to be procured or existing technology has to be extended and maintained regularly: *"I mean, we still have overhead projectors, but you can't use them for digital teaching or recordings. We simply don't have the equipment in the auditoriums for the future"* (Interviewee 20).

User-centered application software. During the pandemic, HE teachers acquired experiences regarding diverse application software for DHET, like learning management systems (LMS) or video conferencing systems. Some limitations and complexities of the software tools have become apparent, so teachers are looking for an adaptation and continuous development of the functionalities. One interviewee clarifies that acceptance of digital tools is essential, which can be promoted by ensuring that the tools are "*definitely intuitive*" (Interviewee 11). Existing application software must be regularly tested for the functional scope and its development potential. One respondent would like to be involved in the development of new functions: "*I would of course be delighted if [the developers] [...] continue to think about [the functions] and*

develop it further together with us" (Interviewee 7). All in all, the focus should be on the needs of the users and their requirements should be regularly queried to achieve a user-centered application software that is needed.

Scalable application software. The capacities of the servers and the used application software were perceived as inadequate by the teachers. The interviewees are concerned that the "*[server] capacities should not be further reduced*" (Interviewee 7). With large numbers of participants, for example, a video conferencing system provided by the HEI collapsed: "*I have a third semester lecture with 350 people, I can't do it live with them*" (Interviewee 5). Scalable application software that can be reliably used for all lecture sizes has proven to be a SF.

Wide range of application software. Alternatively, more selectable software options are suggested. The openness of HEIs to offer a wide range of software is a possible factor in achieving success in DHET. Every teacher has different needs, which can vary from lecture to lecture. This is difficult to cover with one application software. For example, in one interview the teacher asks for an alternative LMS. Having more tools to choose from would allow teachers to meet their DHET needs.

Digital mindset. Teaching in a new digital environment requires awareness by both teachers and students side. One interviewee sums it up as "*together we will learn to trust each other digitally*" (Interviewee 17). The lack of use of a webcam on the student's side can be seen as an example of mistrust, as another interviewee indicates. With a digital mindset, these barriers can be overcome and the use of DHET successfully continued.

Efficient exploitation of teaching material. To continuously use DHET, the efficient working of teachers is a SF. On the one hand, the initial development of DHET materials is often more time-consuming than that of traditional formats. On the other hand, DHET materials offer the possibility of reusing them. A respondent recommends "*build up a database or something [...] from which you can then draw so that you don't have to develop everything from scratch every semester*" (Interviewee 18). Another interviewee emphasized that the reuse of materials should be legitimate and a "*self-commitment [of the teachers] to update the teaching content*" (Interviewee 15).

Provided support services. For the continued use of DHET, teachers are requesting more support for both technical and didactical issues. This support can be offered through consulting or training for teachers who feel underqualified. One respondent even suggests a seminar format supplemented with individual tutorials if required. This way, individual competence gaps can be better addressed. Further support can be provided by instructions and manuals: "*there must be valid templates or blueprints or some kind of a procedural model for the best way to set up a lecture*" (Interviewee 15). These can also relate to the correct use of application software and "*should also be given to students*" (Interviewee 11).

Digital-ready HEI policies. Teachers call on HEI management to emphasize the importance of continuing DHET and to set the appropriate framework conditions for it. One interviewee criticizes that teaching at HEIs often takes second place to research. Good teaching has to be prioritized again, for which a "*university-related change in attitude*" (Interviewee 20) is necessary. Teachers would also like to choose which lectures they offer face-to-face, digitally, or a mix of both. This requires guidelines that define the framework conditions for DHET. Upgrading HEI policies to digital-ready HEI policies is a SF for the use of DHET in the future.

Allocated resources. The HEI handles the provision of resources for DHET. However, the teachers "*fear that the funds will be canceled*" (Interviewee 20). The interviewees see the long-term use of DHET as promising if the efforts are also recognized at the HEI management level. Teachers themselves can be granted more time and resources for preparing DHET. At the time of the interviews, DHET effort is not considered in the teaching loads "*[…] and as long as that's not the case, not many will do it*" (Interviewee 13). Apart from that, staffing resources can be made available that support teachers, such as student assistants. Regardless of the type, resources are a SF for the continued use of DHET in the future.

Encouraged collaboration. *"I think best practices need to be shared more"* (Interviewee 16) shows that collaboration between teachers has to be encouraged. Thus, a HEI can create various opportunities. Suggestions, such as work groups for the exchange of experiences as well as materials, emerge from the interviews. The willingness of teachers is given: "*I simply passed on a presentation because the introduction is similar in another seminar*" (Interviewee 18). Such opportunities can be further exploited if the HEI continues to encourage collaboration.

4. Concluding Discussion

After the disruption caused by the COVID-19 pandemic, DHET has become essential but its continuation is very individual. Most teachers would like to incorporate digital elements in combination with face-to-face elements, which is seen as the DHET form of the future (Imran et al., 2023). In this contribution, SFs for the continuation of DHET were identified in three categories, highlighting the tension between technological, human, and organizational factors. The interaction between the components has been already described by the Man-Technology-Organization analysis (Strohm et al., 1997). Consequently, the success of DHET as the new normal does not depend on technology alone. The resulting DHET success model places equal emphasis on social and technical aspects. The most frequently mentioned category was organization. Teachers believe HEIs should create the conditions by supporting teachers in their work to continue DHET and by setting policies that provide both the framework for DHET and sufficient room for teachers to maneuver. Technology is the second most mentioned category. Within, the different needs of the teachers become clear. Whilst identical conditions were mentioned for hardware availability and internet connection, the expectations for application

software are different. While some respondents are in favor of their institution's software solutions but call for further development of their functionality, others find them so inadequate that would like to see a wider range of tools, including external ones. In this respect, new digital technologies have serious potential to enrich teaching and make it more attractive for teachers and learners. For example, the integration of artificial intelligence could enable intelligent tutor systems, personalize learning objectives and content, and automate grading (Zawacki-Richter et al., 2019). The scalability of the application software capacities is also discussed, with one lecturer mentioning the possibility of switching to external tools. Identified technology-related SFs for continued use of DHET coincide with dimensions of the Information System Success Model (Delone & McLean, 2003). A reliable Internet connection, available hardware, and application software that meets the requirements of all lecture types and sizes affect the system and information quality. As has been emphasized, the ease of use through intuitive handling of software functionalities must be given high priority to acquire user satisfaction, resulting in accepting and continuing DHET methods. The fewest mentions are in the human category. Here, a distorted self-perception by the teachers may have biased the results. It is noteworthy that previous contributions have identified a significantly higher number of SFs for implementing DHET. For example, another research also addresses SFs that explicitly deal with social interaction and students' attitudes, such as self-efficacy, cooperation, and commitment (Magd et al., 2022). This clarifies that the SFs presented in this contribution do not represent the totality of all requirements for DHET in general, but focus on continuity. This also reflects the experience gained, which is significantly higher in the post COVID-19 era. At the same time, a smaller selection of factors is the aim of the SF concept: HEIs must concentrate on these few aspects to be successful. As the main success areas are addressed and not all barriers that might be encountered, a holistic overcoming of barriers is not to be expected. Further research should investigate the interactions between these success factors, as these conclusions could not be drawn from the data presented here. The contribution is not without limitations. Conducted at a German HEI, it may yield different results if expanded globally. While the use of qualitative data provides very good insights into the respondents' assessments, it carries the risk of interpretation. Involving a larger teacher sample could enhance objectivity. An attempt, under Mayring (2014) has been made to minimize subjectivity through independent coding by the authors and an iterative check of the categorization. In addition, the interviews were conducted during the pandemic, whereby it can not be excluded that the teachers' perceptions are influenced by pandemic restrictions. Nonetheless, the findings can help HEIs create an awareness of the SFs for their continuation of DHET. The SFs can be used to categorize the status quo to derive further measures to achieve DHET success.

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Applying Design Thinking to Support Education for Sustainable Development in Higher Education

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Abstract

Education for Sustainable Development (ESD) is a holistic concept that addresses the global challenges of our interconnected world in environmental, economic, and social terms. It aims to empower people to act responsibly for ecological integrity, economic viability, and equitable society, to recognize and evaluate problems of unsustainable development, and to apply knowledge about sustainable development. In this context, Gestaltungskompetenz (shaping competence), which is based on the OECD Competency Categories, is an important aspect in enabling sustainable development processes and facilitating the change of perspective from reaction to action. Therefore, prospective strategies are required. This is an essential link to the innovation methodology of Design Thinking. This article introduces the concept of Gestaltungskompetenz, the core elements of Design Thinking, and the relevance of its mindset. It also highlights examples of how Gestaltungskompetenz can be supported by Design Thinking in the context of ESD in Higher Education.

Keywords: *ESD; Gestaltungskompetenz; Design Thinking; Mindset; Higher Education*

1. Introduction

The UNESCO program 'Education for Sustainable Development (ESD): Achieving the Sustainable Development Goals' emphasizes the important role of education in implementing the global sustainability agenda (UNESCO, 2017). Gestaltungskompetenz (shaping competence)[1], the acquisition of competencies to design a desirable future, plays a key role in enabling sustainable development processes and facilitating the change of perspective from

[1]In the following, we refer to de Haan (2008 and 2010) who coined the term Gestaltungskompetenz, usually translated as shaping competence. The term is associated with a specific understanding. Therefore, we will use the German expression.

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reaction to action (de Haan et al., 2008). This is an essential link to the innovation methodology of Design Thinking, which can be described as inventive thinking in multidisciplinary teams to develop solutions to complex challenges. This article presents key aspects of Design Thinking as well as the relevance of its mindset and provides examples of how Gestaltungskompetenz can be supported by Design Thinking in the context of ESD in Higher Education.

2. Education for Sustainable Development (ESD) and Gestaltungskompetenz

ESD is a holistic concept that empowers people to make responsible decisions in terms of ecological integrity, economic viability, and equitable society. It promotes participation, solidarity, future-oriented thinking, and action - these are key skills for shaping the sustainable development of our society (BNE-Portal, 2024). The concept of Gestaltungskompetenz, derived from de Haan and Harenberg (1999), has a significant impact here. According to de Haan, Gestaltungskompetenz means "[...] having the skills, competencies, and knowledge to change economic, ecological, and social behavior without these changes merely being a reaction to existing problems. Gestaltungskompetenz makes an open future possible that can be actively shaped and in which various options exist" (de Haan 2010, p. 320). Gestaltungskompetenz plays a key role in enabling the realization of sustainable development processes and facilitating a change of perspective from reaction to action. Due to the future-oriented nature of ESD, prospective strategies are required to develop creative hypotheses (de Haan, 2008). This is where the innovation methodology of Design Thinking comes into play: "Everyone designs who devises courses of action aimed at changing existing situations into preferred ones" (Simon, 1996, p. 111). According to this interpretation, design can be characterized as a practice of transformation and shaping the future (Mareis, 2016). Design Thinking takes up this view and aims to shape prospective development processes (Brown, 2019).

3. Design Thinking

Design Thinking can be described as inventive thinking in heterogeneous teams to develop creative solution ideas for complex problems (Plattner, 2009). This understanding of Design Thinking as a human-centered innovation methodology is largely based on the Hasso Plattner Institute of Design, founded at Stanford University in 2005 (Meinel et al., 2015). Meanwhile, Design Thinking has established itself internationally in teaching and research in the field of Higher Education and other areas of education (Lor, 2017). The core elements of this methodology are collaboration in a multidisciplinary team to broaden the horizon of possible solutions, a flexible working environment that stimulates creativity, and an iterative process flow (Plattner et al., 2009). In this article, the six-step Design Thinking process shown in

Figure 1 is explained in more detail. The starting point of every Design Thinking process is the problem definition, the so-called Design Challenge (Plattner et al., 2009). The formulation 'How might we...' helps to define the problem in more detail and facilitates a target group-oriented definition. (Lewrick et al., 2018).

As shown in Figure 1 the Design Thinking process can be divided into the problem space and the solution space. This separation is known as the double diamond and enables a detailed consideration of the problem without rushing into solutions (Design Council, 2007).

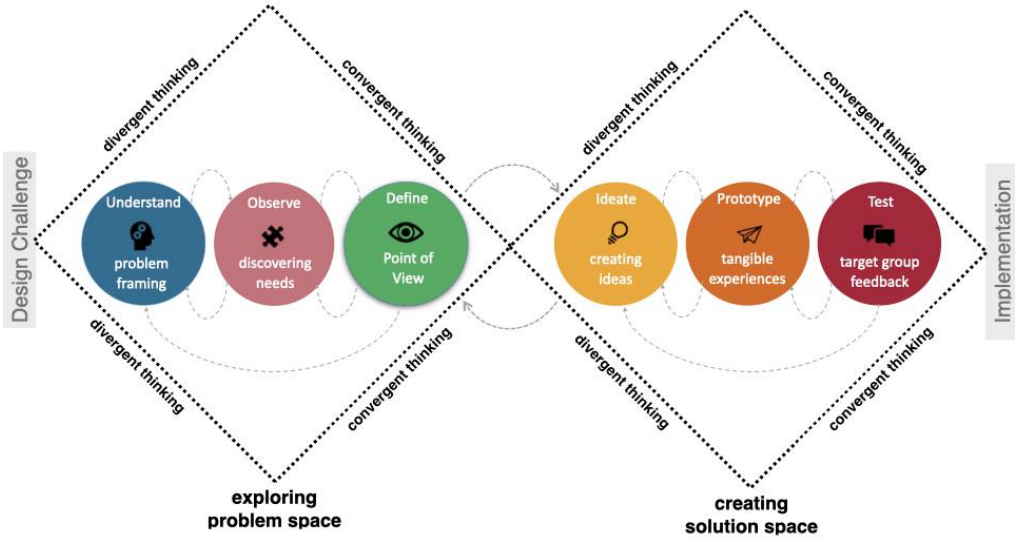


Figure 1. Problem Space and Solution Space in the Design Thinking Process (Source: Schmidberger & Wippermann, 2022, p. 40, translated by the authors).

In the beginning, the focus is on divergent thinking to explore the Design Challenge as openly as possible. Therefore, the first step relates to an in-depth understanding of the problem. This involves collecting existing knowledge and reflecting on one's assumptions about the Design Challenge (Plattner et al., 2009). In the next phase, qualitative research methods (e.g., semi-structured interviews or field studies) are used to get to know the target group's perspective (Lewrick et al., 2018). The results may raise the question of whether the problem has been correctly understood. This iteration, which is used also at all other stages, supports reflection on the process and the findings (Plattner et al., 2009). During the evaluation of the observations, the focus is increasingly on convergent thinking. The results are the basis for defining a common point of view, which marks the transition to the solution space. Now as many ideas as possible are generated in a short time by using various creativity techniques. Here again, divergent thinking is required to support creativity. To make an initial idea tangible as quickly as possible and ready for testing by the target group, a prototype is created

to get to know the strengths and weaknesses of the idea. This experimental development is essential for Design Thinking and learning from mistakes is seen as an opportunity for further development (Brown, 2019). Then, once again convergent thinking is required to concretize and implement the prototype. Design Thinking is an explorative process, which can lead to unexpected discoveries that require fundamental assumptions to be rethought (Brown, 2019). Therefore the connection to the problem space is maintained throughout the entire process.

4. Mindset

With the tools, methods, processes, and iterations described, the Design Thinking methodology provides a framework for developing specific solutions to Design Challenges. However, the team members need a particular mindset to unleash their creative potential successfully (Schmidberger & Wippermann, 2022).

The term mindset refers to individual attitudes, opinions, and beliefs about oneself and the world and represents a powerful framework of assumptions, enabling individuals to simplify and interpret the complex tapestry of the world. They are not just passive filters of reality, they actively guide decisions and shape expectations and behaviors (Primeau, 2021; Dosi et al. 2018). By distilling vast and intricate worldviews into manageable information, mindsets play a pivotal role in how we perceive and engage with our surroundings. “Mindsets can impact your outcomes by determining the way you think, feel, and even physiologically respond to some situations” (Primeau, 2021, p. 1). Dweck's research on mindset had a major impact on educational psychology and beyond and the significance of her findings was widely emphasized (Yeager, et al., 2019). She distinguishes between two general mindsets and the ability to change and adapt our belief systems: the fixed and the growth mindset. With a fixed mindset, it is assumed that all individual characteristics and abilities are given and cannot or only hardly be changed (Dweck, 2017).

The growth mindset, however, is different: it assumes that one's talents and attitudes can be actively changed through (learning) experiences.“This growth mindset is based on the belief that your basic qualities are things you can cultivate through your efforts, your strategies, and help from others. Although people may differ in every which way their initial talents and aptitudes, interests, or temperaments, everyone can change and grow through application and experience” (Dweck, 2017, p. 7).

It becomes obvious that mindsets influence the way we think and feel (Primeau, 2021). “The mind can therefore be understood as something that can be set rather than a set mind“ (Krohn, 2023, p. 18). In the context of Design Thinking, an innovation mindset plays an important role. The Stanford University Design Thinking Manifesto calls the mindset a set of “vital attitudes for the Design Thinker to hold” (Both & Baggereor, 2010, p. II). The Design Thinking mindset for innovation allows each team member to **think and act in a human-**

centered way, which is one of the greatest strengths of Design Thinking. This requires an open and non-judgmental attitude towards people with different backgrounds and perspectives. The ability to empathize with others allows one to change perspective and recognize the actual needs of the target group. Empathy affects also positively the **collaboration in a diverse team**, that values heterogeneity as an opportunity to develop innovative solutions. The mindset also plays an essential role in **exploring the problem space** and **learning through experimentation**. The aim is to understand the problem and its context as comprehensively as possible to uncover blind spots. Iteration loops continuously create the opportunity for reflection, where mistakes are seen as an important learning experience to leave paths already taken and explore new possibilities. **Uncertainty is embraced** and accepted as part of a complex challenge and used constructively to find solutions. This requires an optimistic mindset that allows the **envisioning of a radically new future** (Graves & Fuchs, 2022).

The full potential of Design Thinking can only be exploited when the framework conditions and the individual prerequisites of each team member work together (Schmidberger & Wippermann 2022). Regarding the different types of mindsets, it is obvious that the growth mindset is essential for the Design Thinking mindset.

5. Supporting Gestaltungskompetenz by Design Thinking

Gestaltungskompetenz is based on the three OECD Competency Categories ‘Using Tools Interactively’, ’Interacting in Heterogeneous Groups’ and ‘Acting Autonomously’, each of which de Haan (2010) divides into four sub-competencies. Table 1 provides an overview of the four sub-competencies according to de Haan (2010) regarding the OECD Competency Category ‘Interacting in Heterogeneous Groups’. It shows also examples of the support potential of Design Thinking in Higher Education as well as the key focus of the Design Thinking Mindset in this Competency Category.

Table 1. Sub-competencies of Gestaltungskompetenz in the Competency Category 'Interacting in Heterogeneous Groups' and the support potential of Design Thinking with the key focus of the Design Thinking Mindset (Source: Own presentation based on de Haan, 2010, p. 321).

OECD Competency Category	Sub-competencies of Gestaltungskompetenz	Support Potential of Design Thinking in Higher Education	Key focus of the Design Thinking Mindset
Interacting in Heterogeneous Groups	Co-operate in decision-making processes	Planning and acting together in a diverse team play a key role in Design Thinking. In addition, empathy positively influences teamwork to value heterogeneity as an opportunity to develop innovative solutions.	Think and act in a human-centered way. Collaborate in diverse teams.
	Cope with individual dilemmatic situations of decision-making	Iteration phases create space for reflection on action strategies to deal constructively with existing conflicts of objectives and with dilemmatic situations.	Explore the problem space. Learn through experi-mentation.
	Participate in collective decision-making processes	The definition of a shared point of view during the Design Thinking process is based on collective decision-making, in which all team members are equally involved.	Think and act in a human-centered way. Collaborate in diverse teams.
	Motivate oneself as well as others to become active	The Design Thinking mindset allows cooperation based on trust and enables an open exchange within the team. This helps to overcome uncertainties when dealing with complex challenges and to motivate oneself and others to take action.	Collaborate in diverse teams. Embrace uncertainty. Envision a radically new future.

6. Conclusion and critical reflection

This article focuses on the support potential of Design Thinking in Higher Education based on the concept of Gestaltungskompetenz according to de Haan et al. (2008) in the context of ESD. Design Thinking facilitates a change of perspective from reaction to action and is

particularly suitable for shaping the process of future-oriented and creative transformation. The example of Design Thinking's potential to support the Competency Category `Interacting in Heterogeneous Groups` shown in Table 1 is exemplary of the potential to effectively support all three Competency Categories through the use of this methodology. The full potential of Design Thinking can only be realized if, in addition to the core elements described above, an appropriate innovation mindset is practiced. The foundation of the innovation mindset is a growth mindset. It enables all team members to think and act in a human-centered way, collaborate in a diverse team, and explore the problem space. Furthermore, it allows them to learn through experimentation, embrace uncertainty, and envision a radically new future. Table 1 highlights the key focus of the mindset but all these aspects are necessary throughout the entire process. Further research should be conducted to empirically investigate the described theoretically related concepts of Gestaltungskompetenz and Design Thinking, the support potential of the competency categories, as well as strategies to promote an innovation mindset based on a growth mindset. Finally, Design Thinking is only one way to support Gestaltungskompetenz in the context of Education for Sustainable Development in Higher Education.

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Bridging Disciplines in Higher Education: The Convergence of AI and Sustainability

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Abstract

The 'digitalization lab sustAInability' represents an educational initiative, bridging the realms of artificial intelligence (AI) and sustainability within an interdisciplinary, cross-university framework developed collaboratively by experts in computer science, political, social and economic sciences. The primary learning objective is to weave AI into the three dimensions of sustainable development – economy, society, and ecology – fostering a trans- and interdisciplinary understanding. This paper introduces a pioneering educational framework, focusing on how this course equips students as key architects of a sustainable future. Emphasizing the need for future competencies in sustainability of AI and AI for sustainability, the program not only educates but also acts as a platform for these critical issues across the involved universities and beyond. This program cultivates students who are equipped to handle the complex interplay between technology and sustainability in their future professional roles, contributing to societal, economic, and environmental advancement.

Keywords: *AI and sustainability; interdisciplinary course; cross-university learning; higher education; challenged-based teaching; future skills development.*

1. Introduction

The past decade marked an era of unprecedented growth in artificial intelligence (AI). Today, AI is profoundly influencing diverse sectors including business, industry, and research. The surge in computational power, the abundance of data, and significant algorithmic advancements have propelled machine learning (ML) – particularly deep neural networks – to the forefront of innovation. However, AI's duality in the context of the Sustainable Development Goals (SDGs) presents a tension of extraordinary promise tempered by considerable risks. While AI-driven technologies promise vast opportunities for sustainable progress in areas such as energy or agriculture, they also bring environmental and societal challenges (Vinuesa et al., 2020;

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Coeckelbergh, 2021). These include substantial energy demands and carbon emissions of training and using ML models, alongside concerns of algorithmic bias and discrimination. This dichotomy underscores the need for a nuanced understanding of AI's role in shaping a sustainable future. We agree with (Crawford & Calo, 2016) on the sentiment that AI presents a cultural shift as much as a technical one. Therefore, the urgency to bridge the gap between technological advancements and sustainability in an interdisciplinary and culturally diverse environment has never been more critical.

In a joint project between the Hochschule München University of Applied Sciences and the Technical University of Munich, the teaching and research course sustAInability – Advanced Topics on Sustainability and AI studies the opportunities and interdependence, and – together with an interdisciplinary group of students – develops technical and non-technical solution approaches at the intersection of AI and sustainability. Our course aims to transcend traditional academic boundaries, fostering a holistic understanding of AI's potential to drive sustainable solutions. By blending theoretical knowledge with practical applications, it prepares students to innovate responsibly, ensuring that technological development aligns with ecological and societal well-being. We belief that the introduction of an interdisciplinary course, integrating AI with sustainability practices, marks a pivotal shift towards nurturing a generation equipped to tackle the pressing challenges of our time.

This paper delves into the genesis of this innovative educational model, highlighting its objectives, design, and the imperative for such interdisciplinary approaches in cultivating future leaders capable of navigating the complexities of a rapidly changing world.

2. Objectives and Rationale

The interdisciplinary course sustAInability – Advanced Topics on Sustainability and AI aims to forge a new pathway in higher education by integrating the dynamic field of AI with the multifaceted concept of sustainability. The course is designed to equip students with the necessary skills and knowledge to become influential actors in shaping a sustainable future using AI and assessing potential benefits and risks with respect to contributing to the SGDs. The rationale for this challenge-based course stems from the significant advancements in AI over the past decade, which have brought both transformative potential and profound challenges to society. As AI applications increasingly permeate our daily lives, the need for a critical understanding of their impact on sustainability becomes paramount. Our course aims to address this need by intertwining AI with the three pillars of sustainable development: economic, social and environmental.

It focuses on both sides of Sustainable AI (van Wynsberghe, 2021), that is, AI for sustainability and the sustainability of AI. The goal is to educate students on how AI can be leveraged to foster sustainable development across various sectors, including but not limited to energy, agriculture,

and social governance. Furthermore, students learn how to critically examine the sustainability of AI systems themselves, considering possible tensions with all three pillars of sustainability with respect to the whole AI life cycle.

A central feature of the course is its project-oriented learning approach, which encourages students to apply theoretical knowledge to practical real-world challenges. This method aims to foster critical thinking, problem-solving skills, and the ability to work collaboratively across disciplines (Bell, 2010). Through this approach, students will be prepared to contribute meaningfully to sustainable solutions in their professional endeavors (Blumenfeld et al., 1991).

By integrating disciplines, the course prepares students to critically assess and navigate the complexities of AI in the context of global sustainability challenges. Graduates of this program are expected to emerge as leaders who can balance technological innovation with sustainable practices, contributing to the achievement of the Sustainable Development Goals (SDGs). The course, therefore, sets out to create a platform for sustainable AI education and to catalyze interdisciplinary dialogue and collaboration across the academic community and beyond.

3. Course Design

Our interdisciplinary course is designed to provide an integrative learning experience that spans across a semester, offering students the opportunity to earn 6 ECTS[1] credits through a blend of self-study, seminar participation, and a collaborative project week. The course commences with a kick-off event that provides students with an initial substantive insight into the focal topics as well as an overview of the structure and sequence of the program. Leveraging speculative design methodologies (Auger, 2013), a futurizing workshop is conducted, enabling students to envision future scenarios and grasp the ethical, technological, ecological, social, and economic implications of AI.

Until week 9, the course focuses on building a foundational understanding and facilitating critical engagement with the dual perspectives of sustainability and AI. It proceeds with an introductory teaching-learning unit (Unit 1), setting the stage for exploring how AI can be harnessed for enhanced sustainability and what constitutes sustainable AI practices. Subsequent units are bifurcated into two tracks, allowing students to delve into the benefits of AI for each sustainability dimension (environmental, economic, and social) while concurrently critiquing AI technologies from a sustainability point of view. Each unit features a two-week self-learning phase culminating in a four-hour seminar, where students independently investigate specific themes and then collaboratively discuss identified questions and problems using the just-in-time teaching approach (Novak et al., 1999). With useful facts and references to further literature,

[1] ECTS: European Credit Transfer System

those topics are supplemented by the instructors. The collection of topics, issues, and extended content thus provides the foundation for the project work in the subsequent workshop week. The respective modules employ various teaching and learning formats and methods aimed at the acquisition of diverse competences (see Figure 1) motivated by the key competencies in sustainability (Brundiers et al., 2020; Wiek et al., 2011).

Week 1	Week 2	Week 3 & 4	Week 5 & 6	Week 7 & 8	Week 9	Week 10
Seminar	Seminar	Self-study & seminar	Self-study & seminar	Self-study & seminar	Self-study	Interactive workshop
Kick-off Check-In, course overview workshop: futurizing	**Unit 1: Introduction** AI for sustainability & sustainablilty of AI	**Unit 2: AI & Ecology** Track A: AI for the environment, Track B: ecological AI	**Unit 3: AI & Economy** Track A: AI for a sustainable economy, Track B: AI and economic sustainability	**Unit 4: AI & Social Justice** Track A: AI for social justice Track B: AI for the common good	**Reflection** Pooling of ideas, collecting and rehashing of results from Unit 2-4	**Workshoopweek** Development of technical and non-technical solutions to challenges in the context of AI and sustainability.
Aquired 21st Century Skills						
Analytical thining	Analytical thining	Analytical thining	Analytical thining	Analytical thining	Sense making	Design mindset
Critical thinking	Critical thinking	Critical thinking	Critical thinking	Critical thinking	Digital literacy	Computational thinking
Interdisciplinary work	Computational thinking	Computational thinking	Computational thinking	Computational thinking	Tolerance of ambivalence	Noval & adaptive thinking
		Independent work	Independent work	Independent work	Virtual and personal communication & collaburation	Creative problem solving

Figure 1. Structure of the digitalization lab sustAInability.

The final week encapsulates the essence of the course, where students engage in a workshop week, applying their accrued knowledge to conceive and develop creative solutions to pre-identified real-world challenges. This last phase is dedicated to project work that synthesizes theoretical insights with practical applications, prompting students to translate academic concepts into concrete, innovative, and practice-oriented proposals.

Interdisciplinarity is woven throughout the course structure, merging social sciences with technical and economic disciplines. Partner institutions contribute expertise in computer science, economics, entrepreneurship, political science, and sustainability governance, creating a multi-perspective platform for innovation. The co-teaching strategy enriches content delivery, ensuring a comprehensive understanding of the complex interplay between AI and sustainability. The pedagogical design emphasizes project-oriented work and interdisciplinary teams, enhancing outcome quality by utilizing diverse student skill sets. This approach fosters cross-disciplinary cooperation and prepares students to apply their knowledge in ways that are reflective, informed, and sensitive to the various dimensions of sustainability and technological impacts.

In summary, the sustAInability course is a comprehensive educational endeavor that integrates self-directed learning, interactive seminars, and collaborative project work, all underpinned by the critical and innovative exploration of AI and sustainability. Its design reflects a commitment to developing competencies that are essential for addressing the challenges and opportunities at

the intersection of these pivotal fields. The course acknowledges that the challenges and opportunities presented by AI and sustainability are too complex to be addressed from a single disciplinary perspective. Instead, the course prepares students to become adept at navigating and integrating multiple fields of study, fostering a breed of professionals who can contribute to sustainable development with technological acumen and a comprehensive worldview.

4. Expected Outcomes and Impact

The course is designed on the assumption that acquiring skills in the 21st century requires digital and technological skills. At the same time, these skills must be considered in the context of ecological, social and economic changes. Digital and technological skills alone are not sufficient to prepare students for the major challenges of the coming decades, so the interdisciplinary approach of the college aims to combine education for sustainable development (ESD) with digital and technological skills. The skills acquired through the program include:

1. **Professional competence**. Students can reproduce subject-specific knowledge on concepts and developments in the field of ecological, economic and social sustainability and AI, name advantages and disadvantages and illustrate them using examples. They can interpret and compare current developments and interdisciplinary perspectives on the intertwining of sustainability and AI. Students can assess the impact of AI on different dimensions of sustainability.
2. **Methodological competence**. Students can apply interdisciplinary methods to analyze, develop and reflect on concepts at the interface of sustainability and AI. They can develop use cases for AI in sustainability and develop concrete approaches on how AI can be used to solve sustainability challenges or how AI can be made more sustainable.
3. **Self-competence**. Students can locate their own role in the digital and sustainable transformation, position themselves and develop further within these transformations.
4. **Social competence**. Students can communicate efficiently and productively with other disciplines and initiate and implement collaborative projects.

The course aims to influence the students' educational journey significantly, guiding their choices for thesis topics and early career steps, including the uptake of internships or student jobs with a focus on AI and sustainability. Additionally, the partners involved in the program contribute a broad network from both the Munich and Bavarian ecosystems, thereby creating a supportive environment for project development and potential scale-up.

5. Evaluation

In an initial pilot study, we administered a questionnaire to participants, with 20 out of the 32 completing a self-assessment. The questions are listed in Table 1. The questionnaire utilized a

Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) for responses. In addition, participants were asked three free-text questions: Q1, Q8, and Q10.

Table 1. Mapping between the question's abbreviations and its content.

Abbr.	Question
Q1	What was your initial motivation to participate in this course? Please explain.
Q2	Participating in the course has enhanced my knowledge and skills about sustainability of AI.
Q3	Participating in the course has enhanced my knowledge and skills about AI for sustainability.
Q4	I want to continue developing my knowledge and skills about AI applications for the Sustainable Development Goals (SGDs) after this course (additional classes, project continuation after the course, career orientation, etc.)
Q5	I feel capable of applying AI concepts and techniques to impact the Sustainable Development Goals (SGDs).
Q6	What would have been your answer to the previous question before the course?
Q7	I benefited from the interdisciplinary nature of the project workshop course.
Q8	Please explain your previous answer.
Q9	The challenge-based format of the course specifically helped me to develop my knowledge and skills about sustainability and AI.
Q10	Please explain your previous answer.
Q11	I am able to assess how an AI contributes and hinders the Sustainability Development Goals (SGDs).

The data, visualized in Figure 2, suggest that participants perceive an enhancement in their knowledge of both the sustainability of AI (Q2) and AI for sustainability (Q3). The majority express continued interest in the field (Q4). Additionally, respondents report increased competency in applying their knowledge (Q5-Q6) and in evaluating potential challenges and advantages related to achieving the Sustainable Development Goals (SDGs) (Q11). The feedback also reflects a positive reception of the interdisciplinary and challenge-based structure of the course (Q7-Q10). The rationale behind the students' motivation for the course (Q1) indicates the perceived importance of AI for their future careers. Four students explicitly emphasized their interest mainly in sustainability. Seven emphasized AI as the driver to join the course and eight mention sustainability as well as AI.

Sustainable AI is a field marked by tension that consists of a seemingly inexhaustible body of knowledge. Finding the balance between depth and breadth has been, and continues to be, a major challenge in the design of our course. Therefore, it is no surprise that the only criticism we received from two participants is a lack of depth. To enhance depth, we plan to carefully integrate a greater number of curated case studies and a well-structured literature collection.

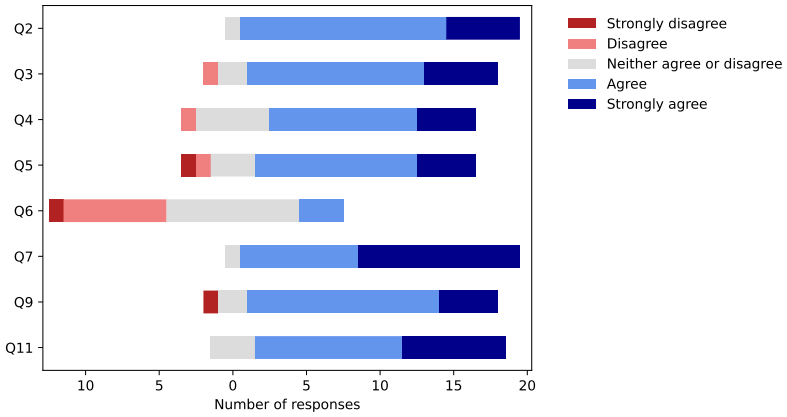


Figure 2. Result of the questionnaire. The difference between Q5 and Q6 indicate a shift in the students' confidence to be able to apply AI concepts and techniques to impact the SGDs.

6. Conclusion and Future Work

Through the digitalization lab sustAInability – Advanced Topics on Sustainability and AI, we were able to specifically promote sustainable AI competencies of the students and to open a new horizon. A solid foundation has been laid, which is still capable of further development – the necessity for additional specialized courses is evident. We belief that our students have acquired the necessary competencies to independently explore this horizon further, to communicate about sustainability issues effectively and to be able to assess benefits and risks of specific AI applications. This belief is bolstered by the results of our pilot study. However, for a solid analysis we require additional results from upcoming semester, including a pre- and post-questionnaire.

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Co-creating an SDG focused micro-credential

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Abstract

This project describes the development and co-creation of a micro-credential programme on the UN SDGs by a team of lecturers and instructional designers from an Irish Technological University. The project explores how the programme and module content development process is enhanced and improved through a mutually respectful collaborative co-creation approach that iteratively evolved in response to student feedback and advances in technology and artificial intelligence. The project output is an on-line asynchronous 20 credit programme consisting of 4 x 5 credit modules, all of which are micro-credentials. The project highlights and demonstrates the potential benefits of lecturer/ID co-creation and collaboration, through the use of a structured design approach, storyboarding, continuous review and an openness to embrace and fully engage with student and peer feedback. Mutual respect and a shared understanding of pedagogical approaches enabled the team to transform the challenges of asynchronous material development into opportunities for innovation and enhanced learning experiences.

Keywords: *Instructional Design, Microcredential, SDGs, pedagogy, co-creation.*

1. Introduction

1.1. Background

Higher education institutions have been increasingly adopting a transdisciplinary approach in developing course content to improve sustainability awareness of students while meeting the expectations of society and future employers of the students (Tasdemir and Gazo, 2020). One catalyst for this is the development of micro-credentials, which offer targeted and flexible learning opportunities (Varadarajan, Koh, and Daniel, 2023). Such curriculum development builds upon the strength of traditional approaches while incorporating more innovative design practice to enhance the teaching and learning experience, including contemporary pedagogy and instructional methods that are learner-centred and designed to empower learners to apply

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knowledge (Hays and Reinders, 2020). Educators are challenged to apply these theoretical insights to new sustainable learning environments, that are aligned to the real world (Richardson et al., 2019).

1.2. Historical context : Challenge and complexity of ID in higher education

Today, an increasing number of higher education institutions employ teams of instructional designers to support teaching and learning practices as they address the expanding need for technology integration and provision of enhanced online learning to accommodate a diversified student body (Dahlstrom et al., 2015). However, while the field of instructional design has been well established to support professional training endeavours, its' application in the development of college-level courses is still evolving (Sinakou et al., 2019).

Evaluative research outlines the diverse role played by instructional designers (IDs) which encompasses course development, institutional learning initiatives, pedagogy and educational technology workshops, quality assurance of blended and online courses, and educational technology, pedagogy, and accessibility support (Leung et al., 2021). Best practices for instructional design project management are proffered to include clear communication, well-articulated project framing, progress tracking, project close-out and reflection (Leung et. al., 2021).

However, it is recognised that regardless of best practice and the expertise of the instructional designer, the challenges recognised within higher education include lack of faculty buy-in, reasonable timelines, resources, leadership/administration, tools and technology, institutional bureaucracy, awareness, project management, pedagogy, and working with subject matter experts (Intentional Futures, 2016) .

1.3. Gaps in research

Stefaniak, Reese, and McDonald (2020) highlight the gaps in research in relation to IDs working with faculty and point out the importance of IDs and faculty sharing the outcomes of collaborative exchanges. Hence this paper shares the narrative of the collaborative efforts of faculty and IDs in tackling a variety of challenges within higher education to bridge the existing research gaps on the effective employment of instructional design. It stresses the necessity for dedicating resources and time for educators to craft innovative learning experiences. Moreover, the paper aims to address literature which indicates the need for a cultural shift required from faculty towards embracing educational technology and instructional design support (Ivens, 2023). Additionally, the paper heeds the call of Chen and Carliner (2020) who identify a significant research void in relation to faculty attitudes towards collaborating with instructional designers. Few will argue the level of complexity involved in developing timely effective asynchronous learning experiences as well as the challenges of integrating instructional design

within academic settings. The narrative presented in this paper may offer some tangible solutions to both.

2. Experience description

2.1. Project description

The project evolved in response to a national funding call to provide skills- focused programmes designed to meet priority skills needs with a focus on sustainability and the application of micro-credentials as a way to provide industry with short training programmes.

A multidisciplinary team of five was formed to explore how a programme focussed on the contents and aspirations of the United Nations SDGs could be developed and rolled out to students from any disciplinary background. A focus on an inter and multidisciplinary approach was considered an essential feature of the programme design.

2.2. Programme development approach

An initial international horizon scan was carried out to seek out higher education programmes that focussed on the SDGs. A range of short course and small individual modules were discovered, but no programme that specifically addressed the SDGs in an Irish context were identified.

A series of strategic programme design meetings took place and a proposal to develop a 20 ECTS certificate on the SDGs was formulated. The proposal identified a number of key aspects and issues that needed to be considered and incorporated into the development.

The programme should be

1. Non discipline specific and accessible for students from all academic disciplines.
2. At a suitable EQF level so that it was not jargon or discipline specific terminology heavy.
3. Primarily on-line or blended, with minimal requirement for face-to-face interactions, thus ensuring maximum access for students from various geographical locations.
4. Focussed on the application and implementation of SDGs in a regional (Irish) context, as well as on progress on an international scale.
5. Incorporate the principles of UDL to maximise student access to the material.
6. Designed to be as interactive as possible to keep students engaged.
7. Presented as a series of short stackable accredited modules, that could be dipped into and completed with maximum flexibility.
8. Grounded in the inter-connectedness/dependence of the three traditional pillars of sustainability, environment, social and economy

The programme was designed in line with the NFQ standard, which equates 1 ECTS with 25 learning workload hours.

2.3. Programme Structure

The programme is delivered on-line asynchronously, and students can engage with the material at their own pace. Each module is of identical design and consist of five units. The structured approach provides consistency in the modules and supports the use and incorporation of a wide range of media types, which include reading material, videos, interactions and blog type discussion forums.

Each unit in the modules is assessed through a bank of MCQs which are designed to ensure students view and engage with the written and recorded materials. On completion of the MCQs the final assessment consists of the production of an "artefact" (e.g. a report/essay, a blog or a creative presentation) or the implementation and reportage of a short social action project that demonstrates engagement with the module content and material.

3. Preliminary Results

As highlighted in research, the development of asynchronous micro-credentials is fraught with challenges (Varadarajan, Koh, and Daniel, 2023). This paper highlights that such challenges require IDs and lecturers to work collaboratively. The benefits of the collaborative efforts undertaken in this project are demonstrated below from some preliminary student survey responses.

1. The LMS (learning management system) was configured to have a visually clear structure allowing for easy-to-understand navigation. Lecturers made the pedagogical aspect of the structure clear to the instructional design team, who subsequently developed visual cues and navigation material that were in keeping with the principles of UDL. The preliminary feedback shows a positive response from 91.7% of students concerning navigation (16.7% - good, 75% - very good or excellent).

2. The lecturer's tutorial videos benefited from the expertise of the team in terms of background, camera positioning, lighting, eye direction, sound, and tips for interacting with an asynchronous audience. The team worked collaboratively in the video editing process to increase engagement through graphical design, real-life visuals, chunking and the development of interactive activities. The success of this approach is evident through student comments which include "I love the videos... The balance of different types of material... worked well for me". One small-scale survey also showed that 91.6% of students rated the quality of content delivery as "very good" or "excellent".

3. During the piloting phase, reflective discussions between faculty and instructional designers, with a focus on UDL, led to the introduction of an alternative option for students to access content 'on-the-go'. This option took the form of YouTube playlists which were accessible outside the LMS but collated in the modules' structure. Students responded positively to this. "I did like when the playlist option came up…to listen when I was driving…you could take the information in without being at the laptop" and "I liked being able to dip in and out of the course".

4. A common challenge of online learning is an institution's ability to develop genuine and authentic online discussions and relationships (Xia et al., 2022), yet this course has yielded highly informative and rich discussions. Comments from students to date include "The interaction in terms of the other participants and what they were saying and putting into the discussions was really good …very varied… coming from very different backgrounds." and "I felt safe saying what I think".

5. The immediate implementation of student feedback, alongside the quality of the materials, has not gone unnoticed by students, again emphasising a positive result when faculty and instructional designers are given the time and resources to work collaboratively. This sentiment is evident in comments from students such as "I just want to say it's very clear that there's a huge amount of effort gone into this course, and I wanted to thank you and the rest of the team for that." and "There's obviously huge work gone into it and… it's great." More research is required in this area, however, students' appreciation for the effort applied by the multi-disciplinary team may have played a role in building credibility and appreciation for the course.

6. In terms of the effectiveness of the course, many students have stated they would or have recommended the course to others and believe the course has changed their thinking. Comments include "I think it is an insightful way of learning more about the SDGs.. really helping to deepen a person's understanding of global challenges...". "[The content includes] …really different thinking that really made you sit back… and my learning has just mushroomed". "What's changed is my awareness...I'm seeing the SDGs everywhere…and you start to understand what is really going on in the world".

4. Discussion

4.1. Challenges

In the development of this programme, many of the general challenges involved in the multifaceted nature of programme development were encountered. In particular, lecturers faced the daunting task of creating content while managing an existing heavy workload (Kenny and Fluck, 2022), and the instructional design team faced the complexity of transforming the received content into engaging accessible online modules within tight deadlines. Both lecturers

and instructional designers faced the challenge of developing an online course that was engaging yet academically rigorous.

The integration of educational technology tools poses challenges (Kenny and Fluck, 2022), necessitating not only technical know-how but also adherence to the planned pedagogical implementation of social constructivism and Universal Design for Learning (UDL). The skills required of the instructional designers were diverse, spanning video editing, pedagogical knowledge, organisation, communication, technical proficiency, and data analytics. Similarly, lecturers faced the complex challenge of creating online content that was relevant, effectively paced, engaging and in keeping with the diverse needs of online learners.

4.2. Enablers

Conversely, several enablers played a pivotal role in the successful development of this micro-credential. Akin to attributes previously reported (Richardson et al., 2019), strong communication skills and mutual respect among team members helped foster an environment conducive to critical, constructive and honest discussions. The establishment of a clear storyboarding approach facilitated content sharing between lecturers and instructional designers, ensuring clarity and consistency of design and clear structure for learners. Continuous review, monitoring, and an openness to student feedback were instrumental in refining the content. These enablers, enhanced by a collegial partnership between faculty and instructional designers nurtured a reflective and collaborative process which led to timely continuous improvements in course design. Mutual appreciation and a shared understanding of pedagogical approaches meant the team could transform the challenges of asynchronous material development into innovation opportunities and enhanced learning experiences. In the development of this programme, team members' openness to feedback and adaptability served as a crucial facilitator in addressing the challenges encountered.

5. Conclusion

The overall responses from students regarding the course have been positive. Despite the existence of many areas that require further research, this paper argues that the collaborative approach between instructional designers (IDs) and faculty was instrumental in enhancing the online educational experiences of students. The team's constructive communication led to timely solutions throughout the course's design, development, and implementation.

IDs face a variety of challenges, including their positioning within the institutional hierarchy, clarity in roles and navigating the dynamics of collaborative relationships. While some research has highlighted the positive impact of such collaborative efforts, Chen and Carliner (2020) note a significant gap in research regarding faculty attitudes towards collaboration with IDs. This narrative emphasises the value of faculty placing trust in the skills, knowledge, and ability of

the ID team, and the importance of IDs developing mutually respectful relationships with faculty.

This experience lays the groundwork for further exploration on how positive faculty-ID relationships can be fostered, including the balance between the time required to develop high-quality courses, challenges encountered, and scalability of instructional designer-lecturer support. This experience showcases what can be achieved when IDs are explicitly allocated time to focus directly on a small number of projects with clarity on roles and timeframes.

Further areas for investigation include effective methods for gathering and implementing continuous student feedback in online courses, understanding the characteristics that define successful instructional design-lecturer relationships, and identifying the specific elements or combination of elements that contribute to high-quality student discussion responses.

It is vital that digital technology is strategically embedded in educational practices, and this research will deepen our understanding of the crucial role these dynamic collaborations can have on making the shift to quality digital education and innovation in higher education.

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Different Implementation Variants of the Synchronous Hybrid Setting in Continuing Education

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Abstract

The synchronous hybrid setting combines face-to-face and online learning at the same time. This format offers freedom of choice of learning location, which is an advantage for participants in continuing education. However, the implementation of this setting poses some challenges for participants, lecturers, and programme management. The aim of this study is therefore to identify the different ways in which the synchronous hybrid setting can be implemented in continuing education to take advantage of its opportunities and to address its challenges. Based on structured interviews with programme managers from different universities, two main variants of the synchronous hybrid setting and three design conditions were identified. The variants and conditions were evaluated from a learning, teaching, and management perspective. The results show that the benefits and possible risks for stakeholders vary depending on the variant and design condition. Several requirements for a successful implementation of this setting are discussed.

Keywords: *synchronous hybrid setting; continuing education; programme management; new learning formats.*

1. Introduction

The Covid 19 pandemic has pushed many universities to experiment with hybrid formats in higher education. Hybrid formats combine face-to-face teaching with online learning. One of these formats is the synchronous hybrid setting, where one part of the group participates simultaneously on site and the other part of the group participates virtually via video conferencing system (Raes et al., 2020). This format offers participants the advantage of a free choice of learning location combined with the possibility of synchronous interaction (e.g., Butz & Stupnisky, 2016).

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In addition to degree programmes, universities also offer continuing education programmes leading to a Certificate of Advanced Studies (CAS), Diploma of Advanced Studies (DAS) or Master of Advanced Studies (MAS). These programmes are aimed at working people with a bachelor's or master's degree, but also at "non-traditional" students with work experience but without a university degree. Usually, these people participate in continuing education programmes for professional reasons, especially to "keep up to date/maintain knowledge" and "be able to do the job better/increase career opportunities". For this target group in particular, the synchronous hybrid setting has potential, as participants are usually faced with the task of reconciling their work and/or caring responsibilities with continuing education. Exchange and networking with peers are often motives for attending a training programme (Gegenfurtner et al., 2019). This can be better achieved in a synchronous hybrid setting, as there are opportunities for face-to-face interaction with other participants, as opposed to purely online formats or asynchronous courses. However, there are some challenges implementing synchronous hybrid teaching. The setting requires some technical infrastructure to enable virtual participants to hear and see everything in the room (Raes et al., 2020). The setting is also challenging from a didactic point of view, as lecturers must design the lessons in such a way that the two groups ("on-site" and "virtual") have a similar learning experience (Raes, 2022). This is especially the case when it is not clear in advance how many participants will be on site and how many will participate virtually.

The pedagogical (content and didactic) design of continuing education programmes is only one of the tasks of programme managers. Marketing and public relations as well as cost calculation are also of central importance (Haberzeth & Dernbach-Stolz, 2022). Against this background, it is necessary for programme managers to make it possible to combine the programme with family, social and professional obligations and to consider the needs of the participants in terms of the form of learning. Even if the pedagogical-didactic added value and the effect on individual learning in hybrid settings remains marginal (Müller & Mildenberger 2021). To date, there is little research on the synchronous hybrid setting in continuing education (Jansen & Rother, 2024). However, a recent study based on group discussions with programme managers showed that the need for online offerings and hybrid teaching will remain even after the pandemic (Haberzeth & Dernbach-Stolz, 2022). The current paper, therefore, addresses the following question: *In which variants can the synchronous hybrid setting be implemented in continuing education to exploit the opportunities of this setting and at the same time consider the challenges associated with it?*

2. Methods

To answer the research question, a two-stage process was followed. First, structured interviews were conducted with programme managers of Swiss continuing education programmes. The sample was selected to include individuals who a) are responsible for one or more continuing

education programmes, b) had already used synchronous hybrid settings in their programmes and c) were willing to share their experiences in an interview. In total, the sample consisted of 10 people from different higher education institutions. The aim of the interviews was to find out whether the setting is used strategically in the programme design and how the synchronous hybrid setting is implemented. In addition, the question was asked what prerequisites are needed for the setting to be successful. Therefore, the structured interview guide included both strategic questions and concrete implementation questions. The interviews were recorded, transcribed, and then coded by two people each. The code system was developed step by step: A first version was developed deductively based on the interview guide and then, in a second step, further developed inductively based on the interview material. The code system was discussed and finalised by the two members of the analysis team. Half of the interviews were coded by each of the two individuals and the codes were then discussed in the team for the final coding. Two main implementation variants with different design conditions could be identified.

In a second step, these implementation variants and their design conditions were presented to programme managers to identify the advantages and disadvantages of these options from three different perspectives, i.e., the perspective of the participants (learning perspective), the perspective of the lecturers (teaching perspective) and the perspective of the programme managers (management perspective). Six people from four different schools of the university participated in the group discussion, all of whom had already used the synchronous hybrid setting in their programmes. To structure the discussion, the variants and conditions were considered one by one, first from the learning perspective, then from the teaching perspective and finally from the management perspective. The results were recorded on a Miro board.

3. Results

The interviews showed that the most important decision in programme planning is how many days of training are offered synchronously hybrid. Two main variants of how the synchronous hybrid setting is realised in the programmes were identified. *Variant 1 (V1)*: In some programmes, all or almost all events (e.g., except for the opening and closing events) were offered in a synchronous hybrid format. Participants could therefore (almost) always participate virtually or on site. *Variant 2 (V2)*: In other programmes, only individual events were held in synchronous hybrid mode. For example, only in the case of shorter evening sessions did participants have the choice of attending in person or participating virtually. In another programme, the synchronous hybrid setting was offered depending on the content. Programme managers also described marking specific dates in the programme schedule when a choice of location was available. Across the programmes, these two main variants were each designed with different conditions. One condition refers to the number of times participants are allowed to participate virtually (*condition A*). In some programmes, the participants could choose each time from where they wanted to participate, in others the number of days on which they could

participate virtually was limited ("wildcard days"). Another condition relates to the registration for the place of participation (*condition B*). In some programmes no registration was necessary, in others the participants had to indicate this in advance, varying two to three weeks before or up to the day before. As a third condition, we identified whether the courses are recorded and made available to the participants (*condition C*). In some programmes, the camera was always left on all the time and everything, including the breaks, was recorded, and made available. In other programmes lecturers selected what was recorded and made available. There were also programmes that did not record at all.

To compare the advantages and disadvantages of the implementation variants and the design conditions, they were evaluated from three perspectives. Table 1 shows the evaluations of V1 and V2 from the perspective of the participants, the lecturers, and the programme management. It is noticeable that V1 is associated with several advantages, especially for the participants and the management. However, there are also some risks associated with these advantages. From the teacher's point of view, it depends very much on how often a teacher teaches in the programme and is used to the setting. For the management, the available technical infrastructure is a relevant factor. All rooms used need to be equipped accordingly.

Table 1 also shows that V2 lacks two major advantages in terms of cost calculation of the programme and including a wider target group, namely the larger geographical area from which participants can be recruited and the increase in group size. V2 also limits the participants' freedom of choice to the days on which the setting is offered. On the other hand, this variant is better able to consider the preferences of the lecturers. In addition to the advantages and disadvantages of the two variants, there are further advantages and disadvantages that depend on the design conditions, see Table 2. As we can see, the restrictions of condition A and B lead to a higher control effort for lectures and programme managers. While the advantage of condition A is that more participants are on site and thus interaction is promoted, the advantage of condition B is in particular the better planning security for lecturers and programme managers in terms of presence on site/virtual and the required infrastructure. For condition C, the possible disadvantages seem to outweigh the advantages.

Table 1. Advantages and disadvantages of variant 1 and variant 2

	advantages	*disadvantages*
	Variant 1: all (or almost all) events synchronous hybrid	
Participants learning perspective	Flexibility (save travel time, reconciling professional and private commitments; possibility to participate despite holidays, accident/ illness); inclusion of participants who would otherwise not be able to participate	risk of reduced networking if only a few are on-site; if only a few are on-site, they might feel out of place; risk of distraction of virtual participants
Lecturers teaching perspective	Opportunity of expanding digital competences	high competence requirements; designing two equal leaning spaces is challenging and needs higher effort; risk of increased stress due to the concern that technology will not work
Programme mangers management perspective	greater reach of the programme (geographical); more people can participate; positive impact on marketing and positioning of the programme; diversity can be increased, e.g., by involving external speaker; promotion of digital competences	higher staff cost, e.g., for support of the virtual group, technical support; technical infrastructure is needed
	Variant 2: only individual events synchronous hybrid	
Participants learning perspective	Planning certainty as to when all participants will be on site; chance of increased exchange with the group	Flexibility is limited to the hybrid events
Lecturers teaching perspective	they do not always need to teach in the synchronous hybrid setting; planning certainty as to when all participants will be on site	For the hybrid events: high competence requirements; designing two equal leaning spaces is challenging and needs higher effort; risk of increased stress due to the concern that technology will not work
Programme mangers management perspective	not all lectures have to teach hybrid (preferences can be taken in account); infrastructure does not have to be provided continuously; advantages of hybrid can be partly used, e.g., for marketing	two advantages for the cost calculation (larger group size and wider geographical reach) cannot be used

Table 2. Advantages and disadvantages of design conditions

	advantages	*disadvantages*
Condition A: number of times participants are allowed to participate virtually is restricted		
Participants learning perspective	increased networking opportunities as more participants are regularly on site	flexibility is restricted to number of allowed events; choosing the day to participate virtually can cause stress
Lecturers teaching perspective	higher probability that a certain number of people will be on site	attendance must be monitored, tracking generates effort
Programme mangers management perspective	advantages of the hybrid setting can be partly used (e.g., for marketing) at the same time a certain presence on-site can be ensured	attendance must be monitored, tracking generates effort, results in border cases with potential for discussions
Condition B: participants need to register for the place of participation (on-site/virtual)		
Participants learning perspective		flexibility is restricted depending on how early the registration must be made
Lecturers teaching perspective	planning certainty as to how many people are present on site and how many people are present virtually	attendance must be monitored, tracking generates effort
Programme mangers management perspective	planning certainty as to whether support (and infrastructure) must be provided	attendance must be monitored, tracking generates effort
Condition C: the course is recorded and made available to the participants		
Participants learning perspective	flexibility is increased as lessons can be (re)viewed at a late date	risk of irritating participants (data protection), risk of participants being less likely to ask questions/contribute; recordings are not of high quality
Lecturers teaching perspective		not all lecturers want to be recorded; extra effort if only part of the course is recorded
Programme mangers management perspective	meets a demand from the participants	Risk of videos being passed on without paying for the training; extra effort, high data storage volume is needed

4. Discussion

In line with previous research (Raes et al, 2020; Raes, 2022), the present study shows that, depending on the variant implemented and the design conditions used, different advantages and disadvantages arise for the stakeholders, which must be weighed up against each other. Overall, several prerequisites are necessary for the successful implementation of a synchronous hybrid setting, see Figure 1.

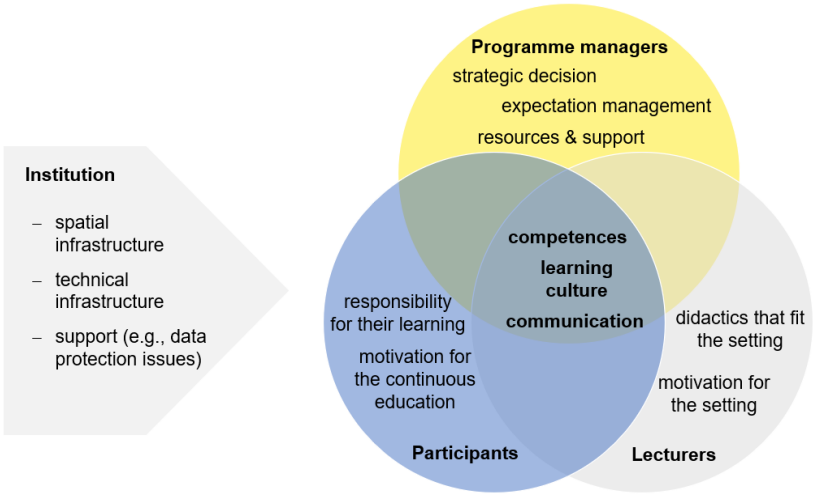


Figure 1. Prerequisites for a successful implementation of the synchronous hybrid setting.

First, there are some prerequisites on the part of the institution. If the spatial and technical infrastructure is not in place, neither variant can be successfully implemented. To avoid the possible risks of V1, an appropriate learning culture as well as competences and communication among all participants are crucial. Furthermore, it contributes to the success if each stakeholder brings further prerequisites, such as motivation for the setting (lecturers) or the training (participants). Based on our findings we recommend V1, if programme managers want or need to open up the programme to a larger group from a wider geographical area, to take into account different needs and to give participants more (local) flexibility. V1 also seems to be the right choice, if the focus is on knowledge transfer with individual work in small groups and exchange in plenary, and if there is a thematic reference to digitisation in terms of content. In addition, participants must have a high level of intrinsic motivation for the programme and lecturers should be open to the setting. Finally, appropriate technical and spatial infrastructure must be available, and flexibility should not be restricted by design conditions (e.g., limited dates, registration). V2 may be an option if programme managers want to offer at least some flexibility to participants and to meet different needs. In particular, if it seems important that the whole group meets regularly on site, or if some lecturers are not willing to teach in this setting, V2 can be used as an alternative to the combination of face-to-face and online teaching.

Programme managers who need to make a strategic decision on whether to use the synchronous hybrid setting could use the following questions: A) Demand/competition: How competitive is the market for the programme? B) Target group: What do the (potential) participants want? What about their motivation and competences? C) Lecturers: What are their motivations and skills? D)Timing: When does the training take place? (full days and/or evenings) E) Focus of the training: knowledge transfer in plenary or focus on application in small groups. Depending on the answers given, programme managers may opt for the synchronous hybrid setting or choose an alternative.

The study is limited as it relies on insights from a select number of programme managers. To improve the reliability of future research, direct perspectives from lecturers and participants should be gathered. Nonetheless, as programme managers often serve as both lecturers and participants in continuing education, we believe our findings can provide valuable guidance for successful implementation of the synchronous hybrid setting.

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University students' attitude, satisfaction, and future preference of online learning: Empirical evidence from an emerging country

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Abstract

Following the COVID-19 outbreak, online learning was only available option to cope with the quarantine policies while continuing education. Still, the debate on the effectiveness of this teaching approach and its potential to strive in the future has been continuing. This debate has nonetheless received relatively less attention in developing countries. Through an integrated conceptual model based on the technology acceptance model and the theory of planned behavior, the current study attempts to investigate attitude, online satisfaction, academic achievement, and future preference of online learning among university students in an emerging country (i.e., Morocco). The proposed conceptual model is assessed using a sample of 588 Moroccan university students, and data is assessed using the partial least square technique. Managerial implications are suggested to universities, educators and policy makers.

Keywords: *Attitude, online learning satisfaction, academic achievement, future preference, Morocco.*

1. Introduction

On January 30, 2020, the World Health Organization (WHO) proclaimed COVID-19 a worldwide public health emergency of international concern, and on March 11, 2020, a pandemic (Kordrostami & Seitz, 2021). The outbreak pushed schools, colleges, and universities throughout the world to close so that students and instructors could practice social distance. However, the transition from a traditional school setting to remote and virtual learning could not occur overnight. This fast change is connected to several hurdles and problems at this time (Amir et al., 2020).

While reviewing extent literature, four main gaps were identified. First, online learning is a complicated and multidimensional study field. It encompasses a variety of research questions, ranging from those centered on technology infrastructures to those with significant socio-

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cultural impacts (Baber, 2021; Bono et al., 2024; Wu et al., 2010). Although it is necessary to have a comprehensive conceptual model illustrating the complexity of online learning implementation, the majority of the literature articles are irregular, and often deliver inconsistent results. Reports often have a small sample size, and in many cases a potential bias on the part of the study authors due to their dual role as instructors (Ali, 2020; Aguilera-Hermida, 2020; Ismaili, 2021). Second, numerous research on online learning primarily assess the short-term effects of technology. Thus, there is a steady recurrence of the same question, with just the learning process or technology changing (Lei & So, 2021; Lima et al., 2020).. Third, the majority of relevant work focuses on certain factors to assess student's perception of online learning, such as instructor perceived performance (Shehzadi et al., 2020), ease of use of the platform (K. Mukhtar et al, 2020), information quality (A. Ahmad et al., 2020)., interaction (Baber, 2020)., perceived usefulness (Alawamleh, et al., 2020), attitude towards online learning (M. Adnan et al., 2020). Consequently, their results do not account for intercorrelated and diverse factors that might simultaneously impact students' perception of online learning.

In an attempt to fill in the gaps on the antecedents and variables of students' perception of online learning, the current study investigates the impact of instructor perceived performance, ease of use of the platform, information quality, interaction, and perceived usefulness on students' attitude towards online learning in Morocco. Moreover, we investigate how the attitude towards online learning can positively or negatively shape online learning satisfaction and academic achievement which also influence the future preferences of students. We presume that in order to reshape the future of Moroccan education, all academic parties need to take these variables into consideration; An academic strategy without direction will inevitably result in failure and uncertainty. We also analyze the moderating effects of the tools used during online learning. Our research is based on data gathered from a survey of 588 Moroccan university students.

2. Literature review and hypotheses development

2.1. Research motivation

Covid-19 and the rapid increase in internet use, both, significantly contributed to the adoption of online learning for Moroccan universities. More online classes are offered and enrolling in them is steadily rising. At first, Moroccan universities did not have the best initial operations, instructors were forced to communicate with students through WhatsApp or Facebook. Online learning remained a new educational experience in Morocco, obstacles naturally started to emerge; slow internet connection, a shortage of computers and other necessary technologies, and other challenges such as negative attitude towards online learning, or the little to no interaction between instructors and students (Draissi & ZhanYong, 2020). Although instructors made incredible efforts, some students were still unsatisfied with the online learning experience. They claimed that they were unable to connect to classes, had difficulties understanding the new

conferencing applications, comprehending the material, and keeping up with the rapid course pace (Razkane et al., 2021). It is also evident that many students have encountered numerous challenges, such as lack of motivation and enthusiasm to attend classes and were not as satisfied as face-to-face classes (Hibbi et al., 2021).

2.2. Hypotheses development

Leng Lei (2021) argues that the student model of satisfaction is significantly affected by both instructor performance and technological innovations. In addition, scholars agree that the overall student's impression of online learning is highly affected by an instructor's content expertise (Kordrostami & Seitz, 2021). Finally, K. Mukhtar et al. (2020) make a similar recommendation, arguing that we should push teachers to design lessons that ease students' minds while keeping them engaged. Therefore, we presume that instructor perceived performance positively influences students' attitude towards online learning.

H1: Instructor perceived performance positively impacts students' attitude towards online learning.

Students now have access to more resources through the most recent platforms and modern technology (Alawamleh, et al., 2020). Hence, the convenience of online learning helps to promote student engagement and improve learner retention (Lei & So, 2021). Incorporating the three dimensions of the students' scenario (interpretation, understanding, and prediction), research shows that students now prefer online platforms (Al-Maroof et al., 2021). Therefore, we assume that students' disposition toward online education is enhanced when the platform is user-friendly:

H2: Ease of use of the platform positively impacts students' attitude towards online learning.

Technology is advancing year after year, information and communication quality are becoming one of the key factors that lead students engaging in online learning to be satisfied with the new way of learning. Online learning is becoming technologically, commercially, and operationally feasible (Lei & So, 2021). Lima et al.(2020) highlight that the quality of information is a key resource, and attaining it necessitates consideration for the social aspect and involvement of information systems. Hence, we presume that information quality positively influences student's attitude towards online learning.

H3: Information quality positively impacts students' attitude towards online learning.

Numerous studies have demonstrated the importance of interaction in online learning, and yet a recurring theme in the research on the subject is that student-led online discussions result in improved learning outcomes and interesting personal applications of course themes and theories (Baber, 2020). Prior research indicates that students interact with one another and the instructor; they exchange opinions on a variety of topics (Alawamleh, et al., 2020). One of the common

implications of prior research is that a blended e-learning system should provide good engagement tools and professors should publicly encourage interaction to be successful and to positively impact motivation and academic achievement (Wu et al., 2010; Baber, 2021). Therefore:

H4: Class Interaction positively impacts students' attitude towards online learning.

Students' perception of the perceived usefulness is significantly influenced by their general impression of the online classes, their consistency with traditional education, and the instructor's reactivity and attentiveness (Aristovnik et al., 2016). However, the online class's structure and the class workload had no significant impact on perceived usefulness. A university portal could be a valuable instrument for both teachers and students by encouraging the former to evaluate their teaching and learning practices and identify areas of improvement and to seek assistance if needed (Rets et al., 2021). Therefore, we hypothesize that:

H5: Perceived usefulness positively impacts students' attitude towards online learning.

Satisfaction is the level of fulfillment and contentment of students with various components of online learning (Murillo-Zamorano et al., 2019). Ismaili (2021) argues that online learning is still in its preliminary stages, and while traditional teaching methods are invaluable still in the Arab world, post-COVID-19, The majority of students perceive distance learning favorably and are eager to take part of the classes which demonstrates that online learning in higher education institutions has a promising future. Potential e-learning proposals are viewed as dependent on the attitudes and beliefs of students regarding e-learning, as well as their gratification with technology and previous online learning experiences. Therefore, we presume:

H6: Students' attitude towards online learning positively impacts their satisfaction with regards to online learning.

Motivation cannot be considered a "separate component". rather, it is a combination of factors such as potential, personality, task values, goals, and accomplishment intentions (Trevino & DeFreitas, 2014). Researchers suggest that students' motivation was increased when their basic psychological needs were met, which was also associated with greater knowledge transfer and improved academic performance in the online learning environment (Hsu et al., 2019). We presume that students' attitudes toward online education have a profound and positive effect on their performance in the classroom. Learning about how students feel about online learning is crucial to improving its efficiency. Hence:

H7: Students' attitude towards online learning positively impacts their academic achievement.

Students from developing countries' universities have mixed feelings about online education, but are typically favorable (El-Gamal & El-Aziz). This was backed by Nassoura (2021), who

found that many students regarded e-learning favorably due to its positive effect on their self-efficacy and motivation. Contentment with the quality of online interactions has been the subject of other research. For instance, Shehzadi et al. (2020) found that when students weren't actively engaged in their coursework, they developed a negative attitude toward online learning. Hence, we presume that student's positive attitude towards online learning positively impacts their future preference of online learning. Therefore:

H8: Students' attitude towards online learning positively impacts their future preference of online learning.

Online learning relies heavily on student evaluations. A recent study by the Quality Assurance Agency for Higher Education found that students' feedback is a vital component in the instructor's structure of the class and it is a way for them to improve the learning outcomes and shape student's future preferences (Quality Assurance Agency for Higher Education, 2018). The effectiveness of face-to-face instruction in a blended course has not been assessed by Al-Busaidi (2021) or Lin and Wang (2021). Since the blended learning mode exposes students to both online and face-to-face learning resources and components, it may have a substantial impact on whether or not students choose to continue their education online. Therefore:

H9: Students' satisfaction positively impacts students' future preference of online learning.

Recent research indicates that a variety of characteristics serve as predictors of academic accomplishment in online learning environments. Each researcher categorised these variables differently (Ong et al., 2021; Amir et al., 2020; Schlenz et al., 2020). Other factors that affect students' performance in online learning include gender, age, employment status, Internet or computer self-efficacy, characteristics, and learning styles (Schlenz et al., 2022). According to Lei & So.; (2021) Students who are motivated and self-aware are more likely to achieve better grades therefore prefer to engage in more online classes in the future. Hence, we presume that students' academic achievement in online learning settings positively impacts their future preferences.

H10: Students' academic achievement positively impacts students' future preference of online learning.

Based on the above, the conceptual model is illustrated in Figure 1:

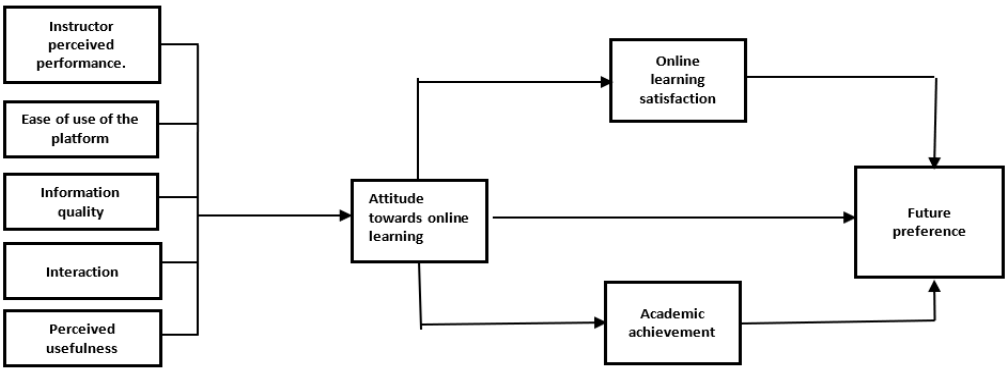


Fig 1. Conceptual model (proposed by authors)

3. Research methods

3.1. Measurements

The research model constructs were derived from existing literature as well as our surveys. Because French is so widely spoken in Morocco, we made sure to provide both French and English versions of our questionnaire's scales and questions (Lebdaoui and Chetioui, 2020). To make the transition from English to French, we used the back-translation technique (Brislin, 1986). All constructs were measured using a five-point scale ranging from 1 (strongly agree) to 5 (strongly disagree). To assess students' general online learning experience, seven questions were asked.

3.2. Sample and data collection

Our survey was answered by 588 Moroccan university students, from both the public and the private academic sector. Our surveys were distributed in all social media as well as sent in Moroccan universities' emails. There is a roughly equal number of males and females in the sample (47.96% Male and 52.04% Female). In terms of age distribution, those between the ages of 18 and 25 made up the largest share (88.27%), followed by those between the ages of 26 and 30 (9.18%) and 31 and older only made up (2.55%) of the survey. Seventy percent of respondents held a bachelor's degree, followed by 27.55% Masters Students, and finally 2.38% of the sample were PhD students. With regard to the device used during online learning, most of the respondents (75.34%) used a desktop/ laptop, followed by smartphone users (22.11%) and finally tablet users (2.55%). With respect to internet quality and access, 78.40% of the respondents had good quality internet, while 21.60% had limited access. Regarding camera use

during online classes, 44.73% don't use cameras, 31.46% answered it depends, and 23.81% used the camera during all their online classes.

4. Results

To assess the main relationships proposed in the conceptual model, structured equation modeling (SEM) was employed. In view of the early stage of the theoretical development, the predictive nature of the theoretical framework, and complexity of relationships of he structural model (Hair et al., 2019), the use of Partial Least Squares (PLS) was considered the most suitable for the current research. Before testing the structural model, the measured model was analyzed in terms of construct reliability, convergent and discriminant validity.

4.1. Assessment of the Measurement Model

The initial stage in establishing indication reliability is to ensure that loadings are larger than 0.70. (Chin, 1998; Hair & Anderson, 2010; Henseler et al., 2009). In our case, each item's loading is greater than 0.70, indicating that the indicator's dependability has been attained. Second, we used Cronbach's alpha (CA) and composite reliability to examine the construct's dependability (CR). Our results illustrate that all of our constructions have CR and CA values more than 0.70, suggesting their dependability (J. Henseler et al., 2009). Third, to evaluate convergent validity, the average variance extracted (AVE) must be equal or greater than 0.5 to be regarded as adequate to explain more than half of the variation of its indicators on average (Hair & Anderson, 2010; Henseler et al., 2009). All of the AVEs are greater than 0.5, which denotes convergent validity (The tables of validity are available upon request).

As for discriminant validity, we used the HTMT table as suggested by Hair et al. (2021). Our results suggest that all values are below the cutoff value of 0.9 (Jörg Henseler, Ringle, & Sarstedt, 2015). Thus, the discriminant validity of the notions is met by all of the measurements. The satisfying results for construct reliability, convergent validity, and indicator reliability suggest that the constructs may be utilized to evaluate the conceptual model (The HTMT table is available upon request).

As for the model fit, our model's standardized root mean squared residual (SRMR) value is 0.061, which is below the threshold of 0.08 (Henseler et al., 2014), indicating a good fit of the measurement model. The normed fit index (NFI) value is also above 0.9 (NFI=0.915), indicating an acceptable fit. Lastly, all variation inflation factor (VIF) values are below the threshold of 3.3; the model is therefore free of pathological collinearity and of common method bias (Kock, 2015).

4.2. Assessment of the Structural Model:

First, our research explains 62% of the variation in Attitude towards online learning. As expected, instructor perceived performance (ß = 0.327; $p < 0.001$), ease of use of platform (ß = 0.222; $p < 0.001$), Information quality (ß = 0.247; $p < 0.001$), Interaction (ß = 0.139; $p< 0.001$) , and perceived usefulness (ß = 0.358; $p < 0.001$) had a significant positive impact on student's attitude towards online learning, approving H1, H2, H3, H4, and H5 (see table 1). Students' attitude towards online learning mainly depends upon instructor perceived performance and impacts positively on it. Moreover, online technological skills and online process skills are crucial factors demonstrating enthusiasm. So the instructor's perceived performance during online education is enhanced when the platform is user-friendly. Studies show that the primary goal of information quality is to facilitate online learning for students and provide them with correct and relevant information (Lima et al., 2020). On top of that, one of the common implications of prior research is that e-learning classes should provide good engagement tools and professors should publicly encourage interaction to be successful and to positively impact motivation and academic achievement. Therefore, Hypotheses H1, H2, H3, H4, H5 are proven to positively impact students' attitudes towards online learning.

Second, 42% of the variation in online learning satisfaction is explained by the conceptual model. Attitude was confirmed to significantly impact students online learning (ß = 0.649; $p < 0.001$), approving H6. This suggests that a positive attitude toward online learning partially influences the connections between intrinsic drive to learn and extrinsic incentive to succeed, as well as between each of the engagement dimensions. Negative attitudes towards online learning were proven to further diminish the chance of student participation. Students who have a positive attitude towards their online classes are more likely to participate and engage with instructors. Hence, they are more satisfied with the class and are more likely to keep engaging during online sessions.

Third, the conceptual model accounts for 41.7% of the variation in academic achievement. Attitude was confirmed to significantly impact students' academic achievement (ß = 0.644; $p < 0.001$), approving H7. This suggests that students with a more optimistic outlook on distance education have a higher chance of academic success. Students like this typically excel academically and in class discussions with teachers and peers. However, students who have a negative outlook on online education are more likely to view their classes as a waste of time. As a result, they perform poorly in school.

Finally, our research explains 50.8% of the variation of Future preference for online learning. The hypotheses of Attitude towards online learning ($\beta = 0.359$; $p < 0.01$) Academic achievement ($\beta = 0.275$; $p < 0.01$), Online learning satisfaction ($\beta = 0.183$; $p < 0.01$) are statistically significant. Therefore, hypotheses H8, H9, and H10 are supported. The results put forward the fact that a positive attitude towards online learning, a positive academic achievement during

online learning, and satisfaction with the new way of learning all lead students into choosing and enrolling in more online classes.

Table 1. Direct effects (developed by the authors based on SmartPLS 3 output)

Hypotheses	Relationships	Beta	STDEV	t-statistics	p-values
H1	Instructor perceived performance -> Attitude towards online learning	0.327	0.044	3.891	0.000
H2	Ease of use -> Attitude towards online learning	0.222	0.042	5.238	0.000
H3	Information quality -> Attitude towards online learning	0.247	0.051	4.894	0.000
H4	Interaction -> Attitude towards online learning	0.139	0.048	2.878	0.004
H5	Perceived usefulness -> Attitude towards online learning	0.358	0.043	8.295	0.000
H6	Attitude towards online learning -> Online learning satisfaction	0.649	0.030	21.517	0.000
H7	Attitude towards online learning -> Academic achievement	0.644	0.031	20.868	0.000
H8	Attitude towards online learning -> Future preference	0.359	0.052	6.960	0.000
H9	Online learning satisfaction -> Future preference	0.183	0.046	3.967	0.000
H10	Academic achievement -> Future preference	0.275	0.049	5.573	0.000

5. Discussion and conclusions

This study seeks to examine students' perception towards online learning as a training mode, particularly on their experience with the Covid-19 pandemic. This technology for distance education was mandated by the Moroccan government's confinement and social distancing policies. In this research, we were able to determine the main determinants of the adoption and acceptance of e-learning as a distance learning mode. We conducted quantitative research using a questionnaire to gather data and concluded that most of the 588 student respondents had a positive experience with online learning. The majority of the students provided a positive evaluation of this distant learning experience. Students also reported that their experiences working on virtual teams in their online classes were engaging and interactive with the instructors (Adnan et al., 2020; Bono et al., 2024).

From a managerial point of view, the results of our research suggest that policy makers should engage in awareness-raising and communication campaigns with students to highlight the contribution of online learning modality to their performance and academic development. This study also conveys important insights for the Moroccan university instructors; in online learning, the updating of knowledge and courses is more important than in the classroom. Teachers are highly recommended to update their courses, to adapt them and to make them as comprehensible as possible; indeed, putting courses online makes them public and accessible to everyone, which then exposes them to control and criticism and leads teachers to propose quality teachings. Our study suggests that interaction between instructors and students is key to a positive attitude for students. Instructors are encouraged to make their online classes more

interactive by offering diverse activities where students can give their opinions and work with their classmates. Indeed, enhancing student satisfaction and academic achievement in online learning requires a multifaceted approach that addresses both the technological and pedagogical aspects of online education. For a better satisfaction and academic achievement among Moroccan students, Moroccan policy makers and instructors are urged to use interactive Learning Materials, maintain regular communication with students through announcements, emails, and discussion forums, provide clear instructions, expectations, and timely feedback on assignments, incorporate group projects and peer-to-peer interactions to foster a sense of community and encourage active participation, ensure that course materials are accessible to all students, implement strategies to keep students engaged (I.e., gamification elements, real-world applications, and case studies), and offer technical support and training to students. By implementing these strategies, instructors can create a supportive and engaging online learning environment that promotes both student satisfaction and academic achievement.

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Changing character of e-learning trajectories at a Ukrainian University: swimming against the tide

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Abstract

The paper aims to describe the contribution of Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University [VSPU] to e-learning in Ukraine that served as a momentum for cardinal transformations in the formats of instruction, content, and engagement of Ukrainian students and professors. With institutional priorities, faculty members' Fulbright commitments and initiatives, and collaborative support of Southeast Missouri State University [SEMO], USA, VSPU has significantly improved technology literacy, intercultural competence, and attitudes to innovation in teacher candidates. The research is empirically based on over ten years of online experimenting with project work that organically became part of university teacher training curricula. The research applies SWOT analysis and qualitative and quantitative methods. The findings demonstrate the evident attitudinal change toward e-education and international collaboration with years of engagement, resulting in relevant teacher preparation. The research concludes that changes in educational trajectories are beneficial and necessary to address global and local challenges.

Keywords: *E-learning and educational technologies; institutional priorities and personal initiatives; international collaborative projects; a Ukrainian university*

1. Introduction

The augmentation of technology applications in education today is rapid, convincingly justified, and indispensable under some circumstances (Haleem et al., 2022, p. 276; Matviienko et al., 2021, p. 137; Matviienko et al., 2023, p. 162; Sivalingam et al., 2018, p. 16). Reflecting on the tools and application and questioning the impact should go in parallel with planning further

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pursuits for developing new educational trajectories within familiar academic planes. Technology integration necessitates additional attention to content delivery and engagement opportunities realization. Furthermore, innovative education today is not viewed as such without technologies because of their "potential" to cognize, modernize, ensure conditions for "spiritual and creative development," and unite in collaborative research (Bykov & Leshchenko, 2016, p. 6; Haleem et al., 2022, p. 277; Kuzmina et al., 2023, p. 89; Matviienko et al., 2023, p. 163). The multiplicity of "ubiquitous technologies" in operation ensures the creation of a "positively integrated reality," affecting institutional priorities and personal initiatives, substantiating belief in the advantages of e-learning over traditional education for international collaboration (Bykov & Leshchenko, 2016, p. 1; Kuzmina et al., 2023, p. 84; Matviienko et al., 2023, p. 163). Computer-assisted, web-based, blended, gamified, and one of the recent developments, AI-generated learning increasingly diversifies the educational landscape and broadens professional horizons (Domenech, 2023, p. 340; Ihnatova et al., 2021, p. 115; Matviienko et al., 2023, p.162; Powell et al., 2014, p. 34; Sivalingam et al., 2018, p. 14). Considering the e-learning development in Ukraine, the authors believe it has been significantly impacted by two dramatic events: the COVID-19 pandemic and the war that began in 2022. They urged Ukrainian education to embark on the way of e-learning exploration, giving this task the utmost attention (Kuzmina et al., 2023, p. 84; Lucenko et al., 2023, p. 2; Matviienko et al., 2021, p. 137; Matviienko et al., 2023, p. 162). The paper aims to share a ten-year experience of the transformative changes at VSPU, a Ukrainian teacher training university, as they resonate with global trends, providing insight into the outcomes of the experience and their potential applicability in other educational contexts.

2. Methodology

The research retrospectively describes the experience of integrating e-learning in teacher education, which began in 2013 with the Fulbright commitments (Powell et al., 2015, p. 381) and faculty members' initiatives from VSPU, Ukraine, and SEMO, USA. Sustained by institutional priorities for e-learning, the initiatives evolved into several online projects that added a significant global perspective to teacher training at VSPU. For over a decade, foreign educators have taught VSPU students different aspects of teacher preparation. The research objective is to examine the initiatives for transformative outcomes in professional training and attitude change. The data collection is based on an annual analysis of students' surveys on Google Forms. Some feedback was self-reported verbally. However, more than 1500 posts in the Forum discussions have been analyzed to identify differences in perceptions. The survey questions addressed the attitudes toward e-learning and educational technologies' role in innovation, international collaboration, content relevance, and interest in projects by years of engagement. Research procedures encompassing reflecting on technologies in operation and the projects' content through the SWOT analysis applied descriptive, qualitative, and quantitative

methods. The sample group included Ukrainian undergraduate and graduate students in English language education enrolled in the Department of Foreign Languages at VSPU from 2013-2023. The age category is mainly 20 through 22, with a prevailing female-student ratio of 1:10; students are mostly city and village dwellers of largely Vinnytsia and Vinnytsia Oblast.

3. One University Contribution to E-learning in Ukraine

3.1. Institutional Priorities and Personal Initiatives Matter

To better understand the contribution of VSPU to e-learning, it is worth mentioning that in Ukraine, education, like in many post-Soviet countries, was traditional primarily before 2019, when "despite solid governmental support," online practices were "sporadic and uncoordinated," and students were "ill-prepared" to work online (Blayone et al., 2018, p. 1; Matvienko et al., 2021, p. 136; Powell et al., 2014, p. 35; Powell et al., 2015, p. 382). "Slow integration of technology," "insufficient material and technical base," "lack of experience to create online infrastructure and curricula," "limited financial resources and low digital readiness among students and teachers" were common and slowed down the advent of e-learning (Blayone et al., 2018, p. 2; Lucenko et al., 2023, p. 2; Matvienko et al., 2021, p. 137). However, due to "institutional priorities and faculty members' initiatives" (Powell et al., 2015, p. 381), VSPU made "remarkable progress swimming against the tide" (Powell et al., 2015, p. 383; Matvienko et al., 2021, p. 142). Web-blended education [WBE] was initiated in 2013 as "an online learning pilot project," *Teacher Candidate Preparation in US Universities*, an outcome of the Fulbright service, which became "an exciting experience" in online collaborative coteaching (Blayone et al., 2018, p. 2; Matvienko & Kuzmina, 2020, p. 166; Powell et al., 2014, p. 36). Since the university did not have its LMS, Google Apps with Java runtime were adjusted for free use to provide the logistics for asynchronous learning and navigation. Skype-enabled synchronous meetings brought together 78 graduates and four guest lecturers from SEMO once a week for an hour to work on the essentials of US teacher training. According to Powell et al., 2015, the excitement of gaining knowledge from American professors (27%) through "e-learning interaction" (32%) and "engagement" (28%) made positive feedback. However, the need for technology for individual use, the Internet, self-organization, and time management issues were challenges. Understandably, the main difficulties were fear of the unknown mode and lack of experience working online. Probable threats were related to weaknesses. The authors are prone to believe that 12% of students who regretted the reduced teacher control (Powell et al., 2015, p. 383) were subject to fear of learning on Google Apps (Table 1).

Table 1. Teacher Candidate Preparation in the US via SWOT Analysis.

WBE Projects.	**Strengths**	**Weaknesses**	**Opportunities**	**Threats**
Teacher Candidate Preparation in the US (2013-2014)	Introduction of online education. Creating online infrastructure on Google Apps. Skype for work International professional collaboration. Improved English Skills	Lack of experience to work online. Time management Self-control. Poor quality of Skype and weak Internet signal	To integrate web-blended-learning. To explore American teacher education. To learn from native speakers-experts	High anxiety level. Loss of interest/disappointment Language barrier fears

In the *Web-Blended Education for English Skills* project (2014-2018), Google Apps and Skype remained in use as available. However, the scope of international engagement and content was significantly broadened. Eleven foreign instructors worked on the methodologies of teaching grammar, reading, intensive English, academic writing, composition, academic honesty, and British and American literature. Weekly F2F sessions and forum discussions afterward were integrated into the compulsory Ukrainian class, Methodologies of Teaching English. Google Forms surveyed students' attitudes, and based on the feedback, the SWOT analysis identified much in common with the first WBE project (Table 1). Positively, 100% of students singled out the crucial role of technologies; 98% viewed exposure to international collaboration as a strength, albeit 73% of students were still hesitant about the advantages of e-learning over traditional. Deadlines and academic honesty issues in the forums were challenged. The authors tend to relate the doubts about the benefits of e-learning (73%) to anxiety issues stemming from the non-traditional class format. The *Facebook Movie-Based Discussions Club* (2015-2020) was initiated as an academic cross-cultural and informal exchange. It engaged Ukrainian 3rd-year students and language instructors, SEMO professors, and members of their families (Lisnychenko et al., 2022, p. 439). The project allowed the participants to interact at their convenience in the FB closed group, discussing American traditions and social and cultural issues depicted in the films, which sustained values education and intercultural awareness. Despite some time management and organization issues about 23% of students faced and about 50 % experienced cultural differences, students' engagement reached 100%, with positive feedback from 98% of participants. Additionally, 100% of participants approved of exchanging personal experiences and memories evoked by films, which made the atmosphere home-like and film analysis deeper, reducing the number of shy about sharing frankly to only 7%. The project similarly addressed the issues of gender, special, and human rights education (Table 2).

Table 2. Facebook Movie-Based Discussions Club via SWOT Analysis.

WBE Projects.	Strengths	Weaknesses	Opportunities	Threats
Facebook Movie-Based Discussions Club (2015.-2020)	Strengthening values education and intercultural competence. Cross-cultural exchange through films. Gender, special, and human rights education. FB for learning	Required extra time to watch films. Much writing. Spending many hours before the computer	To develop an understanding of shared human values and intercultural competence. To improve writing, critical thinking skills	Fear to tell/write the truth to expect polite answers. Cultural misunderstandings that cause frustration and hot discussions

3.2. Responding to Global and Local Challenges

If the pandemic was an ”unprecedented” challenge of “crash course immersion” in e-learning (Lazarenko & Ihnatova, 2022, p. 8; Matvienko et al., 2021, p. 137), the war became a tragedy. Resuming teaching two weeks after the war broke out technically relied on the lessons learned from the pandemic (Matvienko et al., 2021, p. 139; Kuzmina et al., 2023, p. 84). *The Interdisciplinarity Approach to English Language Teacher Education* project (2019-2024) was meant to stay connected globally despite physical isolation. Therefore, the project developed into a 2-credit elective class designed on Moodle, with instructors from SEMO and 13 other US universities - members of the NGO GCUE educational organization (Kuzmina et al., 2023, p. 86). The focus was on technologies, academic integrity, methodologies of TESOL, internationalization, inclusion, gamification, social-emotional learning, culturally-based assessment, and cultivating kindness. During wartime, the partners-in-education doubled their effort in educational and emotional support. As a result, 100% of students appreciated such support, 96% believed in e-learning for gaining education under war conditions, and 100% understood the strengths and opportunities of interdisciplinarity for language studies (Table 3).

Responding to the war, COIL projects, *Kindness and Trauma-Informed Teaching”* (2022) and “Computer-Assisted Language Learning (CALL) (2023) were integrated into the “Traditions of Academic Collaboration: International Experience” and “Interdisciplinary Approach to English Language Education” elective classes at VSPU. The Kindness project united graduates of VSPU and the University of Worcester, USA, to collaborate on combating violence in the USA and the stress of war in Ukraine with a focus on skills for the after-war recovery of Ukraine (Kuzmina et al., 2023, p. 85). The applied modes of engagement ensured communication during F2F Zoom meetings; meanwhile, asynchronous tasks were performed on Google Classroom. SEMO’s initiative, the Computer-Assisted Language Learning (CALL) project, was a sign of goodwill and support for the Ukrainian undergraduate program during wartime, adjusting the

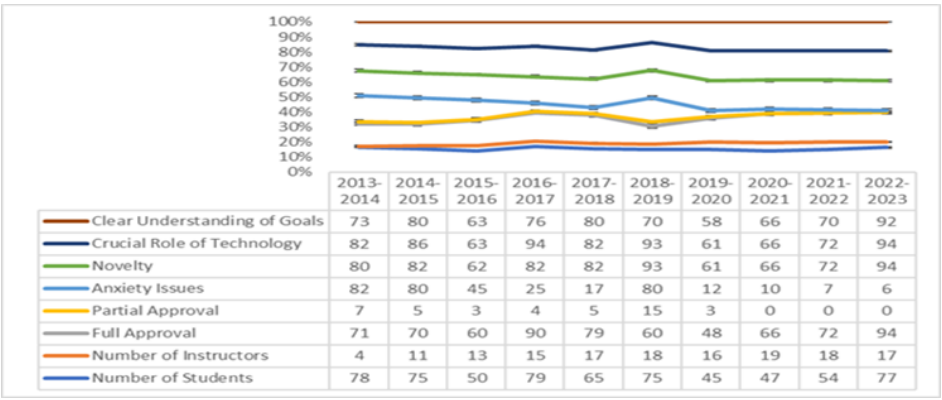
CALL approaches to the war conditions and cross-cultural communication. The SEMO LMS CANVAS was hospitably offered as a platform for registered Ukrainian students in the Online Methodologies of TESOL class to conduct asynchronous research and explore American university online infrastructure along with professional and ethical policies. Through the SWOT prism, based on the observations and surveys, the two students' COIL projects had apparent strengths for personal (70,4%) and multiple opportunities for professional growth (93.8%). In students' opinion (100%), the weaknesses and threats were related to blackouts and air raid alerts. However, both projects' mission was to teach how to cope with them.

Table 3. Interdisciplinary Approach to English Language Teacher Education via SWOT.

WBE Projects.	**Strengths**	**Weaknesses**	**Opportunities**	**Threats**
Interdisciplinary Approach to English Language Teacher Education (2019-2024)	Introduction to Moodle, ZOOM, Google Meet, Google Classroom. Interdisciplinarity. Acquiring the skills of the 21st-century teacher	High-level anxiety because of the sudden transition to distance learning. Fears that knowledge would not be relevant	Introduction to distance education. To understand the importance of interdisciplinarity in English teacher training	Increased stress due to the pandemic and war.Technology deficit. Increased inequality. Insufficient understanding of interdisciplinarity

4. Summarising Experience and Making Conclusions

Irrespective of the challenge, "swimming against the tide" has made a difference. VSPU's initiatives catalyzed the transformative change in technology, content, and engagement. The transformation of attitudes is apparent when comparing the first project's feedback with that of later ones: *flexibility, novelty, interaction, and engagement* were marked as essential (Powell et al., 2015, p. 383). The answers to the questions, "Was the project interesting? What can you suggest for improvement?" did not always sound reassuringly optimistic: "Yes, it was interesting, but the time difference was inconvenient," "Yes, but too much writing in the Forum was tiring," "Yes, it was, but I felt nervous to answer and ask American professors questions." The suggested improvements were concerned with time management and organization and complaints about the quality of technology, resulting in a reluctance to join forums timely. Nevertheless, the years of e-learning experience led to evident maturity. From 94 to 98% of students emphasize as mandatory "*learning from native speakers, technology literacy, international collaboration, intercultural awareness, establishing long-term professional contacts, broadening outlook, learning innovative methodologies, implementing an interdisciplinary approach to knowledge, commitment to innovation.*" The positive shift is also evident in the understanding of goals by 100% of students; 100% attest to the decisive role of



	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
Clear Understanding of Goals	73	80	63	76	80	70	58	66	70	92
Crucial Role of Technology	82	86	63	94	82	93	61	66	72	94
Novelty	80	82	62	82	82	93	61	66	72	94
Anxiety Issues	82	80	45	25	17	80	12	10	7	6
Partial Approval	7	5	3	4	5	15	3	0	0	0
Full Approval	71	70	60	90	79	60	48	66	72	94
Number of Instructors	4	11	13	15	17	18	16	19	18	17
Number of Students	78	75	50	79	65	75	45	47	54	77

Figure 1. Changes in attitudes toward participation in online projects by years

technology, with 100% of students' full approval and 100% of teacher candidates' marked novelty. Anxiety in the classes is reduced significantly (Figure 1).

Questioning about the interest in and suggestions for improvement of later projects revealed, "*I like it because of e-learning opportunities to transcend physical boundaries; I like oral and written communication with American professors; it broadened my professional outlook; it was good to know about equity, race, special education; good to know about online methodologies and how to teach during the crisis; all the lecturers motivated to achieve more in my profession; it prepares us for present challenges."* Prevailing suggestions for improvement advised,*" more lectures and practical courses with American instructors; to have more joint classes and COIL projects with prospective American teachers; make the number of students in groups less to have more communication with professors."* Based on the research results, the inference is made that the impact of VSPU's priorities and initiatives on teacher education is evident, and the effect is transformative and long-lasting. New knowledge acquisition strategies, content delivery formats, and substantiated opportunities for international collaboration to develop in future teachers a habit of celebrating innovation and striving for quality and high standards are necessary for Ukraine to prosper as a nation and to be prepared to withstand global and local challenges.

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Strategies to reduce dropout in higher education

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Abstract

This study investigates strategies to reduce higher education dropout from the perspective of course directors. Through semi-structured interviews with directors from various institutions and disciplines, the research identifies key strategies focused on academic achievement, student integration, and financial support. Directors emphasize the importance of close student-teacher relationships, individualised support, and mentoring programmes. They also highlight the need for innovative pedagogical approaches, including interactive teaching methods and technology integration, to engage students actively. Findings suggest the necessity of a holistic approach to student support, integrating academic, financial, and socio-emotional aspects to foster an environment conducive to student success and retention. The paper advocates for strategies that address the complex nature of student dropout and suggests that insights from course directors are instrumental for shaping effective institutional practices and policies.

Keywords: *dropout; retention; strategies; practices; Portugal.*

1. Introduction

Dropout from higher education continues to represent a serious problem globally (OECD, 2022). Only 39% of full-time students across OECD countries complete within the official duration and, even three years later, the completion rate only reaches 68%. Portugal is no exception to this trend, with dropout being slightly below the OECD average (OECD, 2022). Students who abandon their studies are more prone to unemployment (Ferrão & Almeida, 2018), but higher education institutions and the society also suffer the negative consequences of dropout (Behr, et al., 2020). For this reason, countries and institutions have adopted policies and strategies to diminish dropout. These need to consider the increasing diversity of the student

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body, including students from disadvantaged socioeconomic backgrounds, adult learners or part-time students who work at the same time.

Institutions resort to various strategies to improve retention. The provision of support services, especially for non-traditional or disadvantaged students, is the most documented one (Almeida et al., 2012; Dawson et al., 2020; Delnoij et al., 2020; Jones, 2015). Support varies from the development of academic and study skills to guidance in choosing subjects, to social support or psychological support. A literature review on the characteristics of effective interventions (Delnoij et al., 2020) concluded that coaching, remedial teaching and peer mentoring significantly increase completion rates. A common element of successful programmes in improving retention is the existence of a mentor, advisor, or counsellor who provides students with comprehensive guidance to help them overcome academic, personal or financial barriers (Dawson et al., 2020). Programmes promoting the "culture of belonging" also stand out, such as residential summer schools before entry, orientation programmes, extracurricular activities or emotional support from teachers and peers (Thomas et al., 2017). Financial support is a specific category worth highlighting, e.g. free use of manuals, transport passes, emergency financial assistance, exemption from exam fees or merit scholarships (Dawson et al., 2020).

The reorganisation of course delivery, both in terms of timetable and structure represents another institutional strategy to improve academic success. Timetable reorganisation became necessary following the increasing presence of students who reconcile studies with work. After-work classes or part-time options are measures taken in this sense (Almeida et al., 2012). Another approach involves "structured schedules" (classes occupy the same interval every day, allowing for easier scheduling) and predictability (Jones, 2015).

Pedagogic approaches, too, are employed to increase students' motivation and success. Using technology is one way to ensure the relevance and quality of teaching and learning for diverse groups of students. Besides facilitating access to higher education, it can make classes more engaging and increase student performance (Devlin & McKay, 2016). Then, pedagogical approaches that involve students in the construction of knowledge through project-based learning and problem-based learning, simulating real professional contexts (Chen & Yang 2019), are innovative methodologies proven to be effective in engaging students, boosting motivation and increasing interest (Bender, 2012). Relying on technology, the flipped learning model can positively influence several domains, from learning and communication to empathy and collaboration (Cueva & Inga, 2022). Since dropout is often related to a lack of commitment because of conflicting obligations, innovative teaching and learning approaches which bring together formal education and the workplace emerge as another way to improve retention. Such work-based learning partnerships allow working students to enroll in higher education while continuing to work (Boud, 2006; Hartmann et al., 2009). Internships, practical projects and other forms of experiential learning incorporated into higher education curricula allow students to

apply theoretical knowledge to work contexts. This renders them more aware of the value of academic training for their professional careers.

A useful perspective which can offer insights into institutional strategies and practices is that of course directors. Given their daily, relatively close, interaction with students on their course and the struggles they face, they are aware of the ways in which dropout is tackled via institutional strategies and practices. Even more importantly, their views are valuable because they are aware not only of official structures and initiatives, but also of everyday practices employed informally and of potential measures that could help students stay on course. Against this background, this paper aims to answer the following research questions: What are the course directors' perceptions of the strategies and practices adopted in their institutions to address dropout? What additional measures could be taken to encourage student retention?

2. Methodology

A study conducted in 2023 aimed to understand course directors' perspectives on dropout, including strategies to reduce it, via semi-structured interviews in diverse educational institutions, including universities and polytechnics, across public and private sectors. The study focused on a range of educational levels (higher technical and professional courses - CTeSP, bachelor's, and master's degrees). Contact was made via email with course directors from different disciplines and educational levels, resulting in virtual interviews via Zoom with eighteen course directors. Table 1 provides an overview of the demographic and professional attributes of the interviewees, including gender, academic level of the programmes they coordinate, disciplinary area and the type of institution in which they work.

The study maintained high ethical standards, having obtained participant consent for recorded and transcribed interviews, ensuring confidentiality and anonymity. The flexible interview structure allowed for open discussions about strategies to reduce student dropout rates and suggestions for future initiatives. For analysis, the study used MAXQDA software, following Corbin and Strauss's (1990) grounded theory.

3. Findings

This section presents the findings categorised into two main dimensions: the ongoing institutional strategies and the recommendations for future initiatives aimed at reducing student dropout rates.

Table 1. Characteristics of the interviewees

Interview	Gender	Type of qualification	Disciplinary area	Type of institution
1	Male	CTeSP	Arts	Public Polytechnic
2	Male	CTeSP	Arts	Public Polytechnic
3	Male	CTeSP	Law	Private Polytechnic
4	Male	CTeSP	Engineering	Public Polytechnic
5	Male	Bachelor	Engineering	Public University
6	Male	Bachelor	Engineering	Public Polytechnic
7	Male	Bachelor	Engineering	Public Polytechnic
8	Male	Master	Engineering	Private University
9	Female	Master	Engineering	Public University
10	Female	Bachelor	Management	Public University
11	Female	Bachelor	Management	Public University
12	Male	Bachelor	Management	Public Polytechnic
13	Female	Bachelor	Management	Public Polytechnic
14	Female	Master	Management	Public Polytechnic
15	Female	Master	Education	Public Polytechnic
16	Female	Master	Education	Public Polytechnic
17	Female	Master	Education	Public Polytechnic
18	Female	Master	Education	Private Polytechnic

3.1. Ongoing institutional strategies to prevent student dropout

The course directors mentioned three dropout prevention strategies: those pertaining to academic achievement, which are more prevalent in polytechnic institutions; those concerning student integration, predominantly emphasized in universities; and those addressing financial support, which are particularly highlighted in polytechnic institutions. The course directors tended to point to strategies related to students' academic achievement as the biggest protective factor: individualised support and monitoring by teachers acting as advisors are seen as decisive, especially in master's courses where the internship/dissertation is a vulnerable period:

> In recent years, what we've done is to have regular meetings with them. It was an activity that I made a priority as course director (...) And this has in fact greatly increased our success rate. (...) We know that there are always losses, but what we want to do is minimise those losses and so (…) above all, the relationship with the students has to be very close. (Interviewee 4)

Offering study support and complementary sessions is pointed out as another relevant dropout prevention strategy in engineering, management and education courses alike, although the interviewed directors mention some lack of student participation in these sessions.

> Yes, another thing we've done is create support for some subjects, but then the students don't turn up, we've also created sessions to explain study techniques, working methods, all of this we've done, but often there's very little take-up of this type of offer. (Interviewee 17)

The second most mentioned type of dropout prevention strategy includes initiatives aimed at integrating students. In this area, mentoring programmes occupy a prominent place, and there has even been a Portuguese Mentoring/Tutoring Network in the country since 2018. These programmes, which work based on peer relationships, end up having a dual function because they contribute to academic integration, but they are also a space to support curricular success, as described in the excerpt below:

> It's a programme based on a support network, on social support. Basically, the older, more experienced students, in principle from the same study programme and from the second or third year, support them, give them some instructions, pointers, tips, share study materials. (Interviewee 16)

The process of integrating students is also often affected by mental health issues. The course directors mention various situations requiring psychological support, as well as the importance of these services in the institutions. Some directors mentioned more recurrent situations in recent years related to social anxiety, as mentioned in the extract below.

> We had a situation last year where a student asked not to present her work in front of her classmates because she felt embarrassed and couldn't do it. (Interviewee 3)

Financial support also holds an important place in institutional dropout prevention, although it is not the most frequently mentioned aspect. Support for student accommodation, social canteens and social grants are particularly significant in this regard. In addition to these aspects, there is sometimes support that responds to contextual needs, such as, for example, in the case of institutions located in areas with harsh winters (support for heating accommodation). Nonetheless, student accommodation is highlighted as a central concern today and various adopted measures, or under consideration, are mentioned.

> It's recognised that there are difficulties in finding accommodation. And what we're trying to do is to extend the public residences and network with the private ones. (Interviewee 6)

3.2. Recommendations for future initiatives

A prevalent theme mentioned by course directors as a way to reduce dropout was increasing student engagement and motivation. Directors suggested evolving the educator's role from merely teaching to validating information, reflecting the shift to online learning resources. They recommended interactive, practical teaching methods over traditional lectures, incorporating

tools like "serious games", updating curricula to match student interests, and involving students in course design. This approach positions educators as mediators, countering misinformation and fostering a more engaging, practical learning environment.

> When I start going through content, within 10 minutes eyes start rolling, phones come out. Attention just fades away, more and more. I've been asking myself, "Where do I begin? Maybe I should kick off with a case study, or dive straight into an exercise." (Interviewee 2)

Directors advocate for transparent course planning, interactive pedagogies, and the integration of tech tools and serious games to balance educational depth with enjoyment, thus enhancing student engagement. They emphasise curricula that reflect student interests and encourage collaborative, inquiry-based learning, fostering a participatory, dynamic educational environment. Additionally, directors call for a holistic approach to student motivation, including reimagining physical learning spaces. They suggest redesigning higher education facilities to mirror contemporary, inviting office spaces, arguing that just as companies revamped offices post-pandemic to motivate staff, educational institutions should also make classrooms and campuses more appealing to boost student motivation and engagement:

> Why don't we make our learning spaces more like the welcoming atmosphere of our homes? Soften the coldness, the heavy institutional feel of these educational settings. (Interviewee 2)

The second identified key theme was the promotion of student integration to reduce dropout rates. Academic leaders emphasise the role of peer relationships, student organizations, and strong faculty-student bonds in creating a sense of belonging. They note the particular challenges of integrating international students and recommend enhanced support for them. Suggestions also include personalized approaches, mentoring, and a focus on student well-being to cultivate a positive, inclusive atmosphere that helps lower dropout rates.

> So, essentially, the fact that students feel supported not just by their peers, or the student union, or those groups, but by the lecturers themselves, feeling like they have a second home at the institution, I really think that contributes massively to preventing dropouts. Because they genuinely feel more supported. (Interviewee 10)

Addressing financial barriers was also an issue deemed as crucial to reduce dropouts, with suggestions ranging from need-based financial aid and affordable housing to incentives like tuition fee refunds for high achievers. Reducing the overall financial strain through lower tuition or increased support is vital for broader access to higher education. There is a call for government funding to improve student well-being, including physical and mental health, as these significantly impact dropout rates. It is also recommended that universities mandatorily

provide mental health information and support, aiding students in addressing issues that may impede their academic success.

> Mental health is a big topic nowadays, sadly for the wrong reasons, and it shouldn't be an optional thing for each institution, but rather a mandatory responsibility for them all. (Interviewee 3)

Some directors also mentioned that reducing class sizes is crucial for lowering dropout rates. They argue that large classes hinder effective teaching, especially in subjects needing personalised attention. The challenge of providing individual support in classes with 45 to 50 or more students is highlighted, along with concerns about the impersonal nature of such large classes and the struggle to meet individual learning needs.

Some directors finally emphasised the importance of mentorship programs, professorial tutors, and direct communication for tailored guidance and support. They advocate for early, interest-based career guidance to prevent choices driven by financial pressure. Addressing student preparedness, they suggest initial assessments in subjects like Mathematics and Physics, followed by targeted foundational courses. Recognising the potential for early career decisions to be premature, some propose a flexible educational system that allows exploration before committing to a career path, ensuring choices align with true interests and skills:

> I think in other European countries, especially in Germany, there's already an effort to guide students during their high school years. This kind of guidance should exist, and often it shouldn't just be left to students to find their path. (Interviewee 7).

These approaches might collectively contribute to a more inclusive and supportive higher education environment, ultimately reducing dropout rates and enhancing student success.

4. Conclusion

This paper analysed course directors' perceptions on strategies and practices in higher education institutions to enhance student retention. Findings resonate with the literature's emphasis on comprehensive support systems, englobing academic, integration, and financial strategies. Key elements include personalised support, mentoring programs, and financial aid. Student-teacher relationships and academic support sessions are also emphasised. Educators' evolving role is highlighted, pointing to the need for pedagogical innovation, interactive teaching methods, technology integration and fostering a sense of belonging. These approaches align with the call for student-centred, engaging educational environments (Behr et al., 2020) and are crucial in enhancing student retention. The study highlights the complexity of dropout and the necessity of a holistic approach, integrating academic, financial, and socio-emotional support. The insights form a valuable basis for future research and policy-making, aiming to improve student success and resilience.

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The Third Mission in Chilean Universities: An analysis from the perspective of its academics

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Abstract

The study analyses the participation of Chilean university academics in Third Mission (TM) activities. It focuses on their perceptions of the significance of these efforts for institutional development, their professional careers, and their social impact. The analysis of data from the Academic Profession in the Knowledge Society (APIKS) survey reveals that the faculty is predominantly involved in social, cultural, and educational activities. This reflects a tradition of social and cultural engagement in Chilean and Latin American universities. However, there is less involvement in industrial and entrepreneurial activities, such as patents, licensing, and business creation. Academics acknowledge the significance of TM activities in their teaching and research, which may suggest the integration of TM with the core functions of the university. Additionally, potential areas for future research are proposed, such as incorporating TM activities in performance evaluations and investigating obstacles to collaboration with industry.

Keywords: *University; third mission; APIKS; Chile.*

1. Introduction

Historically, university systems around the world have gained both their internal and external legitimacy based on their apparent separation or detachment from social issues at local and national levels (Pinheiro et al. 2015a). However, in recent decades there has been increasing pressure to broaden their focus beyond teaching and research and to adopt an ambiguous Third Mission (TM) of "contributing to society" (Compagnucci and Spigarelli, 2020; Pinheiro et al. 2015b). In the European context, recent research points to a strong orientation of universities towards collaboration with industry and the productive sector to boost economic development (Compagnucci and Spigarelli, 2020). This university-industry synergy has been explored through various conceptual frameworks, including the "entrepreneurial university", the "triple helix model" (university-government-industry) and "mode 2 knowledge production" (Benneworth and Kitagawa, 2017). Within this framework, universities have adopted

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organisational strategies focused on increasing their competitiveness, following the logic of "value for money" (Jessop, 2017).

In the case of Latin America, the third mission is still strongly linked to the Córdova Movement of 1918, which advocated a greater involvement of universities in improving living conditions and overcoming social inequalities. Over time, this vision of university extension has gradually been transformed into the idea of linking with the environment, with new demands for quality assurance under the growing influence of the evaluating state (Labraña et al. 2023). In Chile, recent studies have focused on the interaction between universities and the environment, the dedication of academics' time to TM tasks and their evaluation in the context of the academic career (Adán et al. 2016; Bernasconi et al. 2021), and the forms of organisation and management of the third mission in Chilean universities (Labraña et al. 2023). These studies show that interaction with the environment is multidirectional and requires integrated coordination of different areas and activities. It has also been observed that academics devote around 10% of their working day to activities related to the TM. However, there is a heterogeneous evaluation and development of this area compared to teaching and research, and in practice it is considered less important, without clear criteria and with lower institutional evaluation. Furthermore, it is noted that management of TM has changed, adopting principles of New Public Management, such as centralisation of decisions, creation of new administrative units, and implementation of monitoring and assessment systems for academic TM activities.

However, there is still a paucity of studies that explore types of TM activities and faculties' perception of their relevance to the core tasks of teaching and research, as well as their contribution to the different local, regional, national and international levels. This article therefore has two main objectives: firstly, to identify the most developed TM activities in Chilean universities; and secondly, to understand academics' perceptions of the importance of these activities for institutional development, their professional careers, and their contribution to the environment. It is divided into four sections: a conceptual framework to examine the results of the study; the methodology used, including the data collection mechanisms and their sources; the presentation of the main results; and, finally, the conclusions drawn from the study.

2. Conceptual framework

The third mission (TM) of universities is seen as a broad and constantly evolving concept, influenced by interactions between universities, the state, industry and society at large. This view has been reinforced in recent debates, highlighting its complex and dynamic nature (Compagnucci and Spigarelli, 2020; Giuri et al. 2019). According to Nedeva (2007), TM is defined more by the relationships it establishes than by the specific functions it performs, and is seen as an institutional commitment of universities to interact and establish different types of relationships with non-academic sectors. This relational approach suggests that TM does not

simply add new functions to the core of the university, but reconfigures the essential functions of teaching and research to enhance interactions with industry and society, promoting the integration of these activities into the core functions of the university.

Montesinos et al. (2008) divide TM into social, entrepreneurial and innovative dimensions. The social dimension emphasises the importance of universities in providing services that strengthen institutional image and community relations, beyond income generation. The entrepreneurial dimension focuses on the creation of economic resources through innovation and collaboration with industry and other sectors, which is crucial for local and regional development in a globalised environment. The innovative dimension relates to how universities use their research and development to create products and services that not only advance knowledge but also have practical applications in society.

Historically, universities have responded to external demands through TM, keeping it separate from their core activities of teaching and research. This separation has been strategic in order to protect the core activities of the university from the potential negative effects of openness to external influences (Pinheiro et al. 2015b). Nedeva (2007) identifies three factors or 'rules of engagement' that determine the interaction of universities with their environment: the nature of the sector (community or industry), the level of institutional recognition in the environment (external legitimacy and market status), and the nature of the exchange (short/long term, public/private, etc.). He also distinguishes two ideal university models according to their relationship with the environment: the private for-profit university, characterised by a high academic reputation and close links with global industry; and the service-providing university, financially dependent on the state and focused on the local community in economic, social and cultural terms.

On the other hand, Laredo (2007) classifies TM functions into three basic categories: accessible and broad education, professional training and specialised research, and academic training and basic research. According to Laredo, universities develop their linkages with the environment through combinations of these functions, depending on their institutional strategy. He also classifies linkage activities according to two approaches: social (including public contracts, policy formulation, social and cultural participation, and scientific dissemination) and economic (human resources, intellectual property, spin-offs, industrial contracts).

From a different perspective, Jongbloed, Enders and Salerno (2008) argue that TM is less about relationships and more about the pursuit of mutual benefits through partnerships, implying that TM and community engagement are inseparable from traditional teaching and research activities. In summary, TM can be conceptualised as a function, a relationship or a partnership, and a gradual but steady movement towards the integration of TM-related activities into the core functions of universities, such as teaching and research, is recognised, highlighting its growing importance in the strategic development of universities (Ramirez, 2010).

3. Method

This study presents an analysis of empirical data obtained from the APIKS (Academic Profession in the Knowledge-Based Society) survey in the Chilean academic context. The collection was extended from the second semester of 2018 to the first semester of 2019, with an email invitation to more than 8,000 full-time academics (working at least 23 hours per week). Sixteen representative Chilean universities were selected, covering state institutions, private institutions that receive direct public funding, and private institutions that do not receive direct public funding. Of these, 11 agreed to participate. A total of 1,850 responses were received, of which 1,258 complete responses were used for analysis. According to Bernasconi et al. (2021), the results indicate differences in how Chilean academics divide their time between teaching and research. The main hypothesis is that different academic profiles may have different approaches to TM activities and their impact. In this study, respondents were grouped into three categories based on their commitment to research, teaching or a balance of both. Atypical responses due to excessive working hours were excluded, resulting in 1,121 valid surveys. Of these, 12% are more research-orientated, 21% are more teaching-orientated and 67% maintain a balance. The perceptions of these groups were analysed from three key perspectives. First, their involvement in TM activities with external partners (question E1). Second, their views on the importance of these activities for their research, teaching, reputation, academic career, and institutional mission (question E5). Third, their perceptions of the contribution of these activities to local, regional, national, and international industries and communities (question E6). Each aspect was assessed independently using descriptive statistical analysis.

4. Findings

The results show that Chilean academics participate more frequently in social TM activities and, to a lesser extent, in activities related to the industrial and business sector. When asked whether they had participated in activities with "external" partners in the last three years, only 7% of academics with a primary research focus participated in activities related to patenting and licensing. This 7% remains the same for academics with a balanced commitment and is reduced to 1% for those whose main commitment is teaching. Regarding activities related to the creation of spin-offs/start-ups, only 1% of research-oriented academics report having participated in these activities. This percentage rises to 4% for academics with a balanced commitment, while it remains at 1% for those mainly involved in teaching. Similar patterns are observed for activities related to testing and prototyping: 4% of research-focused academics, 6% of balanced-focused academics and 7% of teaching-focused academics admit to having participated in these activities. On the other hand, 77% of academics with a research focus say they have participated in voluntary or advisory activities in social, cultural or educational institutions. These percentages are 73% and 74% respectively for academics with a balanced and mainly teaching focus.

In addition, 58% of academics with a primary research focus have participated in external councils or committees, a figure that remains the same for academics with a balanced focus and rises to 72% for those with a primary teaching focus. Similarly, 38% of research-orientated academics report having taken part in conferences and public lectures, a proportion that rises to 45% for those with a balanced focus and 61% for those with a teaching focus. In general, these results are in line with previous studies, which indicate that, in line with Chilean university tradition, social and cultural activities are more important than relations with the productive sector (Labraña et al. 2023). On the other hand, most academics in the different groups agree that TM activities are very important for institutional development and individual academic work. In fact, 71% of academics with a preference for research say that TM is important or very important for their research, while 83% of academics with a preference for teaching say that it is important or very important for their teaching. In the group of academics with a balanced workload, 55% consider TM activities to be important or very important for their research. At the same time, 68% consider these TM activities important or very important for their teaching. Similarly, 73% of academics with a preference for research work recognise that engagement with the environment is important or very important for their academic reputation. This perception is shared by 74% of academics with a balanced commitment and 71% of those with a primary commitment to teaching. Similarly, 62% of academics with a primary commitment to research recognise that TM activities are important or very important for the advancement of their careers. This perception rises to 71% and 74% respectively for academics with a balanced commitment and those with a predominant commitment to teaching. This perception contrasts with the opinion of senior managers in Chilean universities, who consider that the development of TM activities has fewer academic incentives than work related to publications in high-impact journals (Labraña et al. 2023). Moreover, 82% of academics with a preference for research work consider that TM is important or very important for the mission of their university, a perception that rises to 90% in the case of academics with a balanced commitment and 88% in the group of academics with a preference for teaching.

In this regard, we suggest that the aforementioned perceptions are influenced by the recent changes in the regulation of higher education in Chile, whereby Law 21.091/2018. This law establishes that the link with the external environment is an integral part of the institutional mission and, in addition, constitutes a mandatory area to be examined as part of the university quality accreditation process.

On the other hand, most of the academics interviewed consider that their TM activities contribute more to their local or regional community than to the national or international level. Indeed, 71% of those with a predominant commitment to research, 74% with a balanced commitment and 74% with a predominant commitment to teaching consider that their TM activities contribute quite a lot or a lot to their local or regional community. In contrast, only 20% of academics with a predominant commitment to research consider that their TM activities

contribute quite a lot or a great deal to industry. This finding is in line with previous studies showing that the amount of TM activities between universities and industry is lower compared to the intensity of interaction between universities and government and non-profit organisations (Bernasconi et al. 2021). At the same time, 72% of research-orientated academics say that their TM activities contribute quite a lot or a lot to society/community at national level. This perception drops slightly to 68% for academics with a balanced commitment and to 66% for academics with a preference for teaching.

Finally, 32% of academics with a primary commitment to research consider that their TM activities contribute quite a lot or a great deal to society at international level, a perception that reaches 34% in the case of academics with a balanced commitment and 26% in the group of academics with a primary commitment to teaching. This low level of perceptions contrasts with the recognised efforts of universities to integrate internationalisation into their institutional missions and to contribute to the international community through research collaboration, student and academic mobility and the improvement of educational quality through the internationalisation of their programmes (Ramírez-Valdivia and Latorre, 2022).

5. Conclusions

This article examines the participation of academics from Chilean universities in TM activities. It focuses on their perceptions of the importance of these activities for institutional development, their own professional careers, and the contribution of these activities to the environment. The empirical findings contribute to the international academic debate on the development and implications of the TM of universities.

The results show that Chilean academics, regardless of their profile or commitment, are mainly involved in activities of a social, cultural and educational nature. This reflects a strong tendency towards social and cultural engagement, in line with the tradition of Chilean and Latin American universities. On the other hand, there is less participation in activities related to patenting, licensing and the creation of spin-offs or start-ups, which could indicate a weaker link with the industrial and business sector.

Similarly, academics consider TM activities relevant to the development of their teaching and research activities. At the same time, they recognise that these activities are important for their reputation and academic career. This finding suggests that TM activities are integrated with the core functions of Chilean universities related to teaching and research, in line with the current international trend (Pinheiro et al. 2015). However, results of previous studies (Adán et al. 2016) should be considered, which alert of the fact that these external activities carried out by academics are not necessarily evaluated in a standardised and systematic way, even though they are often taken into account for academic promotion purposes.

On the other hand, faculty perceive TM activities have a greater impact on local, regional, and national communities, and to a lesser extent at the international level. This pattern is consistent with the predominant type of universities in Chile, which, according to Laredo's (2007) classification, corresponds to a specialised university with a local focus. Research-intensive universities with a global orientation are a minority.

Finally, this study opens possibilities for future research that could explore how TM activities are included in the performance evaluation of university lecturers and their impact on the possibilities for promotion in the academic career. It would also be useful to investigate the reasons that limit the development of activities and stronger links with industry and the productive sector. These aspects are crucial for a better understanding of how Chilean universities can strengthen their role in society and the economy.

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The influence of rankings on business school students' perception and satisfaction. An exploratory study

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Abstract

Rankings of higher education institutions are used as important marketing tools. Given their competitive environment, business schools increasingly use their position in rankings to attract new students and staff and to communicate about their image and reputation. In parallel, literature has demonstrated the importance of student satisfaction in generating considerable financial and reputational benefits. With few empirical evidence analysing the relationship between the position in ranking and students' experiences, the aim of this paper is to explore the influence of business schools' rankings on students' perception of quality and their satisfaction. The analyses of focus group discussions shows that even if generally students do not pay important attention to the rankings, certain (good) position boosts their expectations towards business schools' product quality (education) and customer service (administration). As a result, they are more critical and less satisfied if they perceive a gap between the position in ranking and the quality of service received.

Keywords: *Student satisfaction, student experience, university rankings, perception of quality, customer expectation.*

1. Introduction

Rankings of higher education institutions (HEIs) are becoming increasingly important due to the growing tendency of public openness and external accountability (Tandilashvili et al., 2024; Luque-Martínez & Faraoni, 2020; Soo, 2013). Despite an important criticism from the academia on the relevance of the ranking methodology, the possibility to objectively judge the quality of education and the negative impacts of rankings higher education field (Tandilashvili et al., 2024; Morgeson & Nahrgang, 2008), rankings are widely accepted by the public and higher education actors (Ashiru, et al., 2022; Luque-Martínez & Faraoni, 2020; Tandilashvili & Tabatadze,

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2016). Ranking in the domestic top 20 and worldwide top 100 have become a source of competitive advantage in the fiercely competitive global market (Warwick, 2014).

Despite the importance of the topic, there is limited knowledge on student perceptions and expectations about the HEI position in the ranking and its impact on their satisfaction. Prior studies have shown that HEIs widely communicate about their top ranking on different channels and use it as an important tool to attract new customers. However, little research has studied the extent to which existing students are influenced by the rankings (Morgeson & Nahrgang, 2008). The few existing empirical studies have shown some contradictory results.

The aim of this paper is to explore the influence of business schools' rankings on students' perception of quality and their satisfaction. With the intention to have a richer understanding of the research topic and in view of generating a data collection tool for future quantitative research, we opted for a qualitative method using a focus group approach. The paper proposes a comparative case study of a French and a Georgian business school which have considerably improved their positions in national rankings. The results show that students do not pay much attention to the position in the ranking. However, once reminded of it, they appreciate a good position, but also express higher expectations in terms of service quality. The results vary per country and institutional context in terms of students' perceptions.

2. Literature Review

2.1. Student Satisfaction

Literature on student satisfaction is rich of examples of the financial and reputational benefits that Higher Education Institutions can generate with satisfied students. Satisfied students lead to higher financial advantages (Dollinger et al., 2018); they are more loyal to their institutions (Tandilashvili et al., 2023); have a more positive attitude and are more involved (Rehman et al., 2020), and recommend their institution to others (Khan & Hemsley-Brown, 2021).

The review of prior studies allows to group the determinants of student satisfaction into purely academic and non-academic elements. Academic aspects are teaching effectiveness, course structure and teaching methods, and the quality of faculty (Khan & Hemsley-Brown, 2021; El Alfy & Abukari, 2020; Sutherland et al., 2019; Tabatadze, 2018). Non-academic factors include services, the general environment, facilities, and the quality of the administrative staff (Tandilashvili, 2019; Herdlein & Zurner 2015; Abdullah, 2006; Mai, 2005; Schertzer & Schertzer, 2004). Additionally, some studies have identified the determinants of dissatisfaction which are the elements which can lead to dissatisfaction when they are taken for granted (Gruber et al. 2012; Tandilashvili, et al., 2023).

Student satisfaction varies per student profile and institutional type. Sociocultural variations among nations and individual student traits that may impact quality perception all contribute to the explanation of the situation. Most research uses demographic variables including age, gender, ethnicity, education level, and religion to explain variance in this area. Other factors are students' abilities and outcomes, motivation and involvement, social integration with other students, relationships with staff, study discipline and level (Herdlein & Zurner, 2015; Lazibat et al., 2014; Abdullah, 2006), the expense of study (Khan & Hemsley-Brown, 2021). Students of business and management seem to be particularly severe when it comes to perceiving the quality of service (Gnusowski & Schoefer, 2021; Ledden & Kalafatis, 2010). Studies have shown that business school students are becoming less satisfied with traditional education services and are demanding more individualized care and attention (Tandilashvili et al., 2023).

2.2. International rankings and student behaviour

National HEI rankings and league tables have existed for many decades and have been used by future students as a comparative tool to make an informed decision. However, the importance of the rankings increased since the 2000s with the introduction of the first international university rankings in 2003 by Shanghai university.

Despite important criticism, rankings and league tables are well established marketing tools in higher education (Gibbons et al., 2015; Davies, 2012). HEIs extensively use their good position in their external and internal communications (Tandilashvili et al., 2024; Hazelkorn, 2011) with the aim to attract new students and faculty and improve their image and reputation (Ashiru et al., 2022; Morgeson & Nahrgang, 2008). Rank is generally the most dynamic attribute, meaning that the rank of a HEI can rise and fall quicker than can the public perception of prestige and reputation (Hazelkorn, 2011). Dramatic changes in rank can lead to action, but gradual shifts may go unnoticed (Ashiru et al., 2022).

Studies have shown that business schools are particularly eager to take advantage of their positions in national and international rankings, given their increased competitive environment (Ashiru et al., 2022). The findings of prior studies reveal that many students consider the business school ranking as a stand-in for the calibre of instruction and overall, HEI experience, despite the ranking system's dubious procedures (Gibbons et al., 2015; Davies, 2012; Morgeson & Nahrgang, 2008). Students also perceive the position in ranking as a promise of future employment. When, companies utilize the applicant's institution as part of the selection process for yearly graduate recruitment schemes, students studying business and related disciplines gain from the social capital of their selected university (Morgeson & Nahrgang, 2008).

Even if most empirical evidence presents rankings as an important symbolic capital of business school to impact students' perception, some studies have conflicting conclusions. For example, for Ashiru et al. (2022) ranking is an important signifier of prestige and quality of the teaching

for the internationally mobile students. Broecke (2012) shows that from 2002 to 2009, UK-domiciled students responded to changes in university rankings. However, Soo (2013) reports that for the period of 2005–2009, the Sunday Times Universities ranking had no impact on student applications.

Interestingly, very few studies have explored the relationship between the HEIs' position in ranking and the perception satisfaction of existing students. The existing empirical evidence has some interesting conclusions. For example, according to Horstschräer (2012), in Germany the position of HEI in international rankings and national league tables were important determinant of satisfaction on some quality dimensions (such as mentoring, faculty infrastructure and the overall students' satisfaction) but not for others (such as research reputation), even if research is a central component of ranking methodologies. Ruigrok et al. (2017) found that rank and reputation were important issues for all student groups but the impact of ranking on students' perception of quality varied per their profile. Students whose parents had university education were more likely to know and consider rankings details and students who had been enrolled longer were less likely to know and consider rankings details.

With very little literature studying the impact of ranking on students' perception and satisfaction, the aim of the present paper is to explore how the rankings influence students' perception and satisfaction in business schools. Even if students' decisions are shaped by gender, nationality and other socio-demographic elements, when it comes to business school context, there seems to be a considerable global convergence in consumer behaviour (Davies et al., 2016). That is why this paper proposes an in-depth analysis of two different context cases. The choice of a comparative study may enable us to better explore this understudied topic.

3. Research Methodology

3.1. Research context

Given the exploratory nature of the study, we opted for a qualitative data analysis. We chose two different but comparable business schools in this study. First, we chose two countries - France and Georgia, with different higher education contexts but similar challenges. Both countries pay important attention to the position of HEIs in local and international rankings due to increased competition and lack of international visibility (Tabatadze, 2018; Harfi & Mathieu, 2006). Additionally, both countries struggle for international visibility at different scales (EU for France and the Caucasus region for Georgia): to attract international students and increase the international exchange rate of their academic staff. Second, we selected business schools with similar institutional characteristics (small, private business school) and similar position in national rankings (top-20). Third, as we wanted to observe the impact of the change in rankings, we selected the schools which have improved their position in national rankings during the last

5 years. We renamed the institutions as French Business School and Georgian Business School to keep them anonymous.

3.2. Data collection and Analysis

Data was collected through two focus groups in each institution during the academic year 2023-2024. In the French Business School (FBS) the groups consisted of 12 and 15 students. In the Georgian Business School (GBS) the groups consisted of 13 and 8 students. Focus group discussions have been used in education research to study similar questions (Ashiru et al., 2022; Pownall et al., 2019; Mazzarol & Soutar, 2002). It allows us to capture novel observations, not foreseen in quantitative data collection methods. To promote spontaneity and candidness, the participation to the group was optional, not graded and students were guaranteed their privacy. Moreover, the questions were asked in a way to promote honesty and free thinking. The focus group discussion was registered and transcribed.

This empirical data was examined with thematic analysis. Using naturalistic inquiry techniques (Lincoln & Guba, 1985), we converted the data into grounded theory. After reading the first material, we were able to create the first-order codes using the NVivo software (Strauss & Corbin, 1998). At the second step of data analyses, the first-order codes were grouped according to their significance. These second-order descriptive codes represent the themes which primarily address trends in the data which are pertinent to the potential influence of rankings on students' perception of quality and on their satisfaction. We determined the "essence" of each topic and the causal relationship between them (Braun & Clarke, 2006).

3.3. Main findigns

Analysing focus group discussions revealed interesting findings. First, we observed that **students do not pay attention to the rankings spontaneously**. Only two students initiated this topic during the four focus group discussions. One student in the French business school mentioned that he had considered the good position of the school when applying. However, once he mentioned the topic, other students also approved the importance of the ranking, some agreeing that they also had checked the school's position in rankings before applying to the school. However, students had different opinion on the outcome of the good position:

> *"Oh yes, it is true. I think that FBS is in the top 20 now. But I do not know if it matters. It does not change anything for us" (FBS, FG2).*
>
> *"It is good to have a diploma from this school as it will be better known" (FBS, FG2).*

Similarly as the French students, the question of the position in the ranking did not pop up spontaneously in the Georgian sample either. However, they often mentioned the topic indirectly when comparinrg ther school to other HEIs.. Students used the term "reputation" and "acknowledgment" to refer to rankings, considering the position in the rankings as logical expression of schools' reputation and public acknowledgment.

Second, **ranking could be an important predictor of students' perception** even if there is an important difference between the two samples. For the French students, a good position in the ranking is a guarantee of a good service quality while studying and an assurance of a job placement after graduation. For the Georgian sample good position in the ranking is the predictor of the quality of education.

> *"Honestly, I have not thought of it, but I think that rankings should take into account also how students are treated at school you know" (FBS, FG1).*
>
> *"When you are going to study to the well ranked school, you know that you will have the best professors and will receive a good education" (GBS, FG1).*

Third, **students' expectations seem to be largely influenced by business school's position in rankings.** As mentioned above, French students expect better customer service from their school. Some students directly express a relation between the position in the ranking and the expectation.

> *"Frankly, it is not what I expected. You know, sometimes my issue can be very specific, and I cannot find the answer on Moodle. You would think to have better service at the top-20 school" (FBS, FG1).*

As for the Georgian students, they expect 'good education', the 'best lecturer', 'exposure to the business world' from a well-ranked business school. They also expect foreign exchange opportunities and good job placement.

Fourth, we found that **not all students were aware of the existence of national rankings**. An important number of Georgian students did not know that there were some forms of national rankings in the country. For them, it was the accreditation of schools which mattered. Once explained what rankings represent, these students were a bit skeptical in terms of the ranking methodology. They argued that it is the reputation of HEI and the quality of education which matters and not the rankings. In the French sample, if all students were aware of the existence of rankings, most of them did not know the FBS's position despite an important communication from the FBS about the improved position from the top 30 to the top 20. This was surprising to discover, given the number of posts on social media preceding the discussion. Appeared not all students follow the institution on social media and not necessarily read the general communication emails (easily recognised with the email title).

The fifth findings of this study concern the **mixed results in terms of student satisfaction.** The difference is observed across cases, but also between the students of the same focus groups. GBS students were more satisfied with their institution and showed more pride to be part of it. They mostly initiated positive discourse towards the institution in contrast with the French sample where students originated both positive and negative attitudes. Georgian students did not criticise spontaneously nearly any service dimension. Only when asked detailed and comparative questions, they expressed some discontent. In contrast, the French students mostly initiated criticisms towards the service quality and when asked more general questions, also expressed some positive opinions.

4. Conlcusion

This research had the objective to explore the potential influence of position in ranking on the experience and satisfaction of business schools' existing students. Prior studies have widely explored the relationship between the ranking position and student's choice, arguing that good position in national and international rankings, attracts students, especially foreign students (Tandilashvili et al., 2024; Ashiru et al., 2022; Gibbons et al., 2015; Davies, 2012). However, there are very few studies on the impact of the rankings on the perception of existing students. Whereas, this topic is crucial, given the benefits of satisfied students for HEIs, in terms of their reputation, student loyalty, word-of-mouth effect (Tandilashvili et al., 2023; Khan & Hemsley-Brown, 2021; Rehman et al., 2020; Dollinger et al., 2018).

We found that even if students do not pay attention to rankings and most of them are not even aware of them, rankings still influence their experiences, perception of quality and satisfaction. Business school students' attitude to their institutions is similar to customers' attitude towards any service provider. Students believe that high-ranked institutions are expected to have better quality products and better customer service. Thus, they have higher expectations towards their business schools and thus, are more critical in terms of their perception of quality. Students take most of school services for granted and are not easily impressed.

Our findings contribute to the literature on student satisfaction by proposing that the HEIs' position in rankings impacts students' expectations and the relationship between the perception of quality and satisfaction. If students perceive a gap between the position in ranking and the quality of service received, they tend to be more critical in terms of satisfaction. Despite interesting and novel findings, this study has a clear limitation in terms of generalisation of its findings. The choice of a qualitative research method with a focus group approach enabled to detect unforeseen topics, but future quantitative studies are needed to examine further the findings of this research.

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Information Accessibility and Decision-Making in Career Selection: An Examination of Influential Sources for University Students

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Abstract

The aim of the present study is to analyze the relationship between information accessibility and career decision making among first-year university students from a Central Eastern European university (n=2,330). Hierarchical cluster analysis was conducted based on motivational factors and four distinct student groups were identified: 'Independent Decision Makers' (IDM, 15.4%), 'Amenity-Oriented Selectors' (AOS, 41.2%), 'Location-Centric Choosers' (LCC, 16.6%), and 'Academic Excellence Seekers' (AES, 26.8%). While IDMs made decisions independent of institutional attributes, AOS prioritized university services, LCC were influenced by the city, and AES emphasized academic course quality. The most relevant sources of information are the official website of the National Office of Admissions, university websites, peer opinions, and institutional information. These findings provide important insights for universities and their targeted enrollment campaigns to understand the different decision-making preferences of students.

Keywords: *Career Decision Making, Information Accessibility, Student Motivations, Higher Education Marketing*

1. Introduction

Higher education institutions are recognizing the need to adopt a marketing orientation in order to compete for student engagement and increase enrollment (Davis & Farrel, 2016). The shift is being driven by the intense competition among higher educational institutions, and changing student behavior patterns (Mogaji et al., 2020). Information technologies are enhancing higher education marketing strategies by leveraging digital techniques for broader audience engagement (Tripathi, 2013). There is great potential in online platforms that offer universities the opportunity to engage and influence digitally native generations (Zervina & Stukalina,

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2019). Current trends in higher education marketing include a shift to a market-oriented approach, the use of technological innovations, and the need for a better understanding of marketing principles (Babb & Giga, 2014). Ziyadin & Serikbek (2020) emphasized the importance of promoting higher education programs to increase their competitiveness.

The basic research question was which groups or clusters of students can be distinguished on the basis of institutional choice and what are their sources of information. After the literature review, the paper presents the methodology of the empirical research, followed by the research results and concludes with the conclusions.

2. Theoretical background

The literature review provides a brief overview of student motivations, with a particular focus on aspects of institutional choice, student clustering, and sources of information.

2.1. University selection aspects

When choosing a university, students consider factors such as reputation, academic quality, location, proximity, and financial considerations (Winkler, 2014). Additional studies (Ariffin et al., 2014, Azzone and Soncin, 2020, Srivastava & Dhamija, 2022) reveal the multifaceted nature of college selection decisions, highlighting aspects such as campus characteristics, job opportunities, and financial viability. Geographic proximity, university reputation, and course reputation are consistently valued (Winkler, 2014; Walsh & Cullinan, 2017; Srivastava & Dhamija, 2022). Notably, the socioeconomic status of students influences the importance placed on hometown proximity. In addition, the influence of peers and family, as well as structural factors such as location, public image, and academic quality, significantly influence student choice (Walsh & Cullinan, 2017; Dhaliwal et al., 2019). Financial considerations, including tuition and economic benefits, also shape decision making (Srivastava & Dhamija, 2022; Dhaliwal et al., 2019).

2.2. Clusters of students

Clustering students based on psychographic (motivational) and demographic variables has become a hot topic today as recruitment and retention are increasingly important issues for higher education institutions (Nonis et al., 2021). Goodrich et al. (2020) highlighted the importance of segmenting students based on psychographic variables such as attitudes, lifestyles, values, and interests. Banász et al. (2023) found that university rankings can be used to create clusters of universities based on similar characteristics and indicators. Goodrich et al. (2020) used K-means clustering to identify six segments in the U.S. market and defined tailored messages for them. Among students, they identified the following clusters: 1) motivated post-

traditionals, 2) focused scholars, 3) unsupported trailblazers, 4) dependent wonderers, 5) privileged experientials, and 6) prestigious collegians (Goodrich et al., 2020:442).

2.3. Information sources of students

Goodrich et al. (2020) provided practical implications for higher education media planning to achieve effective communication goals. They analyzed 14 media channels and categorized these channels as university-driven traditional (campus visits, TV ads, radio, billboards, direct marketing) and online (online ads, social media, university websites) and non-university-driven traditional media channels (family, friends, high school counselors, high school teachers, news) and online outlets (online reviews, third-party reviews). The researchers found that students across all the six segments use campus visits more often than any other university-driven traditional media. Considering personal sources like friends and family more often than any other traditional word of mouth sources.The role of parents (Areces et al., 2016) and peers (Pinna et al., 2018) were highlighted in oder studies, too.

3. Methodology

This empirical study surveys first-year students at universities in Central Eastern Europe using a registration questionnaire distributed at the time of admission. The anonymous survey is administered through the university's website and assesses students' motivations, information sources, and demographics. Questions cover factors that influence the choice of institution, sources of information and information about faculty applications, education level and funding. The survey began on July 27, 2023 and was completed by 2,330 students on September 7, 2023.

The questionnaire consisted of three sections: motivations, sources of program information, and sociodemographic characteristics. Participants reported their motivations by expressing their level of agreement on a 5-point Likert scale with the endpoints 1: not all influenced, 5: totally influences. Based on the literature review 19 motivators were analyzed reputation of the institution, university-industry link, available scholarships, tuition fees, practical training, free language learning opportunities, friends, results from previous years, chances of admission based on previous year’s scores, opinions of family members, opinions of friends, distance from home, low college fees, better chance of getting into college, information from the media, education should be possible while working, diversity of student life, sports facilities, city, job opportunities. The following online and traditional sources of information were measured on a six-point Likert scale with endpoints 0: never, and 5: absolutely agree: official website of the National Office of Admissions (NOA), university websites, national and institutional information publications, opinions of friends, peers, family and information in newspapers. Sociodemographic characteristics included gender, age (in years), residence (Hungary,vs. abroad), and place of residence (village, town, county center, capital).

The university offers a wide range of study programs and the respondents came from different fields of study: engineering (47.1%), social sciences (15.7%), economics (13.9%), law (9.6%), health and physical education (7.8%), agriculture (4.0%) and arts (1.8%). 48.7% of the students are female and 51.3% are male, the majority belong to Generation Z and live in Hungary, mainly in towns and villages. The demographic composition of the sample is shown in Table 1.

Table 1. The demographic composition of the sampe. Source: Own research, n=2330 students.

Gender	**Female**	**Male**		
	48.7%	51.3%		
Generation	**Gen X (44-58)**	**Gen Y (29-43)**	**Gen Z (18-28)**	
	6.4%	14.1%	79.5%	
Residence	**Hungary**	**Abroad**		
	97.5%	2.5%		
Residence type	**Capital**	**County center**	**Town**	**Village**
	7.0%	28.1%	30.3%	34.6%
Form of financing	**Public-financed**	**Self-financed**		
	84.2%	16.8%		
Level of training	**higher-level vocational training**	**Univocational training**	**BA**	**MA**
	6.1%	5.6%	77.4%	10.9%

Data analysis was performed using SPSS 26.0 software. Multivariate statistical analysis was used to answer the research questions. Previously, factor analysis was conducted and four factors were distinguished from the 15 motivators (based on the factor scores) explaining 64.2% of the total variance: education and reputation (22.68%); dormitory and services (15.83%); opinion of others (14.19%) and finally the city (11.50%). The importance of proximity, reputation and educational quality, and peer and family influence have been emphasized by previous researches. This study identified dormitory and services as a new factor. This empirical The study used Ward's hierarchical cluster analysis, specifically agglomerative clustering with Euclidean squared distance, to address the primary research question. Four clustering solutions were considered and treated as nominal variables. F-statistics were used to analyze the relationship between cluster membership and information sources.

4. Results and discussion

4.1. Categorization of students on the basis of motivational factors

Based on the results of Elbow criterion and Agglomeration schedule the four cluster solution was selected. Count and frequency in case of each cluster was the following: 1st cluster 359 people (15.4%), 2nd cluster 961 people (41.2%), the 3rd cluster 386people (16.6%) and the 4th cluster 624 students (26.8%). In order to make a typology of the different clusters, it was necessary to analyze the means. The method of one-way ANOVA was used to check the category means of the motivational factors (education and reputation, dormitory and services, opinion of others and city) in case of each cluster and significant differences (IDM: 581.47, p: 0.00, η^2:0.43; AOS: 2453.05, p: 0.00, η^2: 0.76; LCC: 8.67 p: 0.00, η^2: 0.011; AES: 465.19, p: 0.00, η^2: 0.37). There were significant differences between groups for all variables. To test the homogeneity of variables post-hoc tests (Dunnett T3 and LSD) were performed. according to the results there were statistically significant differences between variables (Table 2).

Table 2. Results of cluster analysis. Source: Own research, n=2330 students.

Clusters	Education and reputation	Dormitory and services	Opinion of others	The city
IDM	-0.7751534	-0.6356900	-0.0366592	-1.2630638
AOS	0.1679341	**1.0332016**	0.1225809	-0.0156210
LCC	-0.9738776	-0.5793173	-0.1088513	**0.8285886**
AES	**0.7897631**	-0.8671114	-0.1003574	0.2381674

Based on the final results, four groups of students could be distinguished: '*Independent Decision Makers'* (IDM), '*Amenity-Oriented Selectors*' (AOS), '*Location-Centric Choosers*' (LCC) and '*Academic Excellence Seekers*' (AES). While Goodrich et al. (2020) focused on psychographic segmentation, Banász et al. examined university rankings and their impact on student clusters. IDMs were not influenced by the quality of the courses offered by the university, the reputation of the institution or the services it provides (the dormitory), or the city of Győr itself during the admission process. On the contrary, the other three clusters were created in which there were main drivers each. AOS were most influenced by the services offered by the university when choosing the institution. Among the services, sports, housing and entertainment facilities were the most important. LCC were clearly attracted by the city and the geographical location was the main influence to the exclusion of all other options. AES made their decision to continue their studies based on the quality of the courses offered by the university. Findings enhance our understanding of student behavior and inform educational strategies. The researchers

systematically classified each cohort of students based on demographic parameters, the details of which are not presented in this report due to space limitations.

4.2. Information sources

Finally, the students' preferred information sources were analyzed using F-statistics. Although there were statistically significant differences between student clusters, the effect size (η^2) was relatively modest. IDMs primarily used the official NOA website (3.92) and the college website (3.68), traditional peers (2.86), and family opinion (1.79), but print advertisements (0.89) were not important to them at all. For all groups of students, the main source of information was online, especially the official NOA website (4.20), followed by the institutional website (4.11) and the interpersonal network (3.55). Traditional sources of information, such as print advertisements (1.59), were less relevant to students, as shown in Figure 1. Previous research (Goodrich et al., 2020) and our findings highlight the increasing importance of online channels and personal sources in higher education marketing, while traditional media channels are becoming less relevant.

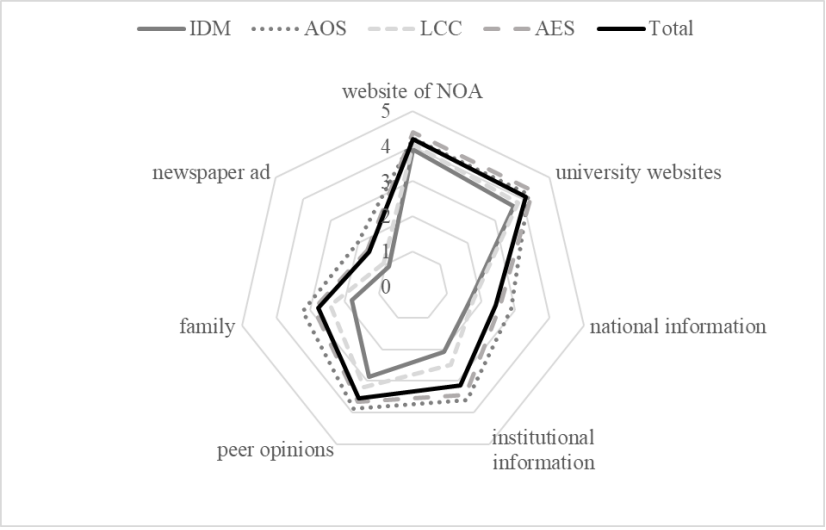


Figure 1. Importance of different information sources. Source: Own research, n=2330 students

5. Conclusion

The results of the research are useful for a variety of stakeholders in higher education, such as institutions (universities), policy makers, students, education and marketing professionals. Institutions can tailor their marketing and communication strategies and develop more effective campaigns tailored to the specific needs and preferences of different student segments, especially for AOS, LCC and AES. Owned online media tools (university-driven and non-

university-driven websites) are more effective than traditional information sources. In the creative concept of the university, it is worth highlighting the factors that students use to make their choices (AOS: '*Enjoy the facilities of the uni*', LCC: '*Feel the city*', AES: '*Reputation, Success, Quality Education*'). Those involved in career counseling use the findings to provide more targeted and effective guidance to students, taking into account the diverse motivations and decision-making factors revealed in the study. Scholars in the fields of education, marketing, and career development can use the study as a basis for further research and contribute to a deeper understanding in the student decision-making process.

As a limitation of the research, we would like to highlight the measurement instrument used in the research, since the online questionnaire was a version developed by the university that has been used for years. Therefore, it would be worthwhile to include both online and traditional university and non-university sources of information, especially events, exhibitions, fairs, and social media for enrollment purposes. To extend the research in the future, the researchers plan to analyze longitudinal data from previous studies and conduct qualitative focus group interviews with students from different faculties. These interviews will provide insights into information sources and brainstorm creative content that appeals to young people.

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Computational Chemistry in Graduation Courses of Chemistry

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Abstract

The experience of the authors on the use of computers on teaching at the various levels of the graduation, in Chemistry and Medicinal Chemistry, ranging from General Chemistry to Drug Design, passing through Computational Chemistry and other courses is presented. The capabilities of computers for revealing the microscopic, unseen, and hidden patterns at all levels of the graduation, and to show how computers are used in research on molecules, materials, and drugs, at higher levels of the graduation, are emphasized. The approach is based on simple ideas and concepts, practical laboratory work, motivational narratives, and clear feedback. New forms of clarifying complex ideas, sometimes presented in a "muddy" way, in particular for Computational Chemistry and Drug Design, are procured.

Keywords: *General Chemistry; Computational Drug Design; Computers in Chemistry.*

1. Introduction

Computational Chemistry is an important part of chemistry research, but usually is judged too difficult to be presented at the graduation level and postponed to master degree or PhD programs. The development of modern computers has retarded the full use of the equations of classical and quantum mechanics that are difficult and tedious to solve even for simple systems. These ideas are very old, and are not fully overcome nowadays. For example, Charles Coulson wrote in 1952: "*In the last twenty-five years the theory of valence has made enormous progress. To a large extent this has been due to the advent of wave mechanics. The result is that a situation has now been reached in which the education of a chemist is not complete unless he knows at least the main lines along which such progress has been achieved. This does not mean that every chemical student should be able to make his own theoretical calculations – this would be ridiculous, and will probably never happen (...)"* (Coulson, 1952). Nowadays, a student can push a button and in a fraction of second obtain results that could take years to achieve, which were impossible to obtain in the 1950's. Our mobile phones have processing capabilities that largely overcome the more powerful and faster computers that lead man to the moon. Since a long time ago it has been proposed to include Computational Chemistry in graduation courses

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(Gasyna & Rice, 1999; Hessley, 2004; Ramos & Fernandes, 2005), as well as many activities are being presented (e.g, Bendavid, 2023; Metz et al., 2021; Miorelli et al., 2017; Nassabeh et al., 2014), but the actual fully integrated courses are still somehow scarce (see, e.g., Grushow, 2019; Paselk & Zoellner, 2002, for other examples). In addition, computers are nowadays ubiquitous so it appears that specific courses are not needed anymore. Nevertheless, our opinion is that all students in Chemical graduations must be exposed to computers as working devices, but specific courses on Computational Chemistry, Computer Modeling, and Computer Design of Drugs are useful even for graduations in Chemistry and Medicinal Chemistry.

In our University, one has a successful semester graduation course on Computational Chemistry, and one has various classes related to computers use in Chemistry, namely General Informatics and Drug Design, where the ideas of doing without knowing many of the technical details are subjacent. In fact, one must note that this is the standard in research. It is not possible to build the equipment used in research from scratch, from glassware to spectroscopes, but one can have clear ideas how it works. A similar situation happens with Computational Chemistry: The researchers and students do not need to build from scratch a computer or a software suite. Like the former, they can have clear ideas about the equations, possibilities, and limitations, among other physical-chemical applications.

Students should be exposed early in introductory courses to computers and mobile phones as powerful working objects and not only as ludic ones. But for this goal, one needs to use new and simplified methodologies centered on conceptual ideas and hands-on approaches. This is not only needed but also it is the proper way, as it is not needed anymore to go through hard equations, make difficult implementations in computer languages and carry out tedious calculations. The computers can help in deducing, simplifying, programming, and also taking decisions, while carrying out repetitive calculations. The emphasis must be not on the following tedious calculations, deductions, and simplifications, but on simple and clear ideas about how the things work and how to put computers producing results. Nevertheless, one must not oversimplify, not hide fundamental details, nor put students in the position of mere uncritical users. One must introduce to them the principles, the capabilities and limitations, and also furnish them the tools for development and improving the existing objects.

In this paper, one uses our previous experience on the classes referred to above to propose new ways and views aiming to obtain a correct balance on the discussed hands-on methodologies.

2. Development

A minimum background on the way digital machines work and on their limitations and capabilities are needed. Also, an introduction to a programming language, that can be Phyton, can help in understanding computational thought, algorithmic strategies, and it is very useful in newer environmental programming tools. In Chemistry graduations, computer architecture and

software development must be referred to briefly for showing how digital machines work and therefore revealing their limitations and capabilities, but not as a view on its own.

Computers have many applications in Chemistry (see, e.g, Rodrigues & Caridade, 2022). In what concerns classical and quantum mechanics, our experience shows that the students have extreme difficulty in obtaining clear and general ideas and even the best students can be lost in various mixed ideas. We also verified that students and researchers can manage very complex objects without knowing the simple ideas behind them.

We touch all the aspects of the use of computers in Chemistry (see Figure 1) and our approach starts with simple ideas, (hopefully) clear ones, dichotomies, motivational narratives on the importance and aesthetics of the matters, and a strong component on experiments and on discussing results. In the classes where practical experimentation is lower, the emphasis is on the former and we try other strategies as “flipped classrooms”. Feedback is always done and dialogue with students is procured. The results (measured as approval rates and anonymous inquiries) are very good. Some examples, and our views will appear next.

2.1 Unveiling the Patterns: Periodic Properties in General Chemistry

The periodic table, with its neatly arranged elements is, as well known, a cornerstone of Chemistry. But beyond its rows and columns lie hidden patterns, the "periodic properties" of atoms, dictating their behavior and shaping the world around us. Periodic properties like atomic radii, ionization energy, and electronegativity reflect the organization of electrons around the nucleus. These trends reveal a captivating story about electron filling across periods, driven by fundamental quantum mechanical principles. By understanding these patterns, students can predict physical and chemical properties, explain trends in reactivity, and visualize the invisible forces shaping molecules. But the journey beyond rote memorization requires active engagement, as it is well known. This is where Computational Chemistry steps in, transforming the classrooms into computational laboratories. One can use software to visualize electron clouds, calculate ionization energies, or simulate reactions.

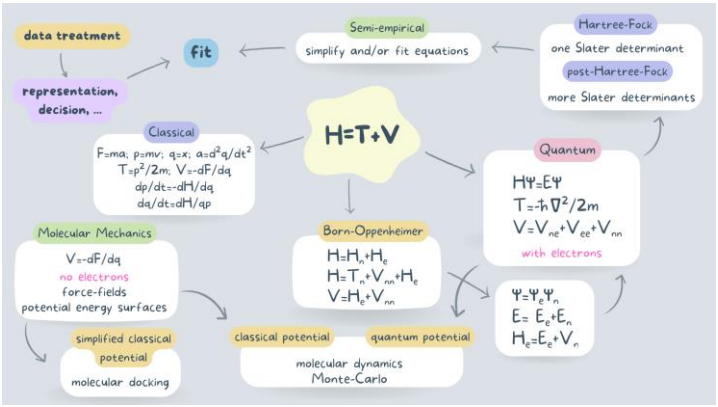


Figure 1. A general view of the computational methods in chemistry

This is done with online software tools such as WebMO (2024). The benefits are multifaceted. Visualization tools bring abstract concepts to life, improving spatial reasoning and conceptual understanding. Interactive simulations allow students to explore "what-if" scenarios, testing their predictions and deepening their grasp of cause-and-effect relationships.

2.2. Bridging the Invisible: Demystifying Chemical Bond

The world around us, from the vibrant colors of nature to the life-sustaining reactions within our bodies, exists due to the invisible dance of atoms held together by chemical bonds. Understanding these bonds is fundamental to grasping both the microscopic intricacies and macroscopic wonders of chemistry. However, traditional methods often paint an incomplete picture, leaving students yearning for a deeper glimpse into the hidden forces at play. This is where the magic of computational chemistry unfolds, offering an invaluable tool to illuminate the world of chemical bonds in undergraduate classrooms.

At its core, a chemical bond is a lowering of potential energy achieved when atoms share or exchange electrons. Computational tools transcend limitations of simple models, allowing students to visualize electron clouds, delve into molecular orbitals, and even simulate bond formation in real-time. Imagine watching electrons shift, feeling the tug of attraction and repulsion, and witnessing the birth of a molecule – a powerful experience that transforms theoretical concepts into tangible realities. Tools such as WebMO (2024.) are used in conjunction with other free ones such as ORCA (Neese et al., 2020), GAMESS (Schmidt et al., 1993), and wxMacmolPLT (Bode & Gordon, 1998).

2.3. Unveiling the Hidden: Infrared Spectroscopy and Computational Chemistry

Everything vibrates with unseen energy, and hidden within these vibrations lies a wealth of information about the molecules that make up our universe. Even at 0K, molecules vibrate. Infrared (IR) spectroscopy, the ability to analyze these vibrations, empowers us to unveil the identities and functionalities of molecules. However, interpreting the complex "fingerprint" of an IR spectrum can be daunting. This is where computational chemistry steps in, offering a powerful tool to enhance the understanding and application of IR spectroscopy.

Each molecule vibrates in unique ways, resulting in a distinct pattern of absorption frequencies in the IR spectrum. This "fingerprint" serves as a signature, allowing us to identify and analyze unknown molecules. However, interpreting the complex interplay of various functional groups and their corresponding peaks within the spectrum can be challenging for students. This is where Computational Chemistry comes to the rescue. By simulating the vibrations of molecules using sophisticated software, it empowers students to visualize and understand the origin of each peak in the IR spectrum. Imagine visualizing the atoms dancing, picturing the stretching and bending of bonds, and directly correlating these movements to the corresponding energy levels observed in the spectrum. This interactive approach transforms the abstract concept of vibrational modes into a tangible and engaging experience.

Again, online software tools such as WebMO (2024) is used with other free software as ORCA, (Neese et al, 2020), GAMESS (Schmidt et al., 1993), and wxMacmolPLT (Bode & Gordon, 1998).

2.4. Computers as tools of research: Computational Chemistry and Drug Design

As stated in the introduction, Computational Chemistry is an important part of chemistry research. More than that, fundamental. Nowadays, chemists and medicinal chemists rarely go to the laboratory to develop new molecules, materials, or drugs without some previous calculations and visualizations. Moreover, also previous browsing of the literature using different methods and databases, but also with computers. In what concerns Medicinal Chemistry various methods of Computational Drug Design are available centered on the ligand or on the target, ranging from virtual screening of candidates to new drugs to guide this research of artificial intelligence (AI), ranging from various forms of molecular modeling and fitting tools. Both Computational Chemistry and Computational Drug Design are full of methods mixed with a thorough jargon and difficult equations.

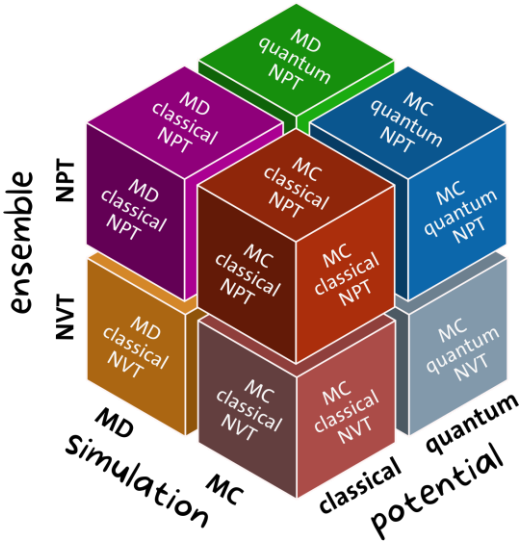


Figure 2. Methods of simulation, ensembles, and forms of obtaining the potential.

As an example of our approach, one presents a new way of making a first introduction of some complex ideas to Drug Design students (see Figure 2): (1) Classical *versus* Quantum; (2) Molecular Dynamics (MD) *versus* Monte Carlo (MC); and (3) *ensemble* NVT *versus ensemble* NPT. They have difficulty in seeing clear differences from methods of simulation and forms of obtaining the potential because they usually are exposed to very complex information about the methods, about solving Schrodinger equation, and force fields without being exposed to the simpler ideas and concepts behind them.

3. python4chemistry: Tools for Chemistry Students

In recognition of the growing importance of interdisciplinary approaches in science education, a new distance learning course titled "python4chemistry" has been developed. The course focuses on more elaborate tools, aiming to provide a simple approach to complex subjects providing foundational skills of Python programming and its application to chemical projects. It delves into core libraries enabling students to manipulate, analyze, and visualize chemical data effectively. A relevant point is the capability of creating craft informative visualizations like bar charts, heatmaps, and 3D plots, effectively communicating complex relationships and trends within their data.

Furthermore, the course explores Cheminformatics to leverage the power of computers in chemical research. Participants will gain the ability to represent molecules *in silico* (computationally), calculate molecular properties, and perform similarity searches for identifying compounds with desired characteristics.

Finally, the course introduces the exciting field of Machine Learning in the context of chemistry. Participants will be exposed to fundamental concepts of machine learning algorithms and their potential applications in chemical research tasks such as predicting reaction outcomes, property prediction, and materials design. Through hands-on exercises, researchers will gain a foundational understanding of these powerful tools and their potential to revolutionize chemical discovery and education.

Being prepared as a facultative course and fully at distance, it offers flexibility and accessibility for students with busy schedules or geographical limitations. It requires a strong commitment by the students and a high degree of self-discipline and time management skills to navigate coursework and complete assignments independently. Despite these challenges, the course encompasses engaging activities, clear learning objectives, and effective communication strategies leading to major benefits of online tools and molecular simulations to create a positive learning experience for students in undergraduate chemistry.

4. Conclusions

In this paper, we presented our experience on using computers on teaching at the various levels of the graduation, in Chemistry and Medicinal Chemistry, ranging from General Chemistry to Drug Design, passing through Computational Chemistry and other courses. We emphasized in this work the capabilities of computers for revealing the microscopic, unseen, and hidden patterns at lower levels at all levels of the graduation, and to show how computers are used in research on molecules, materials, and drugs at higher levels of the graduation. Our approach is based on simple ideas and concepts, practical laboratory work, motivational narratives, and clear feedback. New forms of clarifying complex ideas, sometimes presented in a “muddy” way, in particular for Computational Chemistry and Computational Drug Design, are envisaged. Some examples of concrete applications are presented.

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Using gamification to promote financial literacy and consumer education among future generations

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Abstract

This paper presents the development and implementation of a gamification initiative aimed at promoting financial literacy and consumer education among basic and secondary school students. Designed to engage students aged between 12 and 18 years old, the game addresses key financial and consumption concepts through interactive gameplay. Originally conceived for students visiting the university, the initiative has garnered interest from both educators and parents, highlighting the growing demand for financial education. In the future, efforts will focus on refining game mechanics, improving material quality, and empowering high school teachers to independently facilitate the game in their classrooms. This inclusive approach aims to equip future generations with essential financial skills to navigate personal finance confidently. This paper also aims to share this experience with other educators interested in the topic, providing insights and guidance for replicating similar initiatives in their contexts.

Keywords: *Financial literacy; consumer education; gamification; financial games; game-based learning.*

1. Introduction

The themes of financial literacy and consumer education are currently at the forefront of societal discussions due to their relevance. Recognizing the impact of financial decisions on individuals and their surroundings there is an increasing emphasis on instilling the notion that informed choices are crucial.

Some authors (e.g. Remnova & Shtyrkhun, 2020, p. 70) suggest that "individuals retain nearly 80 per cent of information through visual perception and practical application, 20 per cent through reading, and merely 10 per cent through listening alone". As prime examples of active learning methods (Kalmi & Sihvonen, 2021), one of the ways to promote more effective learning is through gamification. These methods involve learning new material through gaming

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actions and applying acquired knowledge to real-world situations, with some relevant studies giving special emphasis on the effectiveness of gamification in promoting financial literacy (Ahmed, 2023; Bayuk & Altobello, 2019; Hidajat et al., 2022; Kalmi & Sihvonen, 2021).

This paper explores and presents an initiative of gamification promoted at a Portuguese University. Leveraging the National Plan for Financial Education: 2021-2025, (2022) and drawing upon the expertise in accounting, finance, and marketing, the goal of this game is to contribute to enhanced financial awareness and responsible consumption among the future generation of decision-makers. This initiative, called "*ISCA Family Game*", was first implemented during the university's summer academy. Motivated by the need to share these concepts and themes with young individuals, and potential future university candidates, the development of the activity began, aiming to enable them to acquire knowledge through a playful endeavor. The result was a game that aimed to alert young participants to the importance of making intelligent choices in managing finances.

Lifted by the positive reaction and efficacy of the initial experience, the authors, have embarked on an endeavour to expand upon the materials and devise a structured game encompassing fundamental financial literacy concepts and a focus on fostering responsible consumption. This article presents the experience, offering it as an example for other educators or schools interested in implementing similar activities.

2. Development and Operationalization of the Game

This section describes the entire process that led to the implementation of the activity, especially targeted towards youth aged between 12 and 18 years old.

2.1. Conceptualization

The initial phase involved brainstorming sessions to outline the game's name, objectives, mechanics, and educational components. The core financial literacy concepts to be covered were identified and the gameplay elements were designed to reinforce these concepts engagingly and interactively. It was also decided that the name would be ISCA Family Game, ISCA because it's the acronym of the department, and 'Family Game' because we wanted the name to reflect the idea that participants would work on the budget of a family, allowing them to feel related with a real-life situation. With the game's framework established, we proceeded to develop the content, including scenario descriptions, personas representing diverse family dynamics, and financial scenarios. Each element was meticulously crafted to align with the National Plan for Financial Education objectives and ensure relevance to participants.

The game's structure and mechanics were carefully designed to facilitate learning while maintaining an enjoyable experience. We incorporated elements of competition, collaboration,

and decision-making to keep participants engaged throughout the game. Additionally, we ensured that the game progression mirrored real-world financial challenges, providing participants with relatable family examples.

A crucial step involved testing the game successively to evaluate its effectiveness and identify areas for improvement. As we had the first groups participating, feedback was collected and used to refine the game mechanics, clarify instructions, and enhance the overall game experience.

2.2. Implementation

Phase 1. The activity begins with an exploratory quiz (using Kahoot), consolidating essential concepts such as income, fixed and variable expenses, credit, savings, and financial planning. As the participants respond, a teacher—specialist in the field of finance—explains the concepts and addresses any doubts that arise.

Phase 2. Participants, organized into teams, assume the roles of personas (Figure 1) representing diverse family scenarios. These personas encompass various demographics, economic statuses, cultural backgrounds, health conditions, and lifestyle preferences.

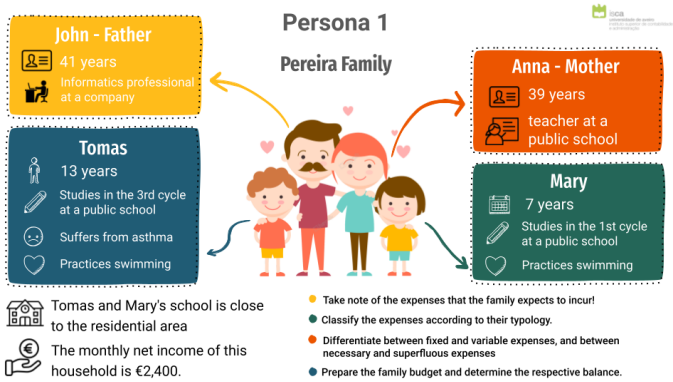


Figure 1. Example of a game's persona.

Then each team is assigned a monthly income and specific expenses, ranging from loan payments and insurance to education, health, transportation, personal, and other relevant categories. Expenses must be classified by type, characterized as fixed or variable, necessary or discretionary, and their periodicity is examined, allowing for monthly and annual analyses (Figure 2). The culmination involves creating a family budget, determining the corresponding balance, and calculating the debt-to-income ratio.



Figure 2. Examples of expenses for a persona.

Phase 3. The game introduces an additional challenge focused on managing a common expense—grocery shopping. Teams are tasked with making conscious choices within a given spending limit, navigating factors such as unit prices, brand differentials, and the impact of promotions on the overall shopping basket. During this phase of the game, one of the marketing instructors engages with the participants, discussing various precautions to consider while shopping. These include always making a list, avoiding shopping on an empty stomach, exercising caution with promotions and package sizes, being mindful of prices by checking the price per kilogram, and verifying the weight of the packaging. These pieces of advice aim to promote conscientious consumer behavior among the participants.

Phase 4. In a subsequent phase, teams evaluate the relationship between income and expenses, identifying potential overlooked costs based on their family characteristics. Unforeseen situations, such as a car breakdown or unexpected medical expenses, add complexity to the decision-making process (Figure 3). The personas are crafted to yield diverse budgetary outcomes, prompting teams to revisit their expenses and make informed choices, whether adjusting consumption habits, selling assets, obtaining credit, or utilizing savings.

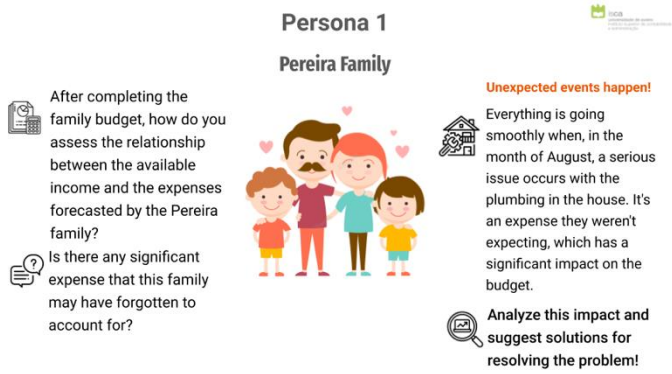


Figure 3. Example of a phase 3 part of the game.

Phase 5. After completing the budgetary exercises, each team is allowed to present their assigned personas and delve into the financial decisions they made during the game. They

discuss the choices they faced, the trade-offs they considered, and the strategies they employed to manage their family's finances effectively. Teams may highlight successful budgeting tactics, challenges they encountered, and any lessons learned throughout the game. This presentation allows participants to reflect on their financial decision-making skills, share insights with their peers and the team, and gain a deeper understanding of personal finance concepts in a collaborative setting.

3. Conclusion

The ISCA Family Game, crafted to be approachable yet closely connected to common family dynamics, stands as a valuable resource for fostering awareness among participants. It provides them with practical knowledge to nurture a more balanced and informed approach to finances and consumption in the years ahead.

The game, initially designed for students visiting our campus, has since last year started receiving requests from basic and secondary schools to implement the activity. In response to these requests, we have begun visiting schools, and to date, we have already impacted more than 300 school students with this awareness activity. Indeed, it seems that there is a growing interest among parents and educators in financial literacy and responsible consumption, and the game makes perfect sense and deserves to continue being developed.

In the future, we envision a comprehensive evolution of this activity. This entails refining the game mechanics to offer a more engaging and immersive experience for participants. We plan to invest in enhancing the quality of materials, focusing particularly on professional design standards to ensure clarity and visual appeal.

Moreover, we aspire to democratize access to financial literacy and consumer education by empowering high school teachers to independently administer the game in their classrooms. By providing comprehensive training and resources, we aim to equip educators with the necessary tools to effectively facilitate meaningful discussions around financial topics.

University professors will transition into a role of providing technical and scientific expertise, collaborating with teachers to develop tailored content that aligns with curriculum objectives and student needs. This shift will foster a more inclusive and sustainable approach to financial education, empowering educators at all levels to cultivate a future generation of financially literate individuals equipped to navigate the complexities of personal finance more confidently.

In terms of scientific research, in the future, comparative studies can be conducted to evaluate the effectiveness of different educational approaches and interventions in promoting financial literacy among youth. This could involve comparing the outcomes of gamified learning experiences like the ISCA Family Game with traditional classroom-based instruction or online financial education courses.

Furthermore, qualitative research methods, such as interviews and focus groups, can be employed to gain deeper insights into participants' perceptions and experiences with financial education initiatives. This could help identify barriers to learning and inform the development of more tailored and effective interventions. Overall, future research in this area can contribute to our understanding of the most effective strategies for promoting financial literacy and consumer education among young people.

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The 'backwash' effect: Prioritising assessment to support student engagement and 'deep' levels of learning

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Abstract

Recent years have witnessed a strong emphasis on student engagement across Higher Education. In particular, institutions are being encouraged to utilise an array of innovative teaching methodologies and learning experiences to support student engagement and learning. Nonetheless, in light of the 'backwash effect', i.e. the effect assessment has on student learning, the position of assessment in supporting student engagement and learning cannot be overlooked. The aim of this paper is to critically reflect on the design, delivery and assessement of a first year undergraduate module in developmental psychology, as delivered to a cohort of 35 students undertaking a joint degree in Education and Psychology in an Irish university. In designing the module, the lecturer placed particular emphasis on employing multiple means of assessment (formative, summative, self- and peer-assessment) to promote high levels of student engagement and 'deep' levels of student learning. Stemming from module-based data, the strengths and limitations of the module are discussed, with specific focus on implications for practice when undertaking curricular design.

Keywords: *Assessment; student engagement; backwash effect; module design; Bloom's Revised Taxonomy.*

1. Introduction

Recent years have witnessed an increased focus on the use of innovative teaching methodologies and learning experiences within Higher Education, aimed at facilitating student engagement and learning. Underpinned by an array of research, student engagement is now recognised as an essential predictor of student learning and development, alongside contributing to the quality of the overall student experience (Axelson & Flick, 2010; Carini et al., 2006; Holmes, 2018; Reeve & Tseng, 2011). According to the Irish Survey of Student Engagement (ISSE, 2023), student engagement reflects two key components. Firstly, student engagement

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pertains to the amount of time and effort that students put into their studies and other educationally beneficial activities. Secondly, student engagement relates to the means by which higher education institutions deploy resources and organise curriculum and other learning opportunities to encourage students to participate fully in meaningful activities that are linked to learning. For the purposes of this paper, focus is placed on the latter compenent of student engagement, particularly higher institution's design of modules and use of assessments to support student engagement and learning. Nonetheless, the shared responsibility of both students and institutions in the overall learning experience is acknowledged.

1.1. Student engagement, curriculum design and module assessment

Reflecting on the construct of student engagement, the linkage between student engagement, curriculum design and module assessment requires attention. Specifically, research shows that the organisation and design of a module, both in terms of teaching methodologies and assessment practices, can serve to facilitate or hinder student learning and engagement (Griffin & Howard, 2017; Griffin, 2020; McMahon, 2006). Focusing explicitly on assessment practices, studies have shown the distribution of student effort and engagement to align directly with assessment time-points across a module (Gibbs & Simpson, 2004; Van Gaal & De Ridder, 2013). In this regard, the concept of 'backwash' comes to the fore (Elton, 1987). This concept refers to the effect assessment has on student learning, whereby researchers have argued that it is assessment, rather than curriculum, that establishes *what* and *how* students learn (Biggs & Tang, 2011; Holmes, 2018). Reflecting on this construct, Surgenor (2010) argues that 'backwash' can present both negative and positive implications for student learning. On one hand, negative backwash can lead to 'surface' level learning, often occuring in an exam dominated system, where strategy becomes more important than substance. Additionally, Holmes (2018) notes how 'surface' level learning can occur when students meet course requirements with minimal effort, such as by memorising facts without understanding. In contrast, 'backwash' can be viewed positively, whereby assessment is used deliberately to encourage appropriate learning (Surgenor, 2010). In this regard, Holmes (2018) highlights the importance of adoping assessments that promoting 'deep' approaches to learning; such as when students engage with tasks meaningfully, with a focus on understanding underlying theories and principles. Surgenor (2010) argues that this 'deep' learning occurs when assessment is well planned, aligned, and designed to measure the full range of identified outcomes.

1.2. Bloom's Revised Taxonomy of Educational Objectives

When considering module design and related assessments, *Bloom's Revised Taxonomy of Educational Objectives* (Anderson & Krathwohl, 2001) cannot be overlooked. Griffin (2020) argues that the concepts of 'deep' and 'surface' level learning can be mapped directly onto this framework, where the taxonomy moves from lower order to higher order cognitive processes.

These include remembering, understanding, applying, analyzing, evaluating and creating. Table 1 presents an overview of the structure of the cognitive process dimensions of the revised taxonomy, as sourced from Griffin (2020, pp. 2 - 3) and adapted from Krathwohl (2002).

Table 1. Structure of the Cognitive Process Dimensions of the Revised Taxonomy. Source: Griffin (2020, pp. 2 – 3) and adapted from Krathwohl (2002).

1.	Remember	Retrieving relevant knowledge from long-term memory	1.1 Recognizing 1.2 Recalling
2.	Understand	Determining the meaning of instructional messages, including oral, written, and graphic communication	2.1 Interpreting 2.2 Exemplifying 2.3 Classifying 2.4 Summarizing 2.5 Inferring 2.6 Comparing 2.7 Explaining
3.	Apply	Carrying out or using a procedure in a given situation.	3.1 Executing 3.2 Implementing
4.	Analyze	Breaking material into its constituent parts and detecting how the parts relate to one another and to an overall structure or purpose.	4.1 Differentiating 4.2 Organizing 4.3 Attributing
5.	Evaluate	Making judgments based on criteria and standards.	5.1 Checking 5.2 Critiquing
6.	Create	Putting elements together to form a novel, coherent whole or make an original product.	6.1 Generating 6.2 Planning 6.3 Producing

Stemming from this framework, and with due regard for the 'backwash' effect, this paper seeks to critically reflect on the design, delivery and assessment of a first year undergraduate module in developmental psychology in an Irish university. In designing the module, particular emphasis was placed on employing multiple modes of carefully-considered assessments across the module to promote high levels of student engagement and 'deep' levels of student learning across all *Cognitive Process Dimensions of the Revised Taxonomy* (Anderson & Krathwohl, 2001). This contrasted with previous iterations of the module, where assessment strategies had predominantly focused on the first two cognitive dimensions of the revised taxonomy (i.e. *remembering* and *understanding*) through multiple-choice questions and short answers in

examination format. Stemming from most recent module data, the strengths and limitations of the module are discussed, with specific focus on implications for practice for curricular design.

2. Teaching and Learning Context

This module was designed and delivered to a cohort of 35 students undertaking a joint degree in Education and Psychology in an Irish university. This module resides in the first semester of students' programme. The aim of the module is to develop student teachers' knowledge and understanding of how to support children and their development. The module introduces students to the theories and frameworks within developmental psychology, with specific focus on theories of child development and learning. The module aims to enable student teachers to understand and critique current thinking on human development and learning, with specific focus on relevant psychological theories of child development and learning, alongside the application of theory to practice.

Presenting with three ECTS credits [European Credit Transfer and Accumulation System], the module comprises two contact hours weekly over a 12-week semester, with an additional three private study hours weekly for students. In accordance with the Faculty of Education guidelines within the university, only one form of graded assessment was permitted within this three-credit module, to a maximum of 1800 words.

2.1. Teaching, learning and assessment strategies

Stemming from the learning outcomes of the module and in light of all cognitive dimensions within *Bloom's Revised Taxonomy* (Anderson & Krathwohl, 2001), significant time and energy were devoted to the design of the module. In particular, the lecturer sought to employ an array of meaningful assessments across the module to support high levels of student engagement and related learning; the latter at both 'surface' and 'deep' levels. Given that students were new to the third level context and to the subject matter of child development, assessment strategies focused initially on the first two levels of the Revised Taxonomy i.e. 'remembering' and 'understanding' the module material. Thereafter, assessment strategies were selected to support the 'deeper' cognitive processes, particularly the 'application' of theory to practice, the 'evaluation/critique' of theories and the 'creation' of novel material, as based on overall learning across the module. Table 2 presents a summary of the assessment strategies employed across the module, spanning domains of self-assessment, peer-assessment, formative assessment and summative assessment. Column 1 presents each assessment strategy and an explanation of the same, followed by its alignment with the cognitive process dimensions of Bloom's Revised Taxonomy (Anderson & Krathwohl, 2001) in Column 2. Given that only one form of graded assessment was permitted within this three-credit module, the online and in-class assessment strategies (as outined in rows 1, 2 and 3) were presented to students as supportive learning tools. Although students were not

awarded marks for attending the module, there was potential for students to lose up to 10% of their overall marks for poor attendance. Accordingly, online engagement in the assessment strategies, alongside in-class engagement in the formative assessment strategies, contributed to students' overall attendance records. The final assessment strategy, as presented in the final row of Table 2, formed the graded assessment within this three-credit module, to a maximum of 1800 words. The related grading rubric/rating scale is presented in Table 3, as applied to each of the four questions within the portfolio, with each question weighted at 25%.

Table 2: Assessment strategies employed across the module and their alignment with the Cognitive Process Dimensions of Bloom's Revised Taxonomy (Anderson & Krathwohl, 2001)

Assessment strategy and explanation	**Alignment with the Cognitive Process Dimensions of Bloom's Revised Taxonomy**
Weekly online self-assessment quizes involving multiple choice questions and short answers, with instant online feedback	1. Remember 2. Understand
Online discussion fora questions, encouraging students to apply theory to practice through short answers, with reference to relevant literature	1. Remember 2. Understand 3. Apply
In-class 'Active Student Responding' techniques, as sourced from Grifin & Ryan (2016). These were conducted on an individual and paired basis in class. Examples included action responses, think-write-pair-share, creation of concept maps, written responses, oral responses etc.	1. Remember 2. Understand 3. Apply 4. Analyze
Individual portfolio, comprising students' critical response to four questions which linked theories of child development to applied practice.	4. Apply 5. Evaluate 6. Create

Table 3: Marking rubric/rating scale for individual portfolio questions (summative assessment)

	Poor	**Satisfactory**	**Very good**	**Excellent**
	0 - 1	2 - 3	4	5
Depth of knowledge & understanding of psychological theory				
Application of theory to practice				
Clear evidence of critical thinking				
Evidence of engagement with cutting-edge literature				
Organisation & adherence to academic and linguistic conventions				

3. Findings

To support critical reflection on the strengths and limitations of this module, module-level data was reviewed. Firstly, attendance data across the module was extremely high, with an average of over 96% attendance across the 12 weeks of the semester. Similarly, online module engagement was very high, with all students accessing the online learning platrform weekly, engaging in each quiz on at least one occasion, and contributing to the online discussion fora. Nonetheless, the potential threat of students losing up to 10% of overall marks in light of poor attendance cannot be overlooked, whereby this may have contributed to overall high attendance records and online engagement. Informal feedback from students, however, highlighted how the in-class formative assessments and weekly online activities served to support engagement and learning, particularly in terms of 'remembering' and 'understanding' the material.

Thereafter, a review of students' summative portfolio assignments was extremely encouraging, whereby in general, students effectively applied theory to practice. Specifically, a review of students' scores on the first two criteria of Table 3 showed a mean score of 3.8 (SD = 1.2) and 4.0 (SD = .8) respectively, highlighting students' *depth of knowledge and understanding of psychological theory* and their *application of theory to practice*. Although direct comparative assessment data from previous years' iterations of the module were not available, a review of student responses across previous examinations showed a dominant focus on 'surface' level learning. Specifically, previous answers were mainly focused on the *remembering* and *understanding* cognitive dimensions, with limited demonstration of *application of theory to practice* (Anderson & Krathwohl, 2001). Undoubtedly, the examination itself cannot be overlooked, whereby this served to direct both students' studies and related examination

responses. In contrast, students' portfolio responses in the most recent iteration of the module revealed 'deep' levels of learning, where students effectively critiqued theories, made direct links between theories of child development and classroom practices, and presented an array of evidence-based strategies to support children's development. Additionally, a number of colleagues noted how students successfully referenced the theories of child development in other education module assignments, highlighting the generalised *application* of learning to other subject areas, including when reflecting on classroom practice. This finding is extremely encouraging, given the focus within the module's learning outcomes.

4. Limitations and implications for practice

Although the design, delivery and assessment of the module presented an array of positives for student engagement and learning, limitations within the overall process must be acknowledged. These included high lecturer workload in preparing and delivering the module, particularly in terms of ensuring constructive alignment between the weekly content and assessement strategies. Secondly, although students only had one formal summative assessment across the module, the weekly online activities were reported as being time-consuming. Additionally, given the final summative task was pitched at the latter end of Bloom's Revised Taxonomy, students reported that they spent a large amount of time engaging in self-directed learning, which may have exceeded the prescribed three independent study hours. Finally, it must be acknowledged that the evaluation of this module did not employ a scientific procedure, which undoubtedly would provide greater rigour and credibility to the findings. Moving forward, the gathering of more rigourous data to support an analysis of module design and delivery is recommended; aimed at providing a more objective critique of the impact of assessment on student engagement and levels of learning, and allowing comparisons across different assessment strategies.

In conclusion, it is anticipated that the critical reflections outlined in this article, particularly with regard to Bloom's Revised Taxonomy and the linkage between the 'backwash' effect and student engagement and learning, may serve to positively influence others when engaging in curricular design and delivery.

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Case study for teaching Tropical Ecology

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Abstract

This study evaluates the effectiveness of employing case studies as a dynamic pedagogical tool in postgraduate Tropical Ecology education. Through qualitative analysis of student engagements and outcomes associated with the Uxpanapa case study in Veracruz (Mexico), we investigate how this approach influences students' critical thinking, problem-solving skills, and participation in ecological debates. Our findings indicate that case studies significantly enhance students' understanding of complex ecological issues and their ability to make informed professional judgments. These insights have profound implications for pedagogical practices in Tropical Ecology, suggesting a shift towards more experiential and problem-based learning methodologies. The evaluated case study model has charted new learning trajectories for students, enhancing their critical and creative thinking skills within ecology.

Keywords: *Case study; graduate education; Tropical Ecology; real-world application.*

1. Introduction

Tropical regions, characterized by their remarkable biodiversity, are pivotal for sustainable development yet face significant socioeconomic challenges. In this context, education, particularly in Tropical Ecology, plays a crucial role in preparing professionals capable of addressing these challenges. The Centro de Investigaciones Tropicales at Universidad Veracruzana (CITRO) has pioneered a graduate program in Tropical Ecology that integrates research with education, focusing on biological conservation and sustainable development. This study aims to assess the pedagogical effectiveness of incorporating case studies, using the Uxpanapa example, to enhance students' learning experiences.

2. Methodological approach

The Ecología Tropical y Conservación Biológica (ETyCB) course within CITRO's master's program introduces students to professional ecological training through a case study-based

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approach (Rodríguez, Hernández & Ruiz, 2022). The Uxpanapa case study, chosen for its rich narrative on socio-environmental conflicts, serves as a practical example to apply theoretical concepts taught in the course. This methodological choice is supported by pedagogical theories that emphasize active learning and engagement (Coll, Mauri & Onrubia, 2008; Fuentes & Muñoz, 2015; Herreid, 2005; Wassermann, 1994) as Constructivism and Problem - Based Learning. Our example is an exercise of reflection and exchange of academic, scientific, and technical arguments about the Uxpanapa case, where each student, based on their thesis topic, embodies the role of the involved parties.

The integration of the case study aims to foster a deep understanding of ecological and conservation issues, encouraging students to apply this knowledge to real-world problems. By integrating textbooks and scholarly articles, the course fosters critical and creative thinking, weaving together the history and philosophy of science (Kuhn, 1970; Matthews, 2017; Rodríguez, 2013) with ecological principles. This interdisciplinary strategy enriches students' comprehension of biological conservation. Initially, the curriculum guides students through an exploration of nature's core principles and conservation methodologies. This journey progresses into an epistemic writing task, culminating in a scientific essay that resonates with their thesis theme, thereby enhancing their participation in the Uxpanapa discussion forum.

The Uxpanapa case stands as a pivotal example of political ecology in Mexico (Gómez-Pompa, 2016), presenting a detailed account of the socio-environmental challenges arising from the area's colonization. Chronicled through a diversified disciplinary lenses for over fifty years, this case remains central to discussions on regional development (Mac Swiney, López, Velázquez, Rodríguez & Muñoz 2018). It serves as a practical backdrop to the theoretical underpinnings of the course, bridging academic concepts with real-world environmental dilemmas (United Nations, 2015).

2.1. Uxpanapa case study integration

The Uxpanapa case study is presented after foundational units on ecology and conservation, using multimedia formats to encourage a multidisciplinary analysis (Conacyt, 1975). Uxpanapa Valley has undergone rapid territorial transformation over the last five decades. Particularly, in the 1970s, a planned colonization process began, which sparked a conflict between government representatives and the scientific community, as two visions of regional development clashed. The approach aligns with the course's objectives to enhance analytical skills and proactive problem-solving. The case study's integration into the curriculum is grounded in the theoretical framework of problem-based learning (Barrows, 1986), which supports the development of critical thinking and application of knowledge in practical settings. This case study helped fulfill disciplinary and multidisciplinary learning objetives, focusing on central themes such as biodiversity conservation, sustainable use of natural resources, maintenance of environmental services, and conditions for human well-being. These issues were discussed withing the

disciplinary framework of Tropical Ecology and the corresponding challenges faced by Biological Conservation in the tropics.

3. Results

3.1 Forum for the discussion of the Uxpanapa case

The use of the Uxpanapa case as an educational resource was evaluated among nine students in terms of ten learning objectives. This evaluation employed a rubric comprising four performance levels: unsatisfactory, basic, competent, and outstanding (with no students in this level), yielding the following results:

Table 1. Student performance in case discussion forum

Learning objective	Criteria	Performance		
		Unsatisfactory	Basic	Competent
		Number of students		
Critical Analysis	· Identification of key problems	1	3	5
	· Evaluation of revelant variables		4	5
	· Depth of analysis	4		5
	· Coherence and clarity	4	2	3
	· Originality and creativity	4	5	
Aplication of knowledge	· Understanding of theories and concepts	2	2	5
	· Practical relevance	3	3	3
	· Effective application	3	3	3
	· Problem-solving	3	3	3
	· Creativity and adaptability	5	3	1
Research skills	· Information retrieval	4	5	
	· Evaluation of sources	4	5	
	· Synthesis of information	1	7	1
	· Application of research to the case	1	3	5
	· Presentation of research	4	2	3
Problem solving	· Problem identification	3	2	4
	· Solution proposal	4	5	
	· Evaluation of solutions	4	4	1
	· Solution implementation	4	5	
	· Creativity and originality	6	3	
	· Coherence and clarity of presentation	4	4	1
Effective Communication	· Clarity in communication	4	5	
	· Persuasiveness in communication	1	4	4
	· Oral skills	3	6	
	· Adaptability to the audience	2	1	6
	· Creativity and originality in presentation	7	2	
Teamwork	· Active collaboration	1	3	5
	· Appreciation of perspectives		2	7
	· Effective communication	1	1	7
	· Constructive conflict resolution		2	7
	· Equitable contibution		2	7
	· Reflection and continuos improvement		3	6

Interdisciplinary thinking	· Understanding of disciplines		7	2
	· Identification of interdisciplinary connections		8	1
	· Application of interdisciplinary approach to problems	2	6	1
	· Creativity and interdisciplinary innovation	6	3	
	· Interdisciplinary colaboration		2	7
	· Interdisciplinary presentation and communication	2	5	2
Ethics and responsability	· Understanding of ethical principles			9
	· Reflection on ethical implications			9
	· Social responsability			9
	· Practical application of ethical principles			9
	· Communication of ethical decisions			9
Adaptability and flexibility	· Openness to new information and perspectives		2	7
	· Adaptation speed		4	5
	· Flexibility in proposing solutions		3	6
	· Continuous learning		2	7
	· Collaboration in changing situations		2	7
	· Innovation in adaptation		9	
Self-directed learning and reflection	· Self-directed learning	2	2	5
	· Reflection on the learning process	1	1	7
	· Establishment of learning goals	3	4	2
	· Monitoring of progress	1	5	3
	· Adjustment of learning strategies	1	1	7
	· Documentation and communication of the learning process	1	2	6

The Table 1 shows student performances according to the 10 learning objectives, and as evidenced, none achieved an "outstanding" rating; likewise, considering the criteria and personal evaluations for each learning, the need for differentiated educational support for students to overcome the limitations determined by this evaluation is recognized. However, it is necessary to explain that the students are in the first six months of their disciplinary training. With this evaluation rubric, lines of improvement can be traced for the case study as an educational resource, as well as educational strategies oriented towards students in a personalized manner. In general, a deficit in research capacity and creative thinking within the disciplinary framework is recognized. Student engagement is assessed through forum participation, initial responses to ecological conservation, a scientific essay, and a self-assessment questionnaire, offering a holistic view of their academic and personal growth throughout the course.

3.2 Student self-awareness of their own learning

Through introspective exercise, students expressed their learning experiences during the course (Table 2), allowing an assessment of the case study as an educational resource. About educational background, some students stated that they did not consider themselves at an

appropriate level for the demands of the course, some recognizing previous educational deficiencies or coming from a disciplinary background different from biology. Among the most significant manifestations, we highlight in the following table:

Table 2. Student self-awareness of their own learning

Aspect	Student Reflections
Self-Leveling	"I recognized the difference in knowledge with my classmates and worked to level myself".
Previous Education	"Previously, I was taught to memorize without reflecting".
Unlearning Concepts	"The course prompted me to unlearn some pre-established concepts".
Academic Skills	"I became aware of my lack of skills in reading scientific articles in English and academic writing".
Critical & Creative Thinking	"The course underscored the importance of questioning beliefs and fostering critical and creative thinking in tropical ecology".
Interdisciplinary Connection	"The case study highlighted the interconnection of ecological issues with other disciplines, emphasizing the value of multidisciplinary work".
Preparation for Unforeseen Situations	"The educational experience prepared me for unforeseen situations, showing the practical importance of case studies".
Contextualizing Knowledge	"It aided in contextualizing my thesis problem and learning new ways of constructing knowledge".
Substantiating Arguments	"I learned to substantiate my answers and engage in discussions, recognizing the importance of critical and creative thinking".
Understanding Complexity	"The course broadened my perspective on the complexity of socio-environmental problems from a professional viewpoint".
Discussion and Reflection	"Engaging with different viewpoints in the forum made me reflect and rethink my own ideas, highlighting the need for discussion and reflection in real-life problem-solving".
Critical Reflection	"Class discussions offered a new perspective on biological conservation, moving away from a romanticized view to a more theoretical and critical approach".
Orienting Thesis Work	"The course helped orient my thesis work, especially in understanding the historical and social contexts of scientific ideas".
Course Design	"The critical and creative design of the course allowed for a thorough review of tropical ecology, changing my conception of biological conservation".
Philosophical Approach	"The unexpected philosophical approach was enriching, helping me critically assess concepts and beliefs in conservation and ecology".

4. Discussion and concluding perspectives

The analysis of student reflections and forum discussions reveals an increased engagement and a deeper understanding of ecological concepts. Comparing these findings with existing

literature our study contributes new insights into the effectiveness of case studies in ecology education, particularly in fostering a multidisciplinary perspective and enhancing critical thinking skills. However, we acknowledge limitations such as the potential for selection bias in student reflections and the challenge of directly attributing learning outcomes to the case study method alone. This report outlines a preliminary experience with heuristic value for planning a more comprehensive study. Due to the length constraints of this report, it is not feasible to elaborate on the methodology used to assess student performance during the discussion forum. According to Table 1, this evaluation considered 10 learning objectives and 55 criteria applied by a subject matter expert. Additionally, Table 2 displays student testimonials on their self-awareness of learning through the case study.

In addressing the critical question of how to effectively prepare professionals in Tropical Ecology to lead in the areas of biological conservation and sustainable development within the Mexican tropics, it becomes evident that the dynamic nature of tropical ecosystems demands an innovative postgraduate curriculum. Such a curriculum should centralize case studies as a fundamental element, promoting a learning paradigm rooted in problem-solving and an updated approach to disciplinary education that ensures professional competence. The utility and impact of integrating case studies into Ecology education cannot be overstated. Our analysis of the case study methodology reveals its profound ability to forge new paths in the educational journey of students. It significantly bolsters their critical and creative thinking capabilities specific to ecological contexts, thereby initiating their transformation into research professionals. These professionals are not only well-versed in theoretical knowledge but are also adept at applying this knowledge pragmatically to address the multifaceted challenges of conservation and sustainable development in the intertropical regions.

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Assessing the Impact of the 'SkillSense for Assessment Mastery (SSAM) Programme©' on Level 4 Higher Education Students: A Study on Assessment Initiatives

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Abstract

This paper introduces the 'SkillSense for Assessment Mastery (SSAM) Programme©' designed to teach assessment literacy in higher education, outlining its theoretical rationale and research-informed insights for its implementation. The SSAM Programme aims to enhance understanding of the learning process, offer personalized support, and align assessments with academic skills. Prioritizing fairness and diversity, it fosters a sense of belonging in the academic Community of Practice (CoP). The programme includes workshops with presentations, peer, and self-assessment activities based on the purposefully designed Academic Skills Feedback and Marking Rubric (ASR). Emphasis is on the vital importance of cultivating students' self-efficacy and essential skills. The initiative focuses on scaffolding reflective learning, utilizing quantitative and qualitative data for its ongoing evaluation. Empirical insights from this continuous evaluation within a UK Higher Education Institution during 2022-24 will also be presented briefly in this paper to demonstrate its effectiveness in promoting student development.

Keywords: *Assessment, self-efficacy, self-reflective learning, community of practice, academic skills, agency*

1. Introduction: Fostering self-efficacy, sense of belonging and academic identity

Bundara (1977) describes self- efficacy as a belief in oneself that is so strong it can affect or even determine one's own behaviour. It is our self-belief in our ability to do something that allows us to succeed in our performance in said task. It is key to building any type of identity. And as I argue in this current paper, creating a sense of belonging to any domain is key to increasing self-confidence, self-belief, and therefore self-efficacy. Our identity affects our learning (McDowell, Živoder, & Tolomelli, 2016). It is therefore important that students 'see' themselves as core members of their academic community, and in the content they study. This

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is because if we associate ourselves with something, we are more likely to see its relevance, to connect with it, to become a better and more in-depth learner (Wenger, 1998). Identity therefore plays a very important role in a student's learning experience. How we see ourselves as doers of learning (in whatever topic or pedagogical field) affects our ability to engage in said field and be successful in the area. Students who can engage at the level where they consider themselves as part of that CoP are more likely to be successful for two main reasons. Firstly, having a sense of belonging can create feelings of self-efficacy; engaging with behaviours that are integral to an identity often leads to success, such as reading, drafting, and completing assessments. But this is driven by understanding what assessments are in the first place. Secondly, they will see themselves as more capable of achieving in their field if they belong, and this belonging comes from understanding, from knowing, and from experience. This is a self-fulfilling prophecy working in a positive (rather than negative) manner (Merton, 1948).

Engaging students in the academic assessment process during the transition stage is pivotal for fostering a sense of belonging. This sense allows students to perceive themselves as university and academic individuals, positively influencing their understanding of assessments and confidence in their abilities which is a crucial aspect of their identity as students. Academic identity significantly predicts student success (McDowell et al., 2016), emphasizing the profound impact of creating a sense of belonging on learning and achievement across academic topics. Developing students' agency in their learning is imperative, involving their integration into the academic CoP (Meyer, 2010; Gonzalez, 2023). Challenging prevailing perceptions of assessment is crucial, transitioning students from viewing it as a process for assurance, as something done 'to' them, to actively embracing it as a tool for knowledge enhancement (Evans & Waring, 2024). To support student achievement, addressing identity issues in the classroom is essential. This involves engaging students in the academic assessment design process, learning outcomes, marking and feedback rubrics, and academic skills. Integrating students into these processes through teaching and explanation helps demystify the assessment process, boosting confidence, self-efficacy, and self-regulated learning, ultimately enhancing achievement. Recognizing the critical role of student agency in assessment and feedback processes is essential for both academics and students. Therefore, I created the *SkillSense for Assessment Mastery (SSAM) Programme* (henceforth SkillSense) to facilitate these objectives for students.

While modest in scale, the SkillSense Programme presented in this current paper contributes to the scholarly discourse on the impact of teaching transitioning into academic learners, a sense of belonging to their new community, highlighting the necessity for further expansive research on the utilization of scaffolding to foster self- reflective learning, learner agency, and self-efficacy within the assessment domain. SkillSense is theoretically grounded in the work of Wenger (1998) and Eckert and Mc-Connell-Ginet (1999) on CoP, and how communities are built on linguistic behaviours, practices, and competencies (King, 2014), as well as the work of

Molloy, Boud and Henderson (2020) on feedback nature in Higher Education, accentuating learner agency and feedback literacy. It extends upon Bandura's (1997) work on self-efficacy development in reflective learning. The research also recognizes the integral role of feedback in reflective learning, emphasizing the dual role of students as receivers and providers of feedback (Boud & Molloy, 2013; Boud, Keogh, & Walker, 2013; Boud, Cohen, Sampson, 2001). Scaffolding, based on Vygotsky (1978) and Bruner (1984), forms the foundation for employing SkillSense aligning with contemporary practices in Higher Education employing scaffolding (Coulson & Harvey, 2013). Given the exponential growth and diversification of the student body, including international students, scaffolding students in the assessment process emerges as crucial processes in ensuring quality assurance in higher education, impacting student efficacy, their learning identity and sense of belonging, and student attainment and improvement. This current paper also affirms the positive impact of SkillSense on; student confidence and understanding of academic assessment; fostering reflective learning, feedback literacy, and learner agency; and self-efficacy among new learners transitioning into a Higher Education context.

SkillSense was created to address the impact of students' self-efficacy on learning outcomes, recognizing the importance of understanding students' divergent starting points upon entry to higher education. It works with the students during the planning stages of assessment to align their perceptions, understanding, attainment and demonstration of academic skills with the task requirements (and learning outcomes) of each assessment. In doing so, it helps students become successful self-regulators. Self-regulators are described as discerning individuals who actively contribute to the assessment process, read task requirements effectively, set appropriate goals, plan carefully, choose and adapt strategies, seek deep understanding, and use feedback judiciously (Evans & Waring, 2024). SkillSense focuses on the students' understanding of the language of assessment, promoting assessment literacy, and making assessment requirements explicit. It teaches students the skills to navigate assessments effectively, allowing them the learning opportunities to apply and adapt their knowledge and skills. Students who learn passively in a classroom rather than grappling with the processes are not given the opportunity to learn the ‘why’, but rather focus only on the ‘how’. It also focuses on connecting assessments with academic skills, a module’s learning outcomes, assessment marking criteria, and marking processes, as opposed to having assessment as a disconnected step. But it does not simply provide them with all the aforementioned information. It teaches students the ‘why’. Procedural understanding is especially important to creating belonging but is often neglected by lecturers. Yet students must be fully engaged with their material to have in-depth learning (Wenger, 1998).

SkillSense teaches students in various assessment processes within their degree program, emphasizing key academic skills as vehicles for displaying learning in assessments. The focus is on teaching the vocabulary of assessment and elucidating what academic skills entail and how they manifest in academic writing. This approach strengthens students' understanding of their

skill base, emphasizing a dynamic process of improvement rather than adherence to fixed grading rubrics. The deliberate use of the term 'skills' implies a developmental connotation, emphasizing that students have the capacity to enhance their abilities throughout their degree. SkillSense not only teaches skill development but also promotes the idea that progressive struggle is beneficial. Skills are viewed not as inherent traits but as capabilities that students can develop over the course of their degree. Recognizing the diversity in students' preparedness upon entering university (Office for Students, 2024), and that groups of students excel in certain skills when they transition into H.E, where others do not (McDowell et al, 2016), SkillSense avoids benchmarking against historically dominant groups, which may not be conducive to the development of at-risk students (Gonzalez, 2023). Instead, the focus is on understanding individual strengths without relying on dominant groups as the unmarked standard. This shift allows for a reframing of what is considered 'good' and 'standard', enabling the identification of opportunity gaps rather than achievement gaps. SkillSense contributes to building every student's academic identity through an inclusive approach that fosters self-efficacy. Poor assessment practices disproportionately affect disadvantaged learners. Thus, employing data effectively to investigate the impact of assessment design on diverse groups is crucial (Waring & Evans, 2024). The SkillSense Rubric (ASR) facilitates data-driven assessment by enabling lecturers to evaluate student skill development and assess the fairness, clarity, and appropriateness of their assessments. This marking rubric provides valuable student outcome data, allowing lecturers to identify performance variations among student groups and understand the underlying reasons. So, the ASR serves as a diagnostic tool for pedagogical approaches and assessment designs, enabling lecturers to address fairness issues, scrutinize assessment robustness, and evaluate the relevance of measures employed in testing student learning.

2. The SkillSense Programme: Embracing a 'Community of Practice Approach'.

The rest of this current paper provides a brief overview of the SkillSense Programme, followed by a subsection of the evaluative data that measures its effectiveness. The Programme consists of 3 x 2hour workshops that encompass group discussions, peer and self-assessment activities,

and assessment preparation, all grounded in the ASR to teach and applying assessment literacy skills in an academic context. Self and peer assessment and such scaffolded learning contributes to an effective learning cycle, reinforcing confidence-building and efficient learning (Bandura, 1997; Kolb, 1984). This approach simultaneously creates a joint enterprise within the CoP, where students collaboratively work toward shared goals (Eckert & McConnell-Ginet, 1998). To achieve this joint enterprise, students learn a repertoire of resources, including the language of assessment and specialized terminology (Holmes, 2006). In workshop one, students learn about the academic assessment processes in their Higher Education Institution. Then, using the ASR, they engage in group discussions on the language of academic skills, and learn how to interpret the language of assessment questions to effectively address specified learning

outcomes. This collaborative approach not only fosters mutual engagement but also serves as a crucial element in the formation of their CoP (King, 2014). Consequently, the identity of 'being a student' must be adopted for group members to effectively communicate with one another. This then increases belonging to their CoP as well as their student learner identity (Eckert & McConnell-Ginet, 1998). In workshop two, students collaboratively engage in the peer assessment of relevant assessment examples, creating a shared learning experience. This experience, akin to the role of a 'marker' provides firsthand marking experience using the tools that will be applied to assess their own assessments. This comparative approach (comparing 'good' and 'weak' assessments) teaches students to understand quality, facilitates internal feedback mechanisms, enhances visualization and exploration skills, all fostering self-regulated learning. Through peer assessment and feedback using the ASR, students develop mastery in academic assessment marking and feedback procedures to address potential discomfort with uncertainty about improvement (Evans & Waring, 2024). During workshop three, students are taught how to utilize the ASR to craft an assessment draft that emphasizes the learning outcomes they are required to exhibit and the academic skills necessary for successful completion. By embedding skills this way (within the context of the assessment rather than presenting them in isolation), SkillSense promotes deeper student engagement, aligning with the principles outlined by Wenger (1998) and the findings of Evans and Waring (2024). The Programme's integration into existing content modules ensures sustained relevance, with continuous references throughout the teaching course. The flexibility inherent in this approach allows lecturers to tailor activities and workshop presentations to align seamlessly with specific assessments, module learning outcomes, and marking criteria, providing a nuanced and contextually relevant educational experience. This integrated model underscores the significance of acquiring skills that are then universally applicable across the entirety of the degree program.

2.1. Using feedback effectively to develop learner agency and feedback literacy.

As well as being taught the linguistic repertoire and processes of academic assessment in depth via peer assessment and scaffolded activities, the SkillSense workshops also teaches students how to use assessment feedback effectively to develop self-reflection skills and learner agency. The potential role of self-assessment in this context signals a tentative shift toward democratizing power and motivating learners to take responsibility for their learning process. Therefore, teaching students how to use feedback effectively to develop their self-reflection skills and develop their agency in their own learning process, is crucial. Feedback literacy is an essential element students must embrace to become a member of their academic CoP. This involves being able to effectively use feedback for not just individual assessments, but for their entire academic journeys (Evans & Waring, 2024). To advance assessment and feedback practices, students must be trained to identify, seek, generate, and enact feedback, converting it into 'feedforward' (p24). But most importantly, students must learn to take greater responsibility in the feedback process. Students who recognise the value of feedback to guide their learning

have enhanced self-efficacy and are more capable of self-regulated learning. In short, students must internalise the potential of feedback, what it means, and how to engage with it effectively, which in turn can come from their understanding of assessment processes and requirements. SkillSense aims then to enhance students' reflective capacity on their learning quality through repeated self-assessment opportunities utilizing existing materials like marking criteria during the workshops. Workshops emphasize the importance of reflective practices, integrating them into the learning process to contribute to students' academic identity. They educate students on how assessment structure impacts module learning outcomes. SkillSense employs the ASR listing 12 key academic skills during marking. This allows markers to highlight positive and negative skill demonstrations in students' writing, enabling self-assessment. Students can learn from both successful and challenging examples, gaining insights into skill mastery and areas for improvement. Therefore, SkillSense also fosters collaboration between students and academics in the feedback process. By teaching students about the skills in the workshops, and providing feedback that integrates these skills, students can understand their success and failure in terms they understand and develop strategies to address any setbacks. This contextualized guidance means staff work *with* students to support their development of positive self-regulatory strategies. This feedback can empower students to strategically focus their efforts for improvement. It not only informs their decisions but also provides them with actionable strategies. Students can *actively participate* in shaping their feedback experience by requesting emphasis on specific skills they find challenging from their lecturer, fostering increased engagement and control over their own assessment feedback process.

3. Evaluating the SkillSense Programme

The Programme unfolded over three consecutive weeks in the first semester of Level 4 (running from September to January). The structure comprised three two-hour workshops, complemented by take-home activities for participants to complete between sessions. Programme evaluation to date has involved participants enrolled in four Level 4 modules (85 students) within the Humanities Programme and one Level 4 module (21 students) within the

Education Programme at a U.K university during the academic years 2022-2023, totaling 106 students. The evaluation process involved a pre-initiative survey of 15 questions to assess student background knowledge and understanding of academic assessment processes, and confidence in such; and a post-initiative survey and focus groups. The post-initiative survey included 20 questions exploring the impact of SkillSense on student confidence, self-efficacy, and understanding, with specific inquiries about the ASR and Peer Assessment activities (see Table 1 ‘themes’ based on survey question topics). Qualitative data was collected via focus groups with self-selected participants from each cohort who also completed the survey, where they discussed topics related to the initiative during 30-minute sessions. This paper does not aim to provide an exhaustive statistical analysis of survey outcomes but instead offers a concise

overview of select quantitative patterns and qualitative subtleties from a subsection of the evaluative data. The data focuses on one module within the Humanities programme, involving two rounds of student cohorts (Sept 2022 - Dec 2023, 10 students; Sept 2023 - Dec 2024, 19 students). Survey responses were collected from 29 students, results of which are combined for this paper. 8 students took part in post-intervention focus groups.

4. Results

The findings involve the 29 students discussed in section 3, with themes coded from survey questions. This paper focuses on subthemes marked 'X' in Table 1, efficiently combining both quantitative and qualitative results for each subtheme.

Table 1: Themes of 'The impact of the overall SkillSense Programme'

Theme: The Impact of the overall SkillSense Programme on:	
A. Specific understanding of marking criteria	
B. Specific understanding and developing of academic skills, and how to demonstrate them in assessments	X
C. Specific understanding and interpreting of essay questions	
D. Confidence in understanding and interpreting essay questions	X
E. Specific understanding of the learning outcomes and how to demonstrate they have been met via using academic skills	X
F. Confidence in using marking criteria in answering an essay question	X
G. Confidence in using the assessment description in answering a question	
H. Overall understanding of assessments in general	
I. Confidence in using feedback effectively as a self-reflective learner	X
J. Improved engagement with assessments and learning (within their CoP)	X
K. Increased identity as an academic student/student learner	X
L. Developed understanding of the academic process of assessment	X
M. Using Feedback Effectively	X

The findings within each theme below highlight the positive influence of the initiative across various dimensions, including specific understanding of grading criteria and essay questions, enhanced confidence in using assessment criteria, an ability to now use feedback effectively, and the overall impact of learning about how to apply the ASR.

4.1. Specific understanding, development and demonstration of academic skills; Specific understanding of learning outcomes and how to meet them by using academic skills

After completing all SkillSense workshops, participants were requested to evaluate their comprehension and application of academic skills gained through the Programme to measure its effectiveness. Participants were asked to rate their understanding of demonstrating academic skills when writing assessments. The results indicate that 21 participants now fully understood, 7 mostly understood, and 1 was still developing an understanding. The ASR assisted students

in comprehending academic skills and, crucially, in demonstrating their acquisition in their own writing. These skills were transferable, with all students finding they could incorporate the skills into a range of different assessments across various modules:

"You can see how to demonstrate the skills and incorporate them into all your different lessons."

Participants were asked to assess their understanding of applying academic skills to meet marking criteria and learning outcomes. The responses reveal that 21 participants now fully understood, 6 mostly understood, and 2 were still developing an understanding of this aspect. One student for example reported that the ASR helped them to further understand the marking criteria and how to address each one in their work by demonstrating the relevant academic skill:

"It really helps me to understand what you needed to hit all of these criteria, and it's easier to break down what they want and what parts of the skills taxonomy they expect you to include to demonstrate each criterion and demonstrate the academic skills necessary to get that percentage mark."

The survey sought to measure participants' confidence in applying the academic skills knowledge newly acquired during the Programme to their assessments. The responses indicate that 15 participants were now very confident, 11 were fairly confident, and 2 were still developing confidence in applying these skills.

Participants were asked to reflect on the effectiveness of the self and peer assessment activities, which included peer marking of 'student paragraphs,' using the lecturer's feedback and the ASR in developing their understanding of these skills in assessments. The results demonstrate that 14 participants strongly agreed, and 15 agreed that these elements contributed significantly to their skill development. These practices in the workshops increased their evaluative judgement, teaching them how to recognise quality in others, and therefore their own, work.

4.2. Confidence in understanding and interpreting essay questions; confidence in using marking criteria in answering essay questions

This section aims to evaluate the influence of SkillSense on participants' grasp of utilizing marking criteria in assessment writing and to measure their proficiency in interpreting essay questions, identifying areas of improvement. Participants rated their confidence when using marking criteria after the Programme. The results indicate that 16 participants now felt much more confident, 8 were fairly confident, and 5 were still developing confidence. This increase in confidence levels among participants indicates a positive shift in their understanding of using marking criteria after attending the workshops. The workshops appear to have addressed concerns and uncertainties, with no participants expressing a lack of confidence post Programme. The absence of students reporting no confidence suggests that SkillSense effectively instilled a sense of assurance and competence in participants regarding the use of marking criteria in assessment writing. This outcome underscores the success of the workshops

in enhancing participants' knowledge and skills in this specific aspect of academic writing. All focus group participants agreed that the initiative had developed their understanding of how to interpret essay questions. They were now able to examine the instructional verbs in a range of essay questions to decipher what the assessment outcomes should be. This then aided them when creating a draft of their essay in line with the marking criteria and academic skills cribsheet. Students felt overall that they had a better understanding of what their lecturers were asking them to report on, and how, in their assessments:

"I know better what they are looking for, like the answers that they're looking for in the words of the essay question...for example, the difference between instructions like 'discuss' or 'explain' and what that means."

4.3. Developed understanding of academic process of assessment; improved engagement with assessments and learning; increased identity as academic student/student learner

To assess students' comprehension of the academic assessment process, the evaluation aimed to measure the impact of SkillSense on students' understanding of learning outcomes and the application of marking criteria (e.g., their purpose, usage, and significance) in assessment writing. It also explored the Programme's influence on students' perception of assessment at the university level and their motivation to engage in the learning and assessment processes. An improvement is observed in students' understanding of learning outcomes post Programme. A remarkable 92% of participants reported a better understanding, indicating the Programme's effectiveness in clarifying the expectations tied to assessments. Students reported that the initiative assisted them in navigating the academic process of assessment writing by enhancing their understanding of academic skills and their application in their work. Additionally, they found value in utilizing marking criteria to strategically plan assessment content:

"I understand the things I'm supposed to talk about in an in an essay question way more than I did before, because at the beginning, I would just see the essay question, and only talk about that. But this has helped me understand the skills I must show to competently answer that question."

All participants (100%) reported a newly developed understanding of how to use marking criteria when writing assessments. This outcome underscores the success of the Programme in equipping students with the skills and knowledge needed to navigate and apply marking criteria effectively. When asked about their current understanding levels of using marking criteria when writing assessments, 14 students reported now having a full understanding, 9 mostly understood, and 4 were still developing their understanding. This distribution indicates an overall positive trend in students' ongoing comprehension of marking criteria post workshops:

"It helped me understand new concepts of how we will tackle exam questions of how we analyse, and we unpack the question for, for the student to comprehend and to write the exact points needed."

The Programme also had a positive impact on students' perception of assessment at university level. A majority of 22 students strongly agreed, 5 agreed, and 2 remained neutral about the workshops teaching them more about assessment and its intricacies at the university level. This indicates an enhanced awareness and comprehension of the assessment process among participants. Furthermore, 92% of participants (28) agreed that taking the Programme motivated them to engage more in their learning and the assessment process because they now felt part of the community. This positive response suggests that the workshops not only imparted knowledge but also inspired an initiative-taking approach to learning and assessment among participants by creating a sense of belonging to their academic subject.

4.4. Using Feedback Effectively: Assessment Results

To evaluate the effectiveness of students utilizing feedback provided through the ASR, which includes annotated comments highlighting strengths and weaknesses, the evaluation involved analysing assessment results from both cohorts. Results from the 2022-2023 cohort (10 students, 9 of which submitted coursework) showed a significant improvement in average marks, rising from 56.88% in the draft assessment to 66.63%, with 1 student advancing by two grade boundaries (62% to 85%). Even those who initially received over 70% (marks exceeding 70% are classified as a First in the UK Higher Education Institution (HEI) degree classification system) saw improvement, such as 1 student moving from 72% to 85% by using their assessment feedback effectively. The module's failure rate decreased from 36% in 2022 to 6% in 2023. In the 2023-2024 cohort (19 students, 16 of which submitted coursework), the average mark increased from 54.81% in the draft assessment to 64.35%, with 6 students improving by two full grade boundaries. Similarly, 2 students who initially received 72% improved to 85% through effective feedback utilization. Notably, the failure rate dropped from 6% in 2023 to 0% in 2024. In contrast to a non-intervention cohort (2021-2022) that, on average, only maintained or marginally improved grades while remaining within the same grade boundary (for example, only increasing from 52% to 55%), indicates added value from the SkillSense training. Students found the peer and self-assessment activities using the ASR valuable for understanding assessment grading and gained confidence in providing their own feedback. Assessing both strong and weak student work allowed them to align assessment learning outcomes with the marking criteria. Group discussions on assigned marks further enhanced understanding and confidence in meeting marking criteria in their own work:

"Individually, we marked another student's assessment, and then we compared it to what each other had said, it was good because everyone had come up with the same points. It was good that [the lecturer] showed us an example that was really good, and then one that was at a lower

level. When you're marking somebody's work, you can point out their mistakes. You can compare the mark you've given with lecturers marking. That's really valuable for when it comes to using lecturer's feedback in my own work."

5. Conclusion

In summary, despite its limited scope on a specific subject area and educational level, survey results overwhelmingly indicate that participants perceive SkillSense as beneficial. The positive influence on understanding and academic skills consistently emerges in both survey responses and qualitative insights from focus group discussions. The evaluation underscores participants' confidence in understanding and applying academic skills acquired through the SkillSense Workshops, particularly focusing on the ASR. The Programme positively influenced participants' ability to demonstrate marking criteria and learning outcomes in assessments, with peer review, lecturer feedback, and the framework playing pivotal roles in reinforcing comprehension. Overall, it instilled confidence in participants to effectively apply acquired academic skills. The notable increase in confidence levels indicates a positive impact on their ability to apply marking criteria effectively when writing assessments to demonstrate the required learning outcomes. This positive impact extends to students' perceptions of university-level assessment and their motivation to actively engage in learning and assessment processes. Lastly, it has been effective in teaching students how to engage effectively with their feedback, resulting in an overall increase in marks within and between both cohorts.

6. Limitations

Caution is advised in generalizing findings beyond the specific university context and limited sample size. Unique institutional factors may restrict the study's external validity. The data collection period, from September 2022 to January 2024, does not capture the initiative's long-term effects. The paper primarily discusses the Level 4 Humanities cohort, posing challenges to generalizability. Evaluation work in other disciplines is ongoing but not included in this paper. Efforts are in progress to enhance generalizability by examining the initiative's impact across diverse demographics and academic levels.

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A human-centred design approach to student success in a first-year high impact module

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Abstract

The success of students in the first year is an important concern for higher education institutions globally. Although much is known about the factors that impact on student success, not many authors have considered how to take such factors into account in the design of a module. In this study we report on a human-centred approach to curriculum design of a first year module in Education. Working from the perspective of the "typical first year student" as a proto-persona, we redesigned the learning management system interface, assessment plan, and support strategies offered to students. We report on students' experiences of the module in terms of these three themes and discuss the implications for using human-centred design approach as a pedagogical tool and discuss ideas for further research.

Keywords: *Human-centred design, Design thinking, student-centred learning, UX design, commitment, mentoring.*

1. Introduction

Worldwide, education has seen significant transformation in the past three years. First, the Covid-19 pandemic, then ChatGPT at the end of 2022 forced educators to reconsider their teaching practices while simultaneously grappling with the impact of Society 5.0 on the purpose of education. Students in the first year of university must learn to adapt to the demands of university and many drop out in the second year.

Early identification is viewed as an important strategy to prevent early exits (Alyahyan & Düstegör, 2020). Significant strides have been made with widening access to education, but as Mishra (2020) points out, inequality continues to be an important problem for institutions with first-generation students and those with a migration background who are at a higher risk of dropping out (Miner-Romanoff, 2023). In recent years, education systems at all levels worldwide have reported challenges with declining success rates (Megbowon et al., 2023).

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South Africa's education system in particular is vulnerable and school leavers' preparedness for further studies is often questioned (Soudien et al., 2022). The Covid-19 pandemic seems to have intensified this problem (Dorn et al., 2021). Some of the factors that impact on student success in the first year include difficulty *adapting* to the demands of university (Cameron & Rideout, 2020), *teacher-student relationships* (Human-Vogel & Mahlangu, 2009; Hagenauer et al., 2023), *self-regulation and commitment* (Human-Vogel, 2013), *personal identity* (Human-Vogel, 2008). Dropping out of university is the outcome of a mix of individual, institutional and economic factors (Aina et al., 2022).

One of the institutional responses to some of these challenges has been to focus on the role of learning management systems to promote student engagement (Veluvali & Surisetti, 2022). The migration to online delivery during the Covid-19 pandemic and thereafter transformed the teaching and learning space from a physical, synchronous space, to what (Dalgarno, 2014; 2015) described as a mixed, polysynchronous space years before. For a while now the use of hybrid teaching and learning strategies were opening new possibilities for designing *personalised* learning environments (Zhao & Watterston, 2021) that respond to the *diverse needs* of students (Robertson et al., 2018) and to encourage *deep learning* (Czerkawski, 2014). It requires universities to develop new pedagogies for effective teaching and learning, but we know that promoting active student engagement in hybrid environments is not that easy and can be hampered by a lack of innovation in teaching at universities (Børte et al., 2020). The Covid-19 pandemic showed that many educators were unprepared to migrate their courses to online learning environment (Adedoyin & Soykan, 2020). One of the reasons is that few educators understand how the design of learning in a digital environment transforms the learning experience for students and how to maintain a teaching presence in an online environment (Garrison, 2007). Because teaching is a complex activity drawing on many interrelated fields of expertise, and considering that educators are essentially designers of learning opportunities, Garreta-Domingo, Sloep and Hernández-Leo (2018) argue that educators can benefit from incorporating human-centred design practices into their teaching practice.

There are many different descriptions of human-centred design but what most of them have in common, is a goal-oriented process that involves developing an empathic understanding of the student's needs by listening to them, observing and empathising with them, or to create personas (Gualtieri, 2009). It is also a key aspect of user-experience design (UX design). In the present paper, we investigate how a human-centred design approach to curriculum development might lead to better student engagement and success to improve the student success rate of a first-year Education module offered at a South African university by using proto-personas as a basis for design. The project forms part of a collaboration with Carl von Ossietsky Oldenburg University (see Oldenburg & Hillenbrand in this volume).

2. Methodology

2.1 Research context

The research sample consisted of first-year students in Education from diverse socio-economic and language backgrounds and varying degrees of academic preparedness for university studies. Students' school backgrounds range from private well-resourced schools, to under-resourced schools that do not charge school fees. Our Faculty is large (approximately 9000 contact and distance education students) with large first-year classes consisting of multiple groups ranging from small (n ~ 50) to large groups (n ~ 350). We follow a hybrid teaching and learning model with both contact and online teaching, and we present the module using the Blackboard learning management system (LMS). The module we report on manifested a decline in the module pass rate – as the proxy for student success – from 88,6% in 2019 to 73.8% in 2021.

2.2. Research design

We used a qualitative and interpretivist lens (Denzin & Lincoln, 2018) and embedded our human-centred design into an action research framework (Cohen *et al*., 2017) comprising one cycle of observation, planning, action, reflection, and evaluation. The study is part of a project focusing on human-centred design to ensure meaningful engagement and student success, and prior ethical clearance was in place. We collected data from 998 first-year students by means of a semi-structured, open-ended online questionnaire. In the present study we report on selected themes from the qualitative data using Braun and Clarke's (2013) approach to thematic analysis.

2.3. Barriers to student success

Understanding the context of our typical first-year student, we identified several barriers that were likely contributing to declining student success in the module. Firstly, learning in an online environment with an LMS requires network connectivity and access to suitable devices which not all students have. The LMS environment also requires a degree of computer literacy and readiness that not all students had, so the design of the LMS interface was an important consideration that impacted students' ability to engage with coursework, manage their time and complete assessments. Our institutional teaching and learning model emphasizes preparation prior to class attendance, which unintentionally led to a higher assessment workload. The intention was to ensure that students engage with the module content before class, but the result was that students spent too much time focused on assessment rather than actually preparing and engaging.

2.4 Human-centred design

From what we have observed regarding the challenges first-year students face, we attempted to develop an empathic understanding of the typical first-year student as our proto-persona by

using LMS data to (i) identify barriers to student success and (ii) to consider student engagement data to formulate hypotheses for what a human-centred curriculum prototype might look like. Coupled with student feedback, we then redesigned the LMS interface to accommodate varying levels of preparedness for university studies, computer literacy and motivation. It was important to accommodate a more flexible design in the module. Considering the barriers to student success for a typical first-year student, we redesigned the module by focusing on the following areas, namely (i) LMS interface, (ii) assessment load, (iii) student support and communication.

3. Results

3.1 LMS design changes

Regarding the *LMS Interface*, we streamlined the module content into more manageable sections, organising it under weekly folders with step-by-step activities to prepare, engage with content, and consolidate their knowledge. We used scaffolding activities for assessments and to facilitate the application of theory into practice. Comprehensive slide presentations of each week were available under folders. In virtual class sessions (synchronous learning) we used group work within online breakout groups, group presentations, and participation in discussion boards. Virtual classes were recorded for flexible access for those students who could not be in class. Students agreed that *the live sessions were [sic] helped me to interact with the lecturers and fellow students during those sessions*; *we participated in the live sessions and that it was not just a listening session but also a participate session*. One student emphasised the importance of attending the live WHY (We Help You) support sessions and stated that *these sessions helped a lot to complete my exam assignment*. The same respondent emphasized that *when I was misunderstanding something while working on the assignment, I was returning back to the recoding and listen on [sic] what to do so that I can complete the task that was confusing me.* A respondent asserted that *attending classes on daily [sic] basis and watching recorded lectures when I couldn't get to class really helped me a lot*.

3.2 Assessment approach

In terms of the *assessment* plan, we allocated 70% of the final mark to continuous assessment (formative assessment and feedback) and 30% to summative assessment and feedback. We reduced the number of online quizzes and replaced the online semester test with assignments that could be completed more flexibly. Students learned to apply the theory to practice through case studies and assignments intended to stimulate deep learning. One of the students said that *having continuous assessments and a portfolio instead of an exam as exams basically reflect what a student can memories [sic] the night before but continuous assessments accurately reflect if a student is understanding something or not and can be helped earlier then [sic] rather the week before the exam*. Assignments were available under the consolidate folder together with comprehensive planning and completion guidelines, assessment criteria and rubrics.

Students were given more flexibility to complete formative assignments in a week, and the summative assignment in three weeks. One student appreciated *the fact that we had sufficient time to complete assignments - and get clarity on what is* [sic] *expected of us.* Students received comprehensive feedback on assessments. Students noted that s*he will give feedback on what you have written to give one a heads up on what to improve in* [sic] *or if one is doing good.*

3.3 Student support and communication

Support included individual online tutor sessions, after-hours content support sessions and instituted two intervention weeks to assist students with preparation for the semester assignment and the examination portfolio. We monitored progress by contacting students via email and telephone calls. National and international motivational speakers were invited to inspire students during challenging times. Students could use a Google form for suggestions to improve the module, and all staff were prepared to respond to students empathically. A human-centred approach focuses on creating a positive and supportive learning environment that meets the needs of students.

One student indicated that *my lecturer was one of the best I ever had. She was supportive, helpful and cared about the whole classes [sic] emotional, physical wellbeing*. Another felt that *my lecturer was a very loving and patient lecture [sic]. Her time and commitment to me, us and a class [sic] worked for me in this module*. Another respondent emphasized *how helpful the lecturer was, she would relate to us a lot which made us seem that we aren't [sic] alone because online learning can be difficult especially for first year [sic students*.

The peer interaction that groupwork provided enhanced students' need for social interaction and learning and they reported that *you get teamwork skills enhanced and can see from peers how to improve the standard of your work.* A further student remarked that *the discussion board activities and in-class activities contributed to my learning and development by pushing me to think about the work and how I understand it.* This was confirmed by a student who said that *the discussion board helped in terms of helping me understand better and creating friends in the online learning platform*.

4. Discussion

The module pass rate improved from 73.8% in 2021 to 88.6% in 2023 and while we acknowledge that factors other than the design of the module may have contributed to this improvement, the feedback from students clearly indicates that they valued the focus on accessibility, support and communication. The changed design of the LMS interface increased accessibility and student engagement. Refining the module content with scaffolding activities facilitated a more student-friendly experience. Replacing timed quizzes to flexible assignments

as part of continuous assessment, received positive feedback and prioritized deep learning in favour of memorization, while providing opportunities for developing writing skills.

Our use of proto-personas helped to ensure that our design better addressed the needs of first-year students, but this "lightweight approach" must be followed up with the development of personas based on student-data (Garreta-Domingo & Hernandez-Leo, 2018), and the development of design prototypes that can be tested more objectively, such as with eye-tracking devices. Zhao and Watterston (2021) argue that education in the post-covid era should be more developmental and personalized and our pedagogy should be more student-centred and purposeful, especially because the recent accelerated the adoption of artificial intelligence by students and educators has transformed how we teach and learn and requires a reconsideration of what actually needs to be assessed. (Lo, 2023).

In general, education practices have transformed radically over three short years, and we think it is very likely that today's students are very different to those who had just graduated from our institutions. Using a design approach to curriculum design necessitates a better understanding of who our "users" are, so we can better accommodate their needs and personalise modules to lead to meaningful learning. Co-designing with students could contribute to such personalised learning experiences, more meaningful learning and greater academic commitment. Zhao and Watterston (2021) urge us to make bold changes to our curricula, pedagogy and how we organize learning experiences. We think that a human-centred design approach can transform educators's pedagogical practices by entrenching a design mindset and ensuring a personalized, student-centred approach to education.

Our study contributes to discourses addressing current challenges in education, particularly teacher education, in what some call Society 5.0 (Tavares, Azevedo, & Marques, 2022). Ensuring student success requires a different approach to the design of learning experiences. Existing pedagogical practices have to evolve to ensure we remain a human-centred and sustainable society amid rapid technological change. We think that a human-centred design approach can be a valuable transformative tool to navigate the complexities of teaching and learning in a complex world.

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The Quid Sapienza model: methods, tools and quality in the innovation of university teaching 4.0

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Abstract

The paper presents the approach adopted by Sapienza University to guide its professors through didactic transformation, analysing findings from a 2022 survey involving 465 professors who participated in the project on the Quality of Educational Innovation (Quid). The data have been analysed to identify commonly used teaching methods and learning strategies related to three approaches outlined in the theoretical framework (constructionist, interactionist, and socio-cultural approach). The results are also discussed in light of limits and critical issues on innovative didactics and digital transformation that emerged from interviews with figures responsible for innovative teaching projects in selected Italian and European universities. Digital transformation in the academic field does not imply introducing one digital or multimedia tool over another. Instead, it involves a cultural redefinition of the training objectives of the university system, recognising its potential in the face of social and cultural transformations in this millennium. The paper is also part of the studies conducted within the European Virtual Auditorium project (ERASMUS-EDU-2023-PI-FORWARD-LOT1; 2024-2027) on the evolution of innovative teaching.

Keywords: *digital transformation; didactic innovation projects; innovative didactics; used teaching methods; learning strategies.*

1. Introduction

Sapienza University of Rome was among the first Italian universities to promote a working group and a project on the Quality of Educational Innovation (Quid). Over the last six years, the Quid initiative has dedicated resources to training Sapienza University's faculty through a compulsory two-year program to cultivate expertise in educational innovation. A total of 555 newly recruited researchers actively participated in various biennial editions. The project, which includes participant observation of the applied teaching methods, working group discussions

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and training sessions, has registered an average annual increase in participation of +29.8%. Concurrently, Quid continues to offer ongoing training accessible to all 3,576 professors.

The primary objectives of the Quid project revolve around establishing a community of professors proficient in maintaining elevated standards of student education, ensuring a continuous evolution of effective and efficient teaching methodologies, and advocating for the integration of technological resources. These objectives are recognised as pivotal in facilitating the successful implementation of student-centred approaches.

The initiative operates on two foundational assumptions concerning its commitment to educational innovation within this context. Firstly, it acknowledges blended learning methods as complementary rather than substitutive to traditional and in-person teaching. Secondly, the project asserts that technologies support innovative teaching methods; however, more than the sole use of technology is required to guarantee the quality of teaching.

Considering these two assumptions, the paper delves into the approach adopted by Sapienza University to guide its professors through didactic transformation. This guidance aims to optimize the utilization of new technologies in teaching and learning activities. Specifically, the paper pursues two primary objectives: 1) identification of commonly used teaching methods and learning strategies aligned with the three approaches outlined in the theoretical framework (constructionist, interactionist, and socio-cultural approach); 2) an evaluation of the university's provision of adequate support to its professors in light of the continual opportunities and potential limitations presented by technologies. Additionally, it seeks to understand the university's perspective on potential future developments in the digital transition or transformation (Casalino et al., 2021; Ceravolo, et al., 2023; Hölscher et al., 2018).

2. Theoretical framework

As Al Rawashdeh et al. (2021) and Aditya et al. (2022) propose, the technological evolution in the education field constitutes a complex, dynamic, and ever-evolving system that necessitates a long-term strategy. Therefore, no one correct approach exists; instead, embracing a perspective of continual experimentation capable of progressing over time and offering flexible solutions is advisable. Notably, contemporary educational approaches endorse a holistic viewpoint, suggesting the integration of insights derived from various pedagogical perspectives, including the constructivist, interactionist, and socio-cultural approaches (Nguwi, 2023).

The first approach, the constructivist one, is grounded in the psycho-social approach (Inhelder, 1966; Vygotsky & Cole, 1978) and underscores the significance of education as a mode of knowledge construction, favouring the development of critical thinking. This approach employs formulating and verifying hypotheses through experiments, such as problem-solving (Omodan & Tsotetsi, 2020). The most advanced technological modality is offered by transformative

learning facilitated by immersive experiences, for instance from virtual reality (VR) and augmented reality (AR). Another effective method is the flipped classroom.

The second approach, the interactionist one, forms the foundation of collaborative learning, concentrating on collaboration among students in teams, both within and outside the classroom, to engage in debate, group work, peer review, brainstorming, and gamification activities. Given the recent integration of AI in gamification, some scholars suggest emphasising not only the results of tasks but also the value of creativity that students must employ to achieve the outcome (Nguwi, 2023).

The third approach, the socio-cultural one, directs attention to influences dependent on context, institution, and students' socio-cultural and relational characteristics. From the socio-cultural perspective, the technology leverages the creation of personalised learning environments tailored to the context, such as the use of dedicated digital platforms for learning, often combined with social networks, chat, and messengers to foster a sense of belonging to the learning community.

These three approaches encompass a variety of teaching styles, understood as a set of didactic strategies that educators employ by combining or prioritising various codes (verbal, iconic, kinesthetic), more or less directive communicative modes, and individual or group. In turn, teaching styles or strategies intertwine with diverse learning styles, both in the sense of promoting and being influenced by them, with consequences on learning outcomes (Prosser et al., 2003). However, Zhang et al. (2022) demonstrate that current educational systems are ill-equipped to meet the evolving needs of training and learning, especially in terms of digital transformation. Indeed, there are several structural, prospective, methodological, and ethical issues that we will discuss in the conclusions.

3. Methodology

This study aims to comprehend how Quid contributes, within Sapienza University, to raising awareness among its professors to adopt innovative teaching and learning methodologies, experimenting with practices and technologies with the perspective of continually improving the quality of student education. Another goal is to foster a common, widespread, and shared culture of teaching quality that avoids deviations and cultivates good practices in a balanced manner, attentive to the needs and characteristics of its students. For this reason, this paper presents some results related to adopting commonly used teaching methods and learning strategies. This paper builds upon findings from a 2022 survey involving 465 professors who participated in the first four editions of Quid. The data have been analysed to identify the redesigned model of certain Quid activities aimed at situating professorial training within the latest scientific and cultural debate on the digital transformation of education. The outcomes of these actions will shape the future decisions of the university's governance concerning the

approach to teaching in the coming years, considering technological, ethical, and methodological interventions to support professors and students.

We have conducted a mono and bivariate analysis of the collected data. Subsequently, a linear regression analysis utilising the Pearson regression coefficient (r), ranging from -1 to 1, was performed to assess the significance of applying methods, strategies, and tools in relation to disciplinary macro-sectors. This analysis aimed to determine whether noteworthy differences exist among educators in different scientific domains. Moreover, the regression analysis was extended to explore the relationship between variables (RI). This extension sought to elucidate the degree of linearity between teaching perspectives (DTPI) and the ensuing teaching and learning strategies (TLSI). The objective was to understand how much the former influences the latter. This investigation aimed to ascertain whether and to what extent teaching innovation, encompassing both pedagogical perspectives and training strategies, is facilitated by digital transformation.

4. Outcomes

Considering the theoretical framework discussed above, we have examined the position of professors who participated in Quid regarding the use of pedagogical perspectives, teaching and learning strategies, and technology usage. Firstly (see Table 1), in adopting a holistic perspective, there is a significant prevalence of the constructivist perspective underlying the most utilised teaching methodologies.

Table 1. The impact of pedagogical perspectives in innovative holistic methodology. Source: Sapienza (2022). MR% (Multiple Responses %).

The prevailing approach (DTPI):	**Health area**	**Scientific area**	**Sociopolitical area**	**Humanistic area**	**TOT.**
Constructionist	**50,2%**	**37,4%**	**27,2%**	**31,6%**	**36,6%**
Interactionist	21,7%	20,3%	**26,8%**	**27,7%**	**24,1%**
Socio-cultural	18,6%	22,8%	**27,8%**	**25,9%**	**23,8%**
Hybrid	9,5%	19,5%	18,0%	14,8%	**15,5%**
TOT. RESPONDENTS	**35,9%**	**31,5%**	**19,6%**	**13,0%**	***465***
(r)	**0.977**	**0.997**	**0.983**	**0.996**	

Respondents preferred the flipped classroom, mainly in the hard sciences, coupled with problem-solving activities and case analysis to foster critical thinking. In the socio-political and humanistic areas, a combination of perspectives emerges, with a prevalence of the constructivist perspective in the humanistic field and the socio-cultural perspective in the socio-political field. This increased heterogeneity also leads to more experimentation with interactive learning

strategies. Overall, it is evident that Quid contributes to stimulating the experimentation of diversified methodologies in favour of teaching quality.

The more diversified the experimentation with teaching practices, the more it fosters the adoption of student-centred teaching and learning strategies. Across disciplinary areas (see Table 2), professors highlight an evident prevalence of adopting interactive transmission strategies. However, in the humanities field, many educators still prefer dialogic transmission strategies (as indicated by low linearity (r=0.91). We observe the same trend in the medical field, although to a lesser extent. In the scientific and socio-political areas, on the other hand, professors are more inclined to use collaborative strategies in addition to interactive ones.

Table 2. The adoption of key teaching and learning strategies. Source: Sapienza (2022). MR%

Teaching and Learning Strategies (TLSI):	**Health area**	**Scientific area**	**Sociopolitical area**	**Humanistic area**	**TOT.**
Trasmissive-dialogical strategy	**29,2%**	26,8%	28,7%	**32,8%**	**29,1%**
Interactive transmission strategy	**42,2%**	**41,0%**	**40,6%**	**44,3%**	**41,4%**
Collaborative-innovative strategy	28,6%	**32,2%**	**30,7%**	22,9%	**29,5%**
TOT. RESPONDENTS	**33,2%**	**32,0%**	**21,7%**	**13,1%**	**465**
(r)	0.999	0.998	0.999	0.091	
RI (DTPI x TLSI) = 0.949					

The study, however, also highlights some critical issues emerging from the relationship among the examined variables. The constraints of digital transformation limit opportunities to combine interactive and collaborative strategies (RI = 0.926). For this reason, they tend to anchor professors' teaching approach to specific methodological perspectives rather than expand their experimentation (RI = 0.804).

In this regard, it is understandable that Quid has decided to modify it, unlike its approach until 2023. Traditionally, the training of professors entering Sapienza is organised over two years. In the first year, professors work in small groups (3-4 individuals from different disciplinary areas), observing their teaching activities and discussing and experimenting with teaching and learning methods and strategies. In the second year, before the approach changed, they were organised into larger groups within their disciplinary area to compare their teaching experiences and individually reorganise their teachings. The new organisation envisages that, during the second year, irrespective of their disciplinary area, they, in addition to individual interventions, contribute to delving into specific issues to identify solutions and proposals that they will present to the University's governance.

Among the discussion topics, updated in each biennial edition of Quid, are those concerning digital transformation to examine opportunities and limitations, the review of teaching and evaluative methods considering not only emerging technologies but also the value of interdisciplinarity, the expansion of educational experiences in other national and international contexts, the use of micro-credentials in university education, and examining how better to enhance the virtuous relationship between teaching and research. All these aspects allow for a more comprehensive view of transformation from a technological perspective and teaching and learning methods.

Furthermore, this year, the University has specifically modified the questionnaire track for evaluating the teaching activities of professors and students to identify teaching methods and strategies and track which tools are most used and which are most requested to facilitate more interactive and collaborative activities. Therefore, it will be possible from next year to contemplate such an extensive audience, encompassing all professors and students of the University on these aspects. However, this is an essential signal of the governance's attention to these aspects.

5. Discussion and Conclusion

Beyond the survey, a section of the research delves into national and European landscapes through interviews with figures responsible for innovative teaching projects. In Italy, the study investigated nine out of ten so-called mega-universities (with over 40,000 students) (Milan, Turin, Padua, Bologna, Florence, Pisa, Naples Federico II, and Sapienza). Each of these institutions has dedicated training projects, albeit with distinct organisational characteristics, and some results have been discussed in Valentini & Mazza (2023). The European comparison has been extending to other universities (Free University of Brussels, University of Tübingen, Autonomous University of Madrid, Aix-Marseille Université, University of Stockholm, Paris Lodron Universität Salzburg, UNIL | Université de Lausanne) chosen for their affiliation with the CIVIS network, Europe's Civic University Alliance to which Sapienza is joined, funded by the European Commission.

From these studies and literature review, essential insights have emerged on optimizing digital transformation to enhance interactive and collaborative educational strategies. In summary, four critical dimensions respond to the main issues derived from scientific literature not presented in the theoretical framework due to space constraints.

At the **structural level**, figures responsible for innovative teaching projects emphasize universities' need to support the transformation of educational processes. This support involves intensified training, particularly for strengthening digital skills (some universities have established dedicated centres for this purpose) and implementing policies that support professors while recognising their efforts. However, emerging applicative limits from technical

issues related to privacy, security, and insufficient support infrastructure have also been identified (Dahalan et al., 2023).

At the **prospective level**, there is a clear consensus among interviewees and in the literature on advocating student-centred educational models in universities. While the overall approach is not in question, there is a need for focused attention to overcome cultural, social, and digital barriers. This is essential to ensure full accessibility and inclusivity for all students, with a greater emphasis on designing learning and teaching models that cater to diverse student needs.

At the **methodological level**, suggestions have emerged for increased student involvement in teaching activities (e.g., through strategies like flipped classrooms and gamification) and in the design phases. This enhances teaching effectiveness and improves relationships between professors and students (Perry et al., 2023). Another crucial aspect is the potential to mitigate plagiarism risks by leveraging innovative technological tools to enhance creative aspects (Sharples, 2022).

Finally, at **the ethical level**, an interesting proposal arising from interviews is the introduction of digital ethics courses into university study programs. This aims to promote greater awareness regarding the boundaries between lawful and unlawful practices concerning plagiarism in university classrooms and subsequent work activities.

Considering professors' positioning regarding teaching methods based on pedagogical perspectives, teaching and learning strategies, and technology use, alongside the briefly mentioned limits and critical issues, the overall perspective goes beyond introducing one digital or multimedia tool over another. Instead, it involves a cultural redefinition of the training objectives of the university system, recognising its potential in the face of social and cultural transformations in this millennium. The goal is to understand and anticipate the necessary changes and the paths to be taken. Future research will delve deeper into adopting teaching and learning strategies and the impact of pedagogical perspectives in the European University of the CIVIS network to achieve this goal better.

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An investigation of the antecedents of entrepreneurial mindset and intention among university students: An emerging market study

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Abstract

The present research aims to investigate the key antecedents of entrepreneurial intention among university students in an emerging market (i.e., Morocco). To do so, we propose and test an integrated framework combining the theory of planned behavior (TPB) with other constructs from prior literature. The proposed conceptual model was assessed using a sample of 408 Moroccan university students and data is analysed using the partial least squares (PLS) estimation. Our findings convey that students' attitudes toward entrepreneurship is a key driver of their entrepreneurial intention. We also demonstrate that attitude toward entrepreneurship is mainly influenced by entrepreneurial education and students' personality traits. Finally, risk-taking propensity and entrepreneurial motivation were found to moderate the relationship between students' attitudes towards entrepreneurship and their intention to become entrepreneurs. Our findings suggest valuable insights to universities, policymakers, and instructors.

Keywords: *Moroccan University students, Attitudes toward entrepreneurship, entrepreneurial education, personality traits, entrepreneurial motivation, risk-taking propensity.*

1. Introduction

Nowadays, one of the most crucial objectives of governments is identifying the factors of economic growth remains. One of the factors is entrepreneurship which is acknowledged as a key driver of a country's economic growth as it boosts employment opportunities, reduces poverty, and enhances individual autonomy (Aljarodi et al., 2022; Y. H. Al-Mamary & Alshallaqi, 2022; Elnadi & Gheith, 2021). Since entrepreneurship is an essential aspect of any nation's economic and social development, there are calls for greater practical and empirical

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research into the variables that affect entrepreneurial intent (Barnir et al., 2011; Kraus et al., 2020). Morocco as well is aware of the critical part that entrepreneurship plays in its economic and social growth. The Moroccan government has put in place several policies and initiatives to encourage entrepreneurship and foster an environment that is favorable to it (Zeinab HMAMA, 2022). Despite these efforts, the level of entrepreneurship in Morocco is still very low, so it is important to identify the variables that affect students' intentions to start their own businesses (Lormeus, 2019). The current research aims to explore the factors influencing entrepreneurial intentions among university students in Morocco. Since it has become essential to understand the underlying drivers of entrepreneurial mindset, the study seeks to provide valuable insights for policymakers, educators, and stakeholders in designing effective strategies to foster entrepreneurship expected support system. Based on the above discussion, we developed the following research questions:

RQ1. What are the key antecedents of attitude towards entrepreneurship among Moroccan university students?

RQ2. Does attitude towards entrepreneurship positively affect the entrepreneurial intention among Moroccan university students?

RQ3. Do risk-taking propensity & entrepreneurial motivation moderate the linkage between students' attitude & intention to become entrepreneurs?

The findings of this study can provide policymakers with a better understanding of the factors that influence students' entrepreneurial intention, hence, promote entrepreneurship in Morocco. By identifying the major influencing variables that are most strongly associated with entrepreneurial education, personality traits, entrepreneurial attitude, entrepreneurial motivation, and risk-taking propensity they can focus their efforts on enhancing these variables to promote students' entrepreneurial intention. The study highlights the importance of entrepreneurial motivation and risk-taking propensity as moderators in the relationship between students' attitudes toward entrepreneurship and their entrepreneurial intention. The insights gained from this research can prove highly beneficial for government officials seeking to promote entrepreneurship development which will help the government achieve its economic expansion goal. These outcomes may guide the creation of policies tailored to stimulate students' entrepreneurial attitude thus their intention to launch their own business. The findings collected in this investigation could guide educators and lecturers to identify these impactful variables to contribute to building students' entrepreneurial attitude. Adopting such measures can increase the significance of university involvement and contribution to help these students become the entrepreneur they want, while also instilling a high-quality educational program.

2. Theoretical background

2.1. Theoretical foundations

Entrepreneurship researchers have long researched people's intentions to start their own businesses (Gieure et al., 2020). To investigate the relationship between attitude, intention and behavior, this study uses the (TPB) model put forth by (Ajzen, 1985, 1991). According to the (TPB) Ajzen (1991), behavior's primary predecessor is the intention, wherein intention refers to how much work a person intends to put into engaging in that at behavior (Entrialgo & Iglesias, 2016). (TPB) has demonstrated reliability in predicting entrepreneurial intent Kautonen et al. (2015), and many researchers have confirmed it (Almobaireek & Manolova, 2012; Renata et al., 2018). Wenzel & Kerber (2016) carried out an experimental study to look at how social norms influence business decisions and discovered that (TPB) factors played a role in the connection between social norms and entrepreneurial intentions and conduct. Liñán & Chen (2009) created and approved a unique tool to assess entrepreneurial intentions across cultural boundaries. They discovered that the most reliable predictors of entrepreneurial intents were the Theory of planned behaviour factors (subjective norms, perceived control of behaviour, and attitude).

2.2. Hypotheses

According to Fayolle (2006), entrepreneurship education refers to any educational program that teaches entrepreneurial concepts. Entrepreneurship education focuses on increasing entrepreneurial-related information, skills, and personal characteristics (Cui et al., 2019; Yuan & Wu, 2020). Many countries have recently developed policies to support entrepreneurship by providing curricula for all levels of education from primary to tertiary level (Głodowska et al., 2019). Most universities aim at increasing the number of young entrepreneurs and raise awareness of the importance of entrepreneurial skills (Bergfeld & Weber, 2011; Garavan & O′ Cinneide, 1994). Handayati et al. (2020) argued that the entrepreneurial attitude is created through entrepreneurship education. According to earlier research, attitude toward entrepreneurship and entrepreneurial education are positively related (Jiatong et al., 2021; Pfeifer et al., 2016; Saptono et al., 2020). Building on the above, you can hypothesize that:

H1: Entrepreneurial education positively affects students' attitudes toward entrepreneurship.

Since entrepreneurship education and service learning have similar goals, it is not unexpected that service learning is among the most popular teaching strategies used in these courses. Application of the course material in service-learning assists students in understanding the information because it connects concepts with their observations and experiences (Litzky et al., 2010; Wessel & Godshalk, 2004). Moreover, Den Hartog et al. (2014) discovered a positive relationship between attitudes toward entrepreneurship and service learning in their study

because service learning can support the development of an entrepreneurial attitude by giving students the chance to work with entrepreneurs and SMEs. Based on the above discussion, we developed the following hypothesis:

H2: Service Learning positively affects students' attitudes toward entrepreneurship.

Entrepreneurial parents persuade their progeny that an entrepreneurial profession is desirable by fostering an atmosphere that has a significant impact on the personal traits of their kids (Mathews & Moser, 1995; Zapkau et al., 2015). Discussions and conversations with parents give people knowledge about job options and, as a result, have a substantial impact on what their kids want to do with their careers (van Auken et al., 2006). Thus, Children learn informal techniques and ability from their entrepreneurial parents. This human capital increases the descendants' confidence in their ability to carry out the duties necessary to launch a firm(Chlosta et al., 2012). As a result, growing up with entrepreneurial parents influences their kids' attitudes towards entrepreneurship (Carr & Sequeira, 2007). Hence, having enterprising parents who serve as role models is likely to promote an attitude toward entrepreneurship (Lančarič et al., 2017). Therefore, based on the above, we hypothesize that:

H3: Parental norms positively affect students' attitudes towards entrepreneurship.

Personality traits refer to permanent patterns of ideas, emotions, and behaviors that define people through time and in various contexts (Löckenhoff & De Fruyt, 2015). Also, personality traits are described by (American Psychological Association., 2019) as "persistent patterns of thought, mood, motivation, and action that are displayed in various contexts and over time. "A popular system for classifying personal traits is the "Big Five" (Antoncic et al., 2015). According to Zhao & Seibert (2006), Entrepreneurs are shown to be more open to new experiences, sociably average, have more conscientiousness, be more disagreeable, and be less anxious (or in the Big-5 jargon, O+, C+, E, A -, N -). So, based on the above we can hypothesize that:

H4: Personality traits positively affect students' attitudes toward entrepreneurship.

Financial literacy is the set of necessary knowledge to make smart financial decisions (Zhang & Yang, 2021). Financial literacy has received a lot of attention from society, professionals, and policymakers since it promotes social values and economic expansion (Goyal & Kumar, 2021; Huston, 2010). The functions of entrepreneurs can be well-nourished through sound financial management (Joyce & Gomathi, 2010; Wise, 2013). According to Brown et al. (2006), a fundamental aspect of being a successful entrepreneur is those who mastered financial literacy. On the other hand, Abubakar (2015) stated that poor financial literacy may cause losses and firm closures. As a result, having a solid foundation in financial literacy is an important factor in increasing attitude towards entrepreneurship (Abubakar, 2015; Huseyin Y., 2011). Afriyie & Osei-Fosu (2020); Arinaitwe & Kajumba (2021) and Kim & Lyons (2011) found that financial

literacy is positively related to entrepreneurial attitude. Accordingly, we propose the following hypothesis:

H5: Financial literacy positively impacts students' attitudes towards entrepreneurship.

The theory of planned behavior (TPB) is a frequently used expectancy-value theory of attitude-behavior interactions that has had some effectiveness in forecasting a range of behaviors (Armitage & Conner, 2001; Cheng & Chu, 2014). According to (TPB), a person's intention to engage in behavior increases as he or she feels good about it (Chetioui et al., 2021). Within the framework of the present study, attitude is defined as the extent to which entrepreneurial practices and outcomes are perceived as meaningful, useful, and positive (Jena, 2020). Several studies supported the connection between attitude towards entrepreneurship and entrepreneurial intention (Duong et al., 2022; Nowiński et al., 2020). Furthermore, most empirical studies identified it as the best predictor of entrepreneurial intention (Fayolle & Gailly, 2015). Building on the above, we can hypothesize that:

H6: Students' attitude toward entrepreneurship positively affects their entrepreneurial intention.

Entrepreneurial motivation is strategies and approaches that are used to motivate entrepreneurs to pursue their objectives and make accomplishments in their companies (Rueda-De-León, 2020). Entrepreneurial motivation is also the internal forces that drive behavior and external forces that can serve as an encouragement to behavior (Locke & Latham, 2004). Entrepreneurs' impressions of their surroundings and their own skills impact their level of entrepreneurial motivation (Estay et al., 2013). Several researchers have demonstrated that entrepreneurial motivation moderates the relationship between attitude toward entrepreneurship and intention to become an entrepreneur (Barba-Sánchez & Atienza-Sahuquillo, 2017; Hassan et al., 2021; Lang & Liu, 2019). Hence, we made the following hypothesis:

H7: Entrepreneurial motivation positively moderates the relationship between students' attitudes toward entrepreneurship and their entrepreneurial intention.

As described by Ibrahim & Salleh (2011), the predisposition of a person to accept a specific degree of risk associated with one's business enterprise, particularly while making a business decision is a risk-taking propensity. When faced with precarious situations, a person's propensity to take risks relates to how probable it is that they will be risk-taking or risk-averse (Gurel et al., 2021). According to Gurel et al. (2021), some personality qualities serve to define and inspire entrepreneurial intention. In this regard, the desire to start a business is impacted by personality qualities including a propensity for taking risks. Studies specifically looking at student selection reveal that students with attitude towards entrepreneurship much higher on risk-taking than students without an entrepreneurial attitude (Ertuna & Gurel, 2011; Gurel et al., 2021). As a result, we speculate that:

H8: Risk-taking propensity positively moderates the relationship between students' attitudes towards entrepreneurship and their intentions.

Building on the above, the following conceptual model was developed:

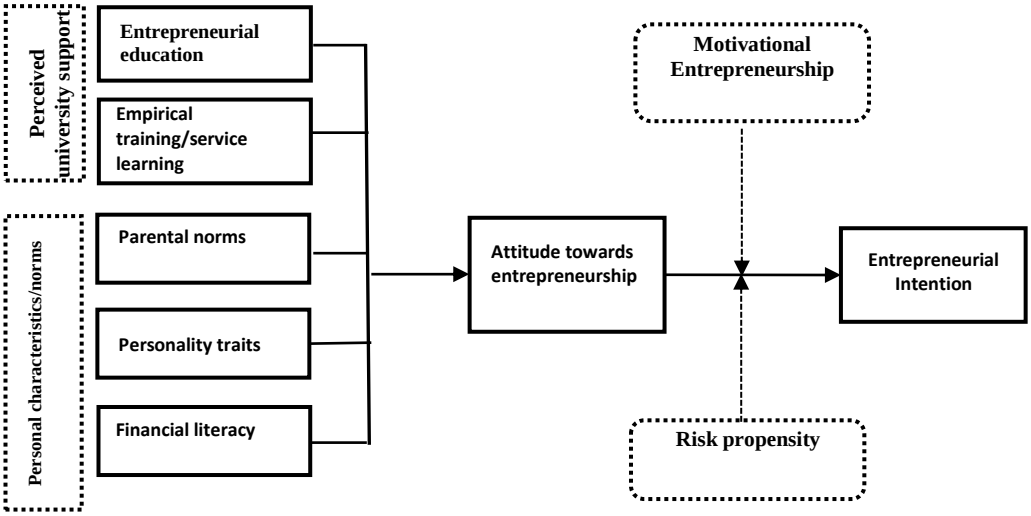


Figure 1. Conceptual model.

3. Methods

3.1. Procedures

The survey for this study was administered to individuals in Instagram and Facebook groups, allowing users to voluntarily complete it. Snow-ball sampling was used as participants in our study were requested to complete the survey and forward it to others via email or social media platforms. Our sample consisted of university students from Morocco, which is why a filtering question was added to the beginning of the survey to weed out respondents who didn't meet our criteria. A total of 435 respondents successfully filled out the survey over the course of two months (from January to Mars 2023), 27 answers were rejected because they did not fit the criteria for our sample, leaving 408 valid responses to be kept (93.79%). To evaluate reliability, validity, and suitability for testing hypotheses, valid responses were examined.

3.2. Measures

All items were borrowed from prior literature and barely adjusted. Each item was rated on a Likert scale with 1 being the strongest disagreement and 5 being the strongest agreement. At the end of the survey, 5 demographic questions regarding gender, city, education, university,

and concentration were included. The shared survey was in French because Moroccans regularly use it (Chetioui et al, 2021). The items and variables were translated using the back translation technique (Brislin, 1986). The survey was posted online so that it may be distributed through social media and emails. Prior to the structural model test, the measured model was examined for internal consistency, convergent, and discriminant validity.

4. Results

Our sample is made up of 408, with 247 females (60.54%) and 161 men (39.46%). We notice that female responses have outnumbered the males', because women may be more likely than males to share their opinions and experiences, which could be explained by societal or cultural factors such as gender norms that encourage women's enhanced communication and empathy (Dillman et al., 2014). Regarding the city of origin, Casablanca comes in first place with 39.22%, this is understandable given the fact that Casablanca is home to numerous universities and business schools. Rabat came in second with 16.67%, Fes came in third with 6.37%, Tangier came in at 6.13%, Meknes came in at 5.39%, Marrakech came in at 4.90%, Agadir came in at 2.45%, and other cities came in at 16.91%. In terms of education, undergraduates make up the majority of respondents (65%), followed by graduates (31%) and people with further degrees in teaching (4%). Al Akhawayn University students account for 45% of the respondents, with the remaining 25% coming from public universities, 10% from private universities, 8% from business schools, 3% from private institutions of higher learning, 2% from public engineering schools, and 1% from private engineering schools. Regarding the respondents' areas of concentration, 22% are majoring in finance, 17% have a background in marketing, 9% are majoring in management, 5% are majoring in international business, 3% are majoring in economy and logistics, and41% are majoring in other concentrations than business.

4.1. Assessment of the measurement model

Our findings demonstrate that all constructs have Cronbach's alphas (CA) and composite reliabilities (CR) that are more than or equal to 0.7, indicating that the constructs are reliable (Henseler et al., 2009). Loadings should exceed 0.7 in order to evaluate the indicator's reliability (Chin, 1998; Hair et al., 2010; Henseler et al., 2009). Our results suggest that every item loading exceeds 0.7, demonstrating the indicator's reliability. Our data also show that all constructs have average extracted variances (AVEs) greater than 0.5, which ensures convergent validity. For the discriminant validity, only one criterion has been used as recommended by (Hair et al., 2021). The Hetrotrait-Monotrait ratio of correlations (HTMT) criterion was the only factor to evaluate the discriminant validity of the model. Prior literature has extensively utilized the HTMT as a more logical method of evaluating discriminant validity (Lebdaoui & Chetioui, 2020). All values were discovered to be below the cutoff of 0.9, confirming the discriminant validity. Construct reliability, convergent validity, indicator reliability, and discriminant validity

evaluations conveyed satisfactory results, indicating that testing the theoretical model using constructs is possible (the tables are available upon request).

4.2. Assessment of the structural model

To test and evaluate the statistical significance of the path coefficients, this study used the bootstrapping technique, and it involved the generation of 5000 samples from the original data. The determination coefficient (R2) of the latent variables that are endogenous, according to Chin (1998), is a key factor in evaluating the structural model. To be considered moderate, the coefficient of determination (R-square) should be above 0.33 (Chin, 1998). The R-square was 43.7% for Attitude toward Entrepreneurship and 45.97% for the variation in entrepreneurial intention in the conceptual model. In other words, the conceptual model can explain 43.7% of the variance in attitude towards entrepreneurship and 45.97% of the variation in entrepreneurial intention, showing a medium level of explanation for the model.

Table 1 illustrates the main direct effects. First, H1 is supported by the finding that entrepreneurial education significantly improved students' attitudes toward entrepreneurship ($b = 0.247; p<0.05$). Students who have taken entrepreneurship classes at their universities are more likely to adopt positive attitudes toward the field. Moreover, personality traits show the strongest positive impact on Attitude towards entrepreneurship ($b = 0.465$; $p<0.05$) indicating that they can significantly influence an individual's attitude toward entrepreneurship, this way hypothesis 4 is supported. On the other hand, the impact of service learning on students' attitudes toward entrepreneurship was the most insignificant ($b = 0.010$; $p = 0.862$). The statistical analysis's p-value, above the 0.05 pre-set level of significance, suggests that hypothesis H2 is not supported. Student attitudes toward entrepreneurship were not significantly impacted by parental norms ($b = 0.063$; $p = 0.241$). The absence of support for hypothesis H3 is confirmed because the p-value is greater than 0.05. The same is true for financial literacy, which has no significant impact on attitude towards entrepreneurship ($b = 0.047$; $p = 0.268$). As a result of the p-value being higher than 0.05, H5 is not approved. Finally, and as anticipated, students' entrepreneurial intention was positively and significantly impacted by their attitude toward entrepreneurship ($b = 0.379$; $p<0.05$), supporting H6 (see Table 1). Students who perceived entrepreneurship more favorably demonstrated higher levels of entrepreneurial intention. Our results also suggest that personality traits the most impactful variable on attitude toward entrepreneurship, followed by entrepreneurial education. Moreover, attitude toward entrepreneurship has the strongest effect on entrepreneurial intention, followed by risk-taking propensity and then entrepreneurial motivation.

Our findings demonstrate that there entrepreneurial motivation positively moderates the relationship between attitude toward entrepreneurship and students' entrepreneurial intention ($b = 0.301$; $p< 0.05$). In other words, the positive association between attitude toward entrepreneurship and entrepreneurial intention is moderated by entrepreneurial motivation,

supporting H7 and confirming earlier findings (Barba-Sánchez & Atienza-Sahuquillo, 2017; Hassan et al., 2021; Lang & Liu, 2019). Likewise, the results confirm the moderating effect of hypothesis H8 by indicating that Risk-taking propensity moderates the connection between attitude toward entrepreneurship and entrepreneurial intention among university students ($b = 0.116$; $p < 0.05$). Based on the positive coefficient, H8 is supported by the likelihood that university students with higher risk-taking propensities will also have a substantially higher entrepreneurial intention.

Table 1. Direct and indirect effects

Hypotheses	Relationships	Beta	STDEV	T-statistics	P-values
	Direct effects				
H1	Entrepreneurial education -> Attitude towards entrepreneurship	0.247	0.058	4.287	0.000
H2	Service learning -> Attitude towards entrepreneurship	0.010	0.057	0.173	0.862
H3	Parental norms -> Attitude towards entrepreneurship	0.063	0.054	1.174	0.241
H4	Personality traits -> Attitude towards entrepreneurship	0.465	0.045	10.386	0.000
H5	Financial literacy -> Attitude towards entrepreneurship	0.047	0.042	1.109	0.268
H6	Attitude towards entrepreneurship -> Entrepreneurial intention	0.379	0.059	6.462	0.000
	Moderating effect				
H7	Attitude towards entrepreneurship * Entrepreneurial motivation -> Entrepreneurial intention	0.301	0.046	3.591	0.002
H8	Attitude towards entrepreneurship * Risk-taking propensity -> Entrepreneurial intention	0.116	0.042	2.785	0.006

5. Discussion and conclusions

5.1. Theoretical implications

The findings of the study lend credence to several theories about entrepreneurship-related attitudes, education, personality traits, motivation, and risk-taking tendency. The Self-Determination Theory, which focuses on how internal motivation influences how people behave (Liñán & Chen, 2009; Nabi et al., 2017) is supported by the findings presented here. Considering this, students who have strong intrinsic motivation are considerably more likely to have strong entrepreneurial intentions. Also, the human capital theory which confirms that education and training can boost the student's abilities and skills (Becker, 1975; Heckman, 2015), is supported by our findings. Especially, when we found that entrepreneurial education positively affects students' attitude towards entrepreneurship. Moreover, our findings also support the Theory of Planned Behavior (TPB), which holds that a person's intention to engage in a particular behavior is a reliable indicator of that behavior in practice. Thus, students' genuine attitude toward entrepreneurship predicts their entrepreneurial intentions (Krueger & Carsrud, 1993; Liñán & Chen, 2009). Additionally, risk-taking influences a student's intention to start their own business

since we found it as a moderator in our study. Risk-takers consider entrepreneurship as an exciting opportunity for financial prosperity and personal fulfillment and are so more likely to view it favorably (Foss et al., 2013). Finally, our findings also support the social cognitive theory emphasizes teaching, self-efficacy, and individual observational learning (Beauchamp et al., 2019). According to this theory, students are more likely to pursue their entrepreneurial goals if they believe their knowledge and skills may help them achieve the desired results (Lim et al., 2020; Wu et al., 2020).

5.2. Practical implications

First, the research findings validate the importance of entrepreneurial education, which encourages government officials to provide additional funding to universities and colleges in order to guarantee that entrepreneurial education is available to all students. In order to better prepare more university students for their future academic, professional, and personal life, entrepreneurial education should be incorporated into the coherent system of general education in universities. This is because entrepreneurial education helps students improve their attitude toward entrepreneurship. The policymakers will be greatly aided by this study in creating an education system that supports entrepreneurship and promotes development. The chances of launching a business for students who have a great level of entrepreneurial intention are high if the government and non-government organizations give them access to funding, business knowledge, infrastructure, and political and economic assistance. This assistance may inspire more students to build and launch new ventures. Moreover, the study has shown that students with higher entrepreneurial motivation have higher entrepreneurial intentions. Hence, universities should motivate their students through workshops, entrepreneurship competitions, and start-up exhibitions where successful entrepreneurs can guide students at the early stage of their businesses (Barba-Sánchez & Atienza-Sahuquillo, 2018). Furthermore, personality traits have been linked to attitudes toward entrepreneurship, and students' entrepreneurial intentions can be significantly influenced by their personalities. Lecturers can take advantage of the fact that students who are eager to learn are proactive and participate more in entrepreneurship by including those students in entrepreneurial activities. Academicians can also design courses for universities that help students progress their personality qualities.

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The role of career services in sustaining students' perceived employability: a quasi-experimental approach

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Abstract

This study analyses the impact of career advancement and industrial networking initiatives (CAIN) provided by the University's career services on students' perceived employability (PE). Furthermore, the study analyse whether the effectiveness of these kind of career services is shaped by students' gender and degree type. The study employ a quasi-experiment method based on pre-post-test questionnaire, collecting data on 277 students at University of Milano-Bicocca, before and after their participation in career services. The results of non-parametric and parametric analysis show that the career advancement and industrial networking initiatives are effective in developing students' perceived employment chances in the labour market). The results also show that CAIN services are more effective for males than for females, and for students enrolled in no-STEM degrees. In doing this, the study expands research on the role of university in supporting students' PE and university-to-work transitions.

Keywords: *perceived employability; higher education; career services; quasi-experiment*

1. Introduction

Providing employment and sustainable careers for university students is at the heart of EU and national employment strategies, with expectations that higher education should contribute to national economic growth and prepare graduates for a successful transition into the labour market (Anderson &Tomlinson, 2021). Growing attention has focused on the role of perceived employability (PE), so on the perception that students have about their chances of obtaining and maintaining employment after graduation (Quenani et al, 2014). PE represents a critical resource for students, especially in turbulent times, to gain or retain employment and to develop a sustainable career over time (Monteiro et al., 2020; Van Harten et al., 2022). Indeed, students

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who perceive themselves to be more employable in the labour market have proven to make more effective decisions about their development and career perspectives during both studies and work experience, that finally can help them to reach higher professional success (Forrier et al., 2015).

The literature does not sufficiently investigate the role that universities can play in supporting the PE of their students, although recent empirical works highlighted the importance of "work-integrated learning" and extracurricular activities (see, e.g., Jackson & Wilton, 2017), university career and placement services (Padgett & Donald, 2022), and the support received from the teaching staff (Petruziello et al., 2022), in developing skills, abilities and personal resources which could be critical for students' prospective employability and employment chances.

The present study considers co-curricular (or parallel) activities (Jackson & Bridgstock, 2021) which are delivered by the central career services as optional awards. In addition, the study focuses on career advancement and industrial networking (CAIN) initiatives, which are considered particularly promising in supporting university students' perceived employability as they enhance the ecosystem for employability fostering the development of networks of interdependent individuals (students) and organisations (universities and employers) (Snell et al, 2023). Indeed, CAIN differ from other employability activities, as they are designed to give students a chance to directly interact with the employers, get their insights on the expectation of employable graduates and continuously learn through sharing knowledge. However, there appears to be little empirical exploration of the relative effectiveness of CAIN in enhancing students' perceived employability. Furthermore, in addition, studies using quantitative methods have highlighted the limitations of the cross-sectional approach, which cannot explain causal relationships between career services and students' perceived employability. This study adopted a pre-post experimental quantitative approach to experimentally test whether providing CAIN services can enhance students' perceived employability. Moreover, we expecte that gender and the field of the study moderate the effect that CAIN services have on PE.

2. Theoretical Framework

COR theory (Hobfoll et al., 2018) conceptualized PE as a critical resource for university students in managing their transitions and career growth in the labour market. More specifically, students with greater degrees of PE could make more effective decisions about their professional development, be more satisfied and more likely to succeed. Scholars are increasingly interested in understanding the determinants of university students' PE. Researchers usually distinguish between personal and context-related factors (see, e.g. Ergun and Sesen, 2021), where the latter are less commonly investigated. With regard to context-related factors, previous research suggests that universities can play a key role in sustaining PE through initiatives that are embedded in the official degree programs or through parallel and optional award services aimed

at preparing students to enter the labour market. Career services may include programs aimed at developing soft and transversal skills, training sessions on CV writing and how to handle job interviews, career guidance, and numerous initiatives designed to bring together students and employers (Donald et al., 2019). Thus, universities may stimulate students' PE by promoting employability-oriented services that foster the perception of professional preparedness. More specifically, providing career advancement and industrial networking through the cooperation between universities and employers - such as via internships, industry, project units, career fairs, career talks, building networks and job application support - improves students' understanding of the labour market and their confidence regarding their future employment (Donald et al, 2019).

The literature on HE and employability underlines that the effectiveness of career advance and industrial networking may differs according to specific student personal characteristics (e.g. Donald et al, 2019). First, career literature is somewhat divided on the moderation role of gender on self-perceived employability. Although some studies report significant gender differences in PE among university students, with greater PE among males (Donald et al., 2019), similar studies report that gender does not affect students' PE (Jackson and Wilton, 2017). Thus, we starts from a position of awareness that gender may moderate the impact of career advance and industrial networking on students' PE.

Previous studies also reveal that graduating in non-professional fields or generalist subjects (e.g., humanities, arts, social sciences) is negatively associated with PE, whereas students in professional fields are usually more optimistic and self-confident about their employment chances in the labour market (Donald et al., 2019). Accordingly, we expect that the type of degree course may influence the overall effectiveness of career advice in supporting the PE of university students.

3. Methodology

The present study employed a quasi-experimental pre-test-post-test non-equivalent control group design (Hoyle et al. 2002) to assess the effectiveness of career advice implemented by the employers and provided as optional awards by the central career services of University of Milano-Bicocca.

The study focuses on students who voluntary took part in different career service initiatives provided by the University between 2021 and 2022. "Control group" is composed by 207 students who participated to short professional development workshops delivered by personnel of job placement services and aimed at learning how to apply for a job, writing resumes, preparing for interview, open a LinkedIn profile, etc. "Treated group" includes 70 students who took part in career advancement and industrial networking initiatives, and then workshops where students directly interact with prospective employers, where HR managers present their

organizations, the open positions and the overall selection process and students had also the chance to hand one's CV and hold real job interviews.

Our decision to focus exclusively on students who took part in career services during the period, and not to consider those who did not (as a control group), is dictated by the possibility of significantly reducing selection bias. Indeed, the whole sample of the study only includes students that freely and voluntary decide to invest time and resources for developing their employability and preparing for the labour market.

In order to test the effectiveness of CAIN services we observe their contribution in enhancing students' PE components. PE was measured through a two-wave survey administered online between January/February 2021 (time 1) and January/February 2022 (time 2), before (t1) and after (t2) students' participation in career services. The final sample is represented by 277 students, of which 70 participated in CAIN, while 207 participated in career development workshops.

3.1. Variables

PE was measured at t1 and a t2 by a well-established self-perceived employability scale for graduate students (SPES) (Rothwell & Arnold, 2007). The SPES scale contains 16 items measured on a seven-point Likert scale (1=completely disagree and 7=completely agree). Based on the relative literature, internal and external factors can influences employability (Rothweel & Arnold, 2007). Internal factors refers to: work's knowledge and skills; job search mastery, learning potential. External factors include the state of the labour market in term of employment possibilities for people with certain skills or employment possibilities for people with a certain type of degree. Starting from these internal and external factors, Rothwell et al. have identify eight components, and for each of these eight components the authors produced two items.

The eight components are the following:

PE_1: "My engagement with my studies and academic performance".
PE_2: "My perception of the strength of the university brand". It is related to student's perception of their university's reputation, contextualised in employment terms.
PE_3: "The reputation my university has within my field of study".
PE_4: "The status and credibility of my field of study".
PE_5: "The external labour market's demand for people in my subject field".
PE_6: "My perception of the state of the external labour market".
PE_7: "My awareness of opportunities in the external labour market".
PE_8: "My confidence in my skills and abilities".

Our dependent variables are the differences between each single PE components at time 2 and each single PE at time 1, which represent the increases (or decreases) of the student's PE components between time 1 and 2.

A set of control variables was included in the pre-test questionnaire to assess the sample's basic demographic characteristics, human and social capital, personality traits (Big Five) and other individual factors inherent to the university career that could affect PE and the outcomes of career services. For human capital, we include the variable high school graduation mark, as a proxy of performance in previous studies. For social capital, we consider parental education level. Since, personality traits can affect both students' PE and their decision to participate in CAIN services, we consider also the Big Five dimensions. With regard to the university career, we included whether a student worked during the university stuedies, the "grade average point" over the last 12 months, and the year of study. Finally, to control for the degree type, "STEM degree" is a binary dummy variable that equals 1 if the student is enrolled in a degree in science or mathematics, and 0 otherwise.

4. Findings

4.1. Preliminary Analysis

The whole sample looks as follows: 32% are men, 17% of the total have had previous work experience during their university studies, but none of them at the time of the of the survey was employed. The average number of examinations taken during the year under investigation is 27.7 (a continuous variable ranges between 18 and 31, according to the grading scale adopted by the Italian universities), 50% are enrolled in their final year of study, and finally, 23% graduated in the last 12 months. As regards the disciplines of study, we used a binary division. STEM area that includes all scientific disciplines and whose acronym identifies four areas: Science, Technology, Engineering, and Mathematics. No-STEM area, which identifies the disciplines with non-science. The latter category includes all humanities disciplines as well as economics. In particular, of the final sample, 30% were enrolled in Economics, 6% in Educational Sciences, 5% in Law, 14% in Psychology, 35% in Sciences, and 6% in Sociology.

Inter-group pre-test and comparisons were carried out, in order to check whether socio-demographic differences and other students' characteristics allow for an appropriate intergroup comparative base. More specifically, the Mann Whitney test were conducted for testing difference between groups in terms of socio-demographic and university career characteristics. Results show that the experimental and control group did not differ in terms of gender, high school grade. parent education level, and family income level. When we look at the personal traits, no significant differences emerge between groups. Finally, none of the factors related to the university career are significantly different between groups. Also when considering the

student's area of study no differences are recorded. Overall, the analysis reduces the possibility of selection bias and that systematic pre-existing group differences could confound our examination of treatment effects in the data.

4.2. Non-parametric analysis

In order to test whether the participation in the CAIN services affect students' PE, the Mann Whitney test was performed for difference-in-difference pre-test/post-test comparisons in the experimental and control group (Table 1). Table 1 presents results considering the variation of PE dimensions from time 1 to time 2 considering the whole sample, the control group, and the treated group. As can be noted, significant variations in the PE dimesions are detected from the third to the seventh PE dimension. Those regarding the reputation of the university within the field of the study contextualised in employment terms; those regarding the demand and the state of the external labour market; and those concerning the awareness of opportunities in the external labour market. In summury, the analysis show significant improvements in the PE dimensions that are linked to the university reputation and to the labour market only for students attending the CAIN services.

Table 1. Perceived employability: means difference between the treatemnet and the control group

Variables	Whole Sample n. 277	Control Group n. 207	Treated Group n. 70	P value
Δ PE	-0.02	-0.07	0.13	0.0160
Δ PE_1	-0.04	-0.03	-0.06	0.8735
Δ PE_2	0.01	0.02	0.01	0.9498
Δ PE_3	-0.05	-0.12	0.16	0.0774
Δ PE_4	-0.20	-0.30	0.09	0.0392
Δ PE_5	-0.20	-0.27	0.01	0.0813
Δ PE_6	0.22	0.14	0.46	0.0765
Δ PE_7	-0.05	-0.13	0.19	0.0556
Δ PE_8	0.13	0.11	0.19	0.4478

In order to test whether the effectiveness of CAIN services varies by gender, we perform the analysis separately for male and female. 146 students in the control group and 42 in the treated group compose the female sample. No significant differences in the PE variation is detected between control and treated group. When we look at the male sample, 61 male compose the control group and 28 the treated one. The total PE variation (mean of the 16 items) is statistically significant between the treated and the control group ($p<.05$). In particular, treated males

experience a significant increase of PE. When focus on PE components we note that variations in PE_5 and PE_6 for male are statistically significant ($p<.10$). These components of the PE regards the perception of the demand and the state of the general and subject specific labour market. Overall, results suggest that the OLA services are more effective for male students then for female in sustaining their external perceived employability.

Finally, in order to test whether the effectiveness of career services varies by degree type, we perform the analysis separately for STEM and no-STEM degrees. 179 students (130 No-STEM students in the control group and 49 No-STEM in the treated group) compose the whole No-STEM sample. There are a significant difference in the PE_3, PE_4, and PE_7 variation between control and treated group ($p<.10$). These components tells us the role of the university reputation within the field of study, the status and credibility of the field of study, and the awareness of opportunities in the external labour market. These PE' dimentions significantly increase in the No-STEM group only for students attending the CAIN services. When considering only STEM students, we not detect any significant difference in the PE variation. Overall, these results indicate that the CAIN services are more effective for students enrolled in humanistic studies (No-STEM area).

5. Discussion

The research's contribution is manifold. First, it expands research on the role of university in supporting students' PE and university-to-work transitions. The study demonstrates that by providing career advance and industrial networking HEs contribute to develop students' self-perceived employability. In particular, the initiative designed by the career services and implemented with employers allow students to improve awareness about their employment chances in the labour market.

Results also support the idea that an employability ecosystem, than the contribution and participation of various (first and foremost, universities and employers), is indispensable to effectively support graduate employability (Donald et al, 2019). Indeed, the study demonstrates that career advices implemented with the employers not only increase PE but also contribute to reverse the common trend where students perceived themselves less employable in terms of market factors as they progress through their years of university study

The empirical findings also indicate the need for additional and tailored support to be provided to females to promote gender equality. Finally, the paper advance existing employability literature, which has focused predominantly on students from specialist degree subjects, by comparing the perceptions of students from STEM and no-STEM degree subjects to explore for which students career services are most effective (Donald et al, 2019).

In the light of this study results, some policies and managerial implications can be draft that concern the design of career service in Higher Education institutions.

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Boosting students' employability skills via transnational online collaboration project: Findings from a qualitative study

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Abstract
This paper argues for the importance of employability skills development in higher education to ensure a smoother school-to-work transition for university graduates. The presented transnational online collaboration project serves as a good practice to prepare university students for their international careers. The project was designed and implemented by four partner universities and involved 88 students from 13 countries. Students' feedback and perceptions regarding the benefits and main takeaways of the project were collected using a post-project survey and written reflections. Qualitative data analysis revealed that the project successfully contributed to the students' knowledge acquisition of the international recruitment process, employability skills development, and improvement of intercultural communication.

Keywords: *Virtual exchange; employability skills; collaboration project; school-to-work transition; job market; online interviews.*

1. Introduction

Globalization trends, the Fourth and Fifth Industrial Revolutions with massive digitalization in all industry sectors and promoting the well-being of all players of the economy are now having far-reaching consequences in the labor markets worldwide reshaping labor market structures and posing new challenges for both employers, employees and jobseekers. Despite promising employment trends, young graduates are at the highest risk of being unemployed as they are facing difficulties in the school-to-work transition (Brozsely & Nixon, 2023; van der Horst, 2021). Even though earning a tertiary degree provides better prospects in terms of employability and getting higher-paying jobs, undergraduate and graduate students often cannot get an entry-level position facing stiff competition in the globalized job market. However, 40% of employers

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believe that graduate students lack the necessary skills for work, hence they are not adequately prepared for the job market (EPSC, 2017). According to OECD studies (Quintini, 2011), many Europeans may be overqualified yet under skilled.

European higher education institutions (HEIs) should play a role in equipping students not only with marketable knowledge, but also with skills to increase new graduates' career prospects and ensure a smoother transition from school to work and lower unemployment rates among fresh graduates. Efforts have been made by HEIs and instructors to answer this call and incorporate skills development courses into their graduate programs (Ng, 2022). Our unique online collaboration project, also referred to as Virtual Exchange (VE) project, presents one example as it aims to promote interaction between employers and universities to harmonize curricula with skills demand and to develop students' global employability skills. The project was born out of an informal partnership between two professors at a Belgian and a Hungarian university. This collaboration project brings together graduate students across Europe and the United States to work in virtual teams, acquire and develop the necessary skills they need for a successful job interview, and provides the opportunity to try themselves out in the real international job market. This paper aims 1) to discuss the necessary employability skills that young graduates need to develop; 2) to present the transnational online collaboration project to boost students' employability skills development; 3) describe the tangible benefits and main takeaways of the project based on the qualitative analysis of students' reflections and feedback.

2. Employability and workplace skills for the new labour market trends

In this newly structured labor market, more and more companies tend to outsource professionals for specific tasks or projects and contract freelancers for short- or middle-term assignments (EPSC, 2019). Projects and tasks often involve physical and virtual teams spreading across countries within the EU and beyond. The increasing use of digital technologies, portable devices, online platforms, and Web 2.0 applications, as well as the aftermath of the COVID-19 pandemic, have made teleworking and blended working possible for many business professionals allowing for less physical presence and flexible working hours. These trends imply that the number of collaborative tasks requiring online, virtual teamwork will increase in the 21st-century workplace, which requires a completely new set of skills from professionals. Thus, experiential learning and team-based business simulation can enhance students' employability and life skills (Scheuring & Thompson, 2024).

An analysis of online job-vacancy data in 18 EU member states revealed that the top four skills that employers are looking for were: 1) adaptability to change; 2) ability to work as a team; 3) ability to use a computer; 4) English language proficiency (Cedefop, 2019). While these results are not surprising, three basic conclusions can be drawn. First, digital skills are a must regardless of the business sector or the position. Second, without high-level English language proficiency

it is very unlikely to pursue an international career in business. English as a lingua franca also plays a dominant role in international business contexts worldwide (Tan, 2024) and has become the common, shared language of the business community. Due to its increased role and importance, not only has English been used in intra- and inter-company procedures and functions (e.g., sales, marketing, procurement, finance, accounting, administration, HR), but it has also become the official corporate language of many multinational companies. Therefore, an adequate level of English language proficiency is one of the prerequisites for getting a business position. Third, transversal skills have a much greater emphasis now than ever before. Transversal skills include traditional business soft skills such as teamwork, creativity, the ability to take initiative, to solve problems, to resist change, adaptability, and entrepreneurial skills, which are now exercised in the virtual space in most workplace contexts.

Moreover, jobseekers need to acquire intercultural or rather transnational cultural competence as they need to respond to various cultural requirements depending on the country where they are applying. Increased workforce mobility also created international and intercultural workplace environments at many businesses where intercultural communication skills, and transnational business communication skills have started to be among the newly marketable human assets. Therefore, it is essential that new graduates are provided the opportunity to develop transversal competence which can then be practiced in English, in intercultural settings, and in the virtual space. In the educational context, HEIs need to design and implement transnational virtual collaboration projects to pursue university graduates' adequate skills development.

All these trends should be considered when preparing for job interviews, which are often done online and in English. Also, job applications and resumés are scrutinized by the recruiters for proof of digital skills, English language proficiency and business professional skills to identify the best candidates for job interviews matching their strict selection criteria. Fresh graduates need to acquire a new skill set and be able to demonstrate it effectively during the recruitment process. University graduates who have acquired, developed, and therefore mastered a high level of digital skills, online collaboration skills, and international business communication skills and can demonstrate their skills have a competitive advantage as job applicants when they enter the globalized job market.

3. Teaching contexts of the four partner universities

The VE project partners come from 4 different universities and thus their educational contexts varied. The university in Hungary offers their students various mandatory and elective classes with virtual collaboration components at various stages of their studies. This project is part of an elective course entitled Career building and it is usually attended by 2nd or 3rd-year bachelor students majoring in Business Administration, Human Resources, or Finance and Accounting.

As the course is run in English, international students, and students on incoming mobilities also tend to register for this course. In this iteration, 18 students - 14 Hungarian students and 4 international students - completed the collaboration project.

At the Polish university, VE projects are embedded in the selected courses for students majoring in Modern Business Management. For the students, it is frequently the first opportunity to cooperate in an English-speaking environment and to reflect on their position as jobseekers. Especially given that most of the participants were first-year students. 20 students participated in the project as part of their General Management course.

At the American university, students may participate in virtual exchange by chance if they sign up for a course where this teaching method is used. While institutional support for these projects is only a recent trend at the university, these projects have been organized by faculty who understand that students appreciate the added benefit of being able to connect with students from other countries. The course is an elective for Writing majors and minors, but it is also a general education course in the category of "Globalization.". Students complete four major assignments, the career focused virtual exchange feeds into two of these projects. 25 American students participated in the iteration of the project.

At the Dutch university, Career Services is a university broad department supporting students in defining and developing their career ambitions. The department is catering to the needs of students of all faculties and levels of study. Through offering extra-curricular activities Career Services support faculties in increasing employability of students. The opportunity to take part in the project was open to all students at the university, and students enrolled on a voluntary basis as part of their preparation for internship abroad.

4. The transnational online collaboration project

Our transnational online collaboration project was designed and implemented during the autumn semester of the AY2023/24. 88 students, representing 13 different countries, participated in this 8-week long project, and worked online in mixed virtual teams on pre-set assignments. 6-8 students were assigned to a multicultural team, each representing at least 4-5 nationalities and cultures each.

The project aimed to provide students with the opportunity to develop, practice and demonstrate their employability, communication, and collaboration skills in a transnational virtual setting. The main learning goal was to enhance students' awareness of different aspects of the recruitment process, which can be reflected in their ability to prepare well for a job interview. During the individual and team assignments students could 1) develop intercultural competences, 2) practice international online collaboration and teamwork, 3) apply digital technologies and master digital skills, 4) organize and manage online meetings, 5) promote

professional skills, 6) prepare for an online job interview, 6) prepare team meeting summaries and a final digital personal portfolio.

During the project, teams scheduled and organized four virtual team meetings to accomplish their team assignments together. At the first online meeting, team members got to know each other and talk about their cultural differences and similarities. The first assignment was to prepare a personal pitch video to be shared among their team members. At the second online meeting, students had to give feedback to each other on how to improve their personal introductions, discussed how to give constructive feedback in English, and explored cultural differences when giving feedback, complaint, or criticism. As the second assignment, students prepared their digital CVs, shared, and discussed them with their peers at the third online team meeting. The purpose of the team discussion was to give each other advice on how to improve their digital CVs. In the final phase of the project, students were preparing for online job interviews by studying and collecting all relevant information about the online recruitment process, the cultural differences, and the challenges they need to face at an online job interview in their home countries. At the third team meeting, students shared their findings with their peers, gave each other advice, recommended solutions to possible problems, rehearsed and practiced a job interview scenario. As a final assignment of the project, students participated in a mock online job interview with a recruiter. An international pool of recruiters, represented 6 different nationalities and worked for different companies in various business sectors in Europe, assisted the project and provided expert advice for our graduate students at the end of the interviews as well as written feedback on the students' performance and areas for development. The project was closed with a final meeting, where students could share their individual experiences of the job interviews with their peers and reflect on their learning outcomes. At the end of the project, students had to write and present a digital portfolio on the successful completion of their assignments, demonstrate the professional skills they developed, the challenges they faced and provide evidence for their intercultural experience.

5. Methods

Our research aimed to explore students' experiences, perceptions, and opinions about the potential benefits and challenges of taking part in the collaboration project. Therefore, this study seeks to answer the following research questions:

1. According to students' perceptions, what skills and competences have they developed during the VE project?
2. According to students' perceptions, what are their main takeaways from the online collaboration project?

Students' perceptions and feedback were collected through post-project surveys and reflections in digital portfolios. The qualitative data compiled from the survey open-ended questions (n=27)

and the reflections of the student portfolios (n=15) were analyzed using the method of thematic content analysis (Creswell, 2009) to identify the main topics and themes. Manual coding was complemented by AI technologies to verify and validate the manual coding procedure.

6. Findings and tangible benefits

6.1. Skills development

Asked about the project experience, students referred to three main themes. Firstly, there is a strong emphasis on learning and development, encompassing insights into job interview preparation, cultural differences, effective communication, and personal growth. This extends beyond professional aspects, fostering cultural awareness and time management skills. Secondly, positive collaboration is a recurring theme, with team members described as engaged, easy to communicate with, and actively involved in the project. Lastly, the project serves as a platform for cultural exchange and diversity, providing exposure to different cultures, habits, and experiences from participants' respective countries.

The analysis of students' perceptions and feedback show that students' management skills, online collaboration and communication skills, English as a second language communication skills and their intercultural competence were greatly improved due to the project experience. Before the project, students lacked experience in online collaboration and managing online meetings and only a few of the students actually had any intercultural experience abroad. Also, most of the students had any experience in applying for a job online and the use of digital tools and online applications were limited. Based on students' feedback, they perceived they learned 1) how to work online in virtual teams; 2) how to use the technology effectively for online teamwork and collaboration; 3) how to apply effective communication practices in business when applying for a job abroad; 4) how to promote and sell their human assets to succeed in an online job interview. Students' confidence also increased: they started to use English business communication more easily after the project.

6.2. Students' main takeaways

Apart from enhancing certain practical skills, students had a chance to use this unique real-life experience for self-development. Firstly, the main takeaways revolve around self-discovery, interpersonal skills, cultural awareness, and professional development. Participants express insights into their preferences for group work, the importance of confidence, the ability to engage with diverse perspectives, and the impact of stress on self-esteem. Additionally, there is a consistent theme of appreciating interactions with people from different cultural backgrounds, highlighting a keen interest in learning about other cultures. Online meetings, set up around specific agendas and questions but not closely supervised by teachers, offered students a lot of

space for taking initiatives in shaping the setup of the meetings, and removed the pressure of evaluated performing, allowing students to open up and speak freely, sharing their opinion without a fear of making mistakes. However, it did not mean that the students considered meetings unimportant, as in their reflections many of them stated that they felt responsible for being well prepared for the meetings and were anxious to share their homework with the team for feedback. Furthermore, professional development is evident through reflections on career-related skills, such as effective communication, job interview preparation, CV building, and self-presentation. Overall, the themes include personal growth, cultural appreciation, and professional skill development through collaborative experiences. The following quotes illustrate students' main takeaways:

"How to work online, how to prepare for a job interview, these were the most useful things for me."

"Improving my personal skills for my future work."

"Seeing the issues of unemployment, discrimination, and personal development from other angles as we worked in multinational teams."

"I learned more about the importance of body language (...) I understood that the appearance – what you wear and how you smell might play a significant role. Moreover, I now know more about what information the interviewers are looking for such as your skills and personal qualities."

"Overall, our team discussions underscored the importance of cultural awareness, adaptability, and a nuanced approach to crafting CVs that resonate effectively in a global context."

"I have to be more confident and present my strengths rather than weaknesses."

"I have what it takes to be successful and that my comfort zone does not control me."

7. Conclusion

Our initiative bridges the gap between formal education and the business world by providing hands-on international project experience in the topics of job search, preparation for the recruitment process, and employability skills development. Taking part in the collaboration project prepares university graduates for the real world of work with marketable skills, thus providing a smooth school-to-work transition process. Our findings show that our transnational online collaboration project increased students' employability in terms of practical skills required to succeed during a job interview, but above all stimulated self-reflection regarding students' attitudes, strengths, and weaknesses.

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Broad horizons of international cooperation to ensure sustainable and innovative learning

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Abstract

This article examines the evolving student and academic staff mobility trends and the impact of a new form of international cooperation on learning outcomes. European universities are increasingly using different forms of Erasmus+ mobilities types, which is facilitating a transformational shift towards short-term, mixed, and virtual mobility for European students, accompanied by the establishment of internationalisation standards and the development of initiatives in borderless learning joint planning of educational programs with partner institutions as well as implementation of pilot projects, testing and exchange of the most successful practices. The article discloses successful practices and experiences developed and gained through international cooperation, focusing on the results of the Erasmus+ blended intensive programme (BIP) projects implemented in 2023, which aimed to develop innovative teaching methods and update existing teaching materials. By highlighting the contributions of these projects, the article highlights the critical role that Erasmus+ BIP initiatives play in shaping the future of education through cross-border collaboration and knowledge sharing.

Keywords: *innovative learning; blended intensive program; students' mobility; Erasmus+ program.*

1. Introduction

In the evolving Erasmus+ program, universities are experiencing a transformative shift in student mobility. This shift includes short-term experiences, blended learning, and virtual mobility to promote internationalization and break traditional learning boundaries. Emphasizing short-term mobility, the program allows students to gain experience without compromising academics, fostering cultural exchange and diverse perspectives. Mixed mobility combines

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physical and virtual components, creating a flexible learning environment that transcends geographical limitations. Virtual mobility is vital, enabling students to engage in educational activities without physical presence and fostering a global community of learners. The program goes beyond geographical studies, emphasizing internalization and integrating global perspectives into curricula. Collaboration with partner institutions enhances education quality, and sharing best practices contributes to continuous improvement. The Erasmus+ program signifies adaptability, inclusiveness, and a commitment to global education, shaping a future where borders are crossed, experiences are shared, and learning knows no boundaries.

1.1. Background

Erasmus+ Blended Intensive Programmes (BIP) hold unique opportunities for bringing the best of both worlds together: virtual teaching is preceded and/or followed by a short period of physical mobility, thus allowing for meaningful encounters between participants from at least three European universities or higher education schools (European Commission, 2021).

Organising BIP is straightforward, but what about improving the learning process and student engagement? How do you promote both engagement and learning? Engagement refers to how much attention, interest, and motivation students show, how much effort and time they invest and the persistence and resilience they demonstrate towards their goals (D'Mello, 2021).

Several decades of research into the cognitive science of learning have yielded principles of effective learning, e.g. (Bransford et al., 2000; Karpicke & Blunt, 2011), which can be implemented in learning technologies, such as Intelligent Tutoring Systems (ITSs).

Engagement describes different behaviours, diverse thoughts, perceptions, and attitudes. (Reshly & Christenson, 2011). Engagement has been a complex construct about diverse aspects of the educational process (e.g. completing homework tasks, feelings of belonging, getting a good time) and across time (e.g. momentary times of interest, stable dispositions).

In the 21st Century, higher education has witnessed a proliferation of transnational education arrangements. Critical education scholars have widely challenged the traditional teacher-centred approach, calling for more active student engagement and staff-student partnerships in teaching and learning (Peters & Mathias, 2018). Active student engagement in learning activities increases student attention, motivation, comprehension, critical thinking, and knowledge application abilities.

After all, it is essential questions arise - how to design effective online and in-person activities; how to assess student performance and provide feedback; how to support student diversity and inclusion; how to foster collaboration and community among students and instructors; how to evaluate the impact and quality of the program.

Maker-inspired learning activities positively impact students' STEM-related knowledge, problem-solving abilities, and skills (Papadimitropoulos, 2023).

2. Methodology

The structure of this study consists of a brief description of the projects carried out, indicating the goals and objectives set, and an analysis of the results achieved in the short and long term.

The general structure of a BIP project (Fig. 1) shows a project preparing the first and second stages and implementing the third and fourth stages.

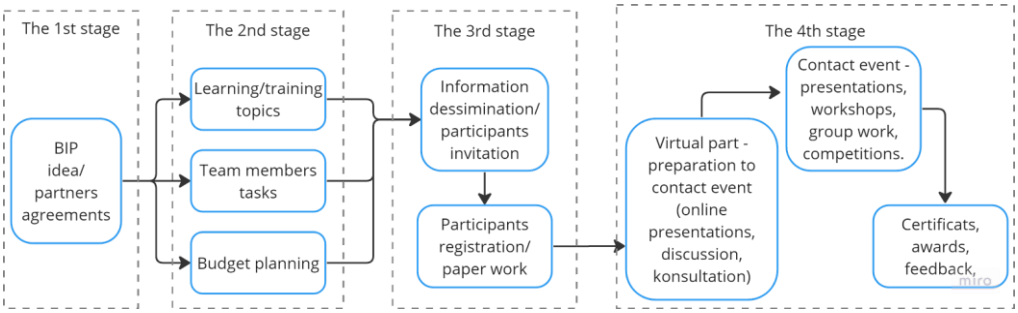


Figure 1. Stages of the BIP project preparation and implementation process. Source: Article authors.

2.1. Erasmus BIP for students - Fundamentals of Modelling and Engineering Graphics

The TTK University of Applied Sciences (TTK UAS) first ERASMUS+ BIP project (BIP001) for students was organised from 23.01 to 23.04.2023. The project aimed to improve innovative interactive learning material for modelling knowledge-getting and skills-applying (Ovtsarenko et al., 2023). Work on preparing for the projects began with an analysis of the educational material that was planned to be used within the project: the content of the educational material and compliance with the chosen topic of the project, viewing the dynamics of development and use of the content.

The MOOC Fundamentals of Modelling and Engineering Graphics (MOOC, 2023) topics included modelling using different CAD software, acquiring basic knowledge for reading technical documents, and presenting the created object. Twenty-seven students from RTU Latvia, VILNIUS TECH Lithuania, Kharkiv Technological "IT STEP" University Ukraine, and TTK UAS Estonia participated in the project (Tab. 1).

Table 1. BIP001 participants. Source: Article authors.

Organisation	Partici-pants	Major of Students'					
		Civil engineering	Industrial technologies	Computer science	Management	Environmental technology	Information Management
TTK UAS, Estonia	4	-	-	-	-	1	3
VILNIUS TECH, Lithuania	7	5	2	-	-	-	-
RTU, Latvia	12	12					
KhTU STEP, Ukraine	4	-	-	3	1	-	-
Total	27	17	2	3	1	1	3

As seen in the table, the project participants are students of different study programs and not all of them had experience in CAD software at the beginning of the project. To participate in the project, the most important thing was the student's desire to gain the skills, and no prior knowledge was required.

Following the Erasmus+ regulations, different events were planned - presentations, consultations, and teamwork remotely and in person. During remote activities, interactive learning materials of MOOC Fundamentals of Modelling and Engineering Graphics, the intellectual result of the Erasmus project Virtual technology for use in STEM (VirSTEM, 2023) were used, and four online consultations were held for students during four months.

The pace of distance learning for one month was optimal for students' independent work with MOOC learning materials, exercises, and tests. The learning process was not only studying e-course content but repeating for better mastery if it was needed. The students shared their feedback as reports on the TTK UAS Moodle (Fig. 2).

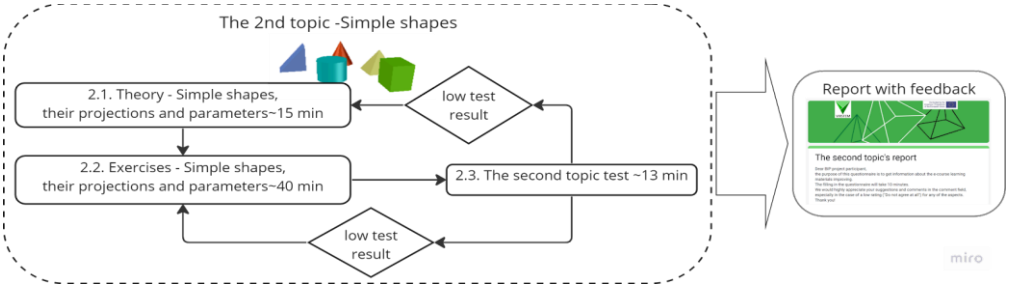


Figure 2. The students' independent work structure. Source: Article authors

The tutors prepared exciting materials and tasks on modelling with practical exercises using four different CAD software: SketchUp, FormIt, Revit, and ArchiCAD to ensure the development of necessary skills and competencies for modelling.

Throughout the event, the participants were divided into groups of 3 students from different countries to complete a practical task related to modelling a modern and comfortable living room for students. Collaboration was organised as a competition, positively impacting interest in the work's overall result and the student's involvement in the modelling process. Each team member was engaged in modelling a specific object. The last part of the competition task was a demonstration of a finished furnished room and a performance by each group member. Of course, the level of acquired knowledge of the students was different. Still, the experience gained in modelling and working in an international team positively affected the motivation for further education and the cooperation of future young specialists from different countries.

Fig. 3 shows the e-course learning material quality rating based on the students' feedback on a 5-point scale.

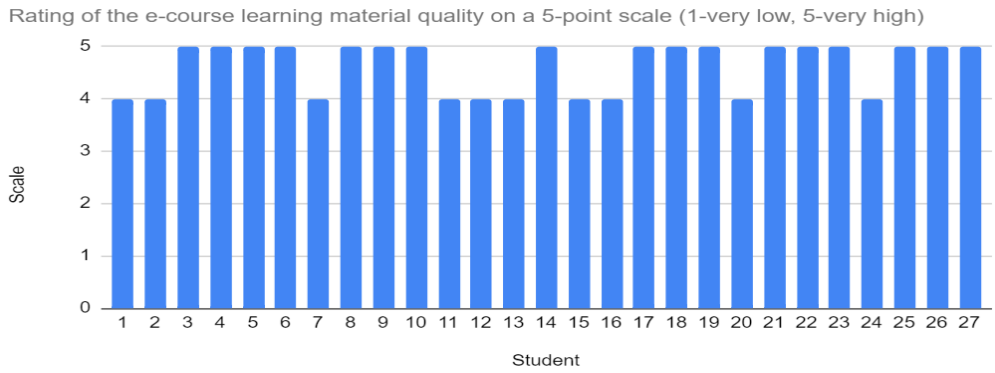


Figure 3. Students' feedback. Source: Article authors.

The participants of the BIP001 project feedback were very positive - an answer to the question "Please rate the e-course quality on a five-point scale (1 is very low, 5 is very high)" was 4 (10 students' assessment) and 5 points (17 students' assessment).

2.2. Erasmus BIP for teachers - Interactive Training – Who, What and How

TTK's first ERASMUS+ project, BIP for teachers (BIP002), was carried out on 1.11-8.12.2023. This project aimed to train academic staff to create interactive tools for students to work and test their knowledge independently and share training experiences for international collaboration. To perform planned activities related to developing interactive teaching materials, the project participants were offered sustainability topics like Eco-friendly, Zero-

Waste, Environmental Sustainability, and Green Building. Twenty-four teachers from 10 higher educational institutions in Italy, Latvia, Lithuania, Germany, Austria, Croatia, and Ukraine participated in the project. Most participants were teachers of STEM subjects - 16 educators out of 26, or 61.5% of all participants.

The first event was held remotely (11/22/2023) to clarify project activity details and in person (12/4-8/2023). During distance learning, participants became familiar with teamwork in the MIRO interactive environment and interactive tools on the e-course page on the TTK Moodle platform. International teams have worked on interactive test creation and developed skills for interactive tools focused on changing students' education goals, which are very effective because they allow students to use their initiative and creativity in independent work. Therefore, to create an interactive learning tool, the teacher needs to think through the topic and structure of the task and master the technology for creating educational material. Moreover, it can be part of the theoretical material in a game form, an exercise with tips, or questions to control the student's knowledge.

Throughout the BIP002 event, the participants were divided into teams of 3 from different countries to complete a hands-on assignment to create interactive learning materials and share their experiences and knowledge gained from the lectures. In addition, teamwork with colleagues from other organisations became an opportunity to exchange teaching experience and use interactive tools in their work with students. During the event, participants received valuable experience in creating interactive tools to engage students in learning, and their feedback demonstrated a high assessment of various interactive tools and how to use them to learn and achieve better results precious (Fig. 4).

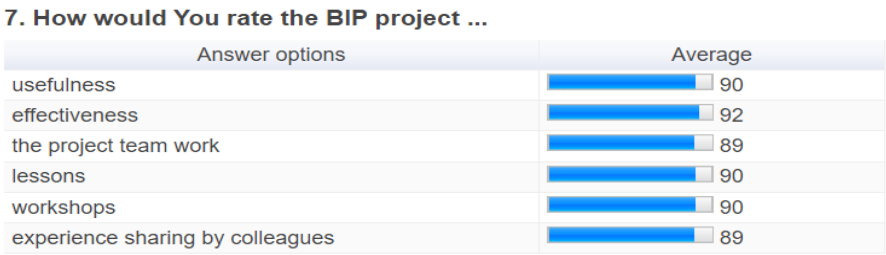


Figure 4. The BIP002 project participants' feedback.. Source: Article authors.

Generally, the BIP002 project assessment is high following the participants' feedback - 89 to 92 points from 100. Moreover, the participants stressed that successful training during project activities ensures the development of knowledge related to modern, effective technological solutions for education.

3. Discussion and Future Work

The biggest challenge for teachers during the organisation of the first BIP project at TTK UAS was recruiting project participants. During the project's preparation period and the beginning of registration of participants from June to November 2023, information about the project was sent to 98 recipients, presentations were made, and flyers were distributed at the SEFI 2023 and ISL 2023 conferences. As a result, out of 34 potential registered participants, 23 teacher partner organisations completed documents for participation in the project, excluding participants from Estonia.

Based on the project results, new activities could be related to the project on how to improve teaching when students have disabilities or disorders like ADHD. This topic is highly relevant when teaching materials are prepared for students with disabilities and disorders. So future activities will answer questions like to what extent educational material should be prepared for students with special needs; is teaching material with preliminary adapted content suitable, or shall it be adopted during the education process? However, according to the article's authors, considering the possibility of using it when teaching students with special needs when preparing educational material would still be more far-sighted.

4. Conclusions

According to the European Commission program, Blended Intensive Programs (BIP) aim to open more opportunities for students and teachers to participate in Blended Mobility activities. Conducted BIP projects have confirmed the assumption that they can be part of university curricula, complement them or expand an existing program with additional functions in a blended learning mode. Considering the BIP projects' results aimed at students and teachers, the organizers and participants evaluate these events as highly relevant and necessary for developing their skills and competencies in digital, professional and international cooperation. Moreover, BIP projects create opportunities to gain knowledge and competencies in areas not directly related to the participants' specialities, which produces the chance to develop horizontal competencies. On the other hand, to gain a broader and more visible impact of the benefits of the BIP project, universities should encourage student and faculty participation in BIP projects and develop a system of incentives and benefits that will ensure more significant development of BIP projects.

This study demonstrates the positive impact of student participation on various aspects of the learning process, including attention, motivation, comprehension, critical thinking, and knowledge application abilities.

Teachers play a central role in creating an environment encouraging active student participation. Using various teaching methods, incorporating technology, and encouraging collaborative

learning are effective strategies for attracting student interest and maintaining active involvement. The relationship between active student engagement and positive learning outcomes is undeniable. By promoting a culture of active participation, teachers enable students to develop a deep understanding of the subject matter, improve critical thinking skills, apply their knowledge effectively throughout their lives, and be ready for the challenges of the 21st century.

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Phonological Awareness of Novel Phonemes and English-Language Reading Comprehension in EFL University Students

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Abstract

This study examines the relationship between phonological awareness of English-language phonemes not found in EFL students' native language and their reading comprehension. Participants included 51 native speakers of Arabic who were all EFL learners. Participants were enrolled in an English-medium university following an American curriculum. Participants' phonological awareness of three sounds was tested. The phoneme /f/, which is found in both English and Arabic, served as the baseline, whereas the test phonemes were /p/ and /ʊ/, which are not found in Arabic. Participants were then tested on a passage from the reading comprehension portion of the TOEFL exam. Higher scores on the reading comprehension task were positively correlated only with scores of awareness of the phoneme /p/. This finding indicates that explicit training in phonological awareness of novel consonant sounds may aid reading comprehension in EFL learners who are native speakers of Arabic.

Keywords: *phonological awareness; reading comprehension; EFL education, Saudi Arabia*

1. Introduction

Although phonological awareness can be defined in a multitude of ways depending upon the theory concerned, it is generally agreed that this term refers to a skill whereby one is cognisant of the sounds and sound systems that are meaningful in a language. It is a metalinguistic skill that refers at the very minimum to speakers' ability to segment speech into parts, such as words, syllables, and phonemes. More broadly, it entails speakers' ability to use and manipulate sounds in a linguistically valid manner (Anthony & Francis, 2005). One critical means by which phonological awareness is put to use is through the process of learning to read.

Reading comprehension entails a complex set of cognitive processes, including decoding and the extraction of meaning from the text being read. Namely, reading comprehension involves,

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besides decoding, an array of memory and inferential processes devoted to the comprehension of the material being read (Míguez-Álvarez et al., 2022). Thus, it is not surprising that the skill of phonological awareness is considered essential to attaining fluid and accurate reading comprehension in both monolingual speakers and foreign language learners (e.g., Hentasmaka et al., 2022). Yet, unclear is the extent to which the impact of phonological awareness encompasses not only decoding but also reading comprehension in understudied English foreign language (EFL) learners who are competent users of the English language. A case in point is learners whose first language is Arabic. The present study focuses on this population.

Theories of orthographically-based phonological awareness (i.e., the ability to map letters to the sounds with which they are typically associated) acknowledge that the development of oral/aural phonological awareness (i.e., the ability to recognize and manipulate sounds that are spoken and/or heard) is key (Hoover & Tunmer, 2020). These theories further propose that the ability to develop automatic associations between individual letters and the sounds with which they are associated leads to immediacy in the recognition of words with orthographically "regular" spelling (i.e., the letters used to spell these words correspond to sounds typically associated with their primary phonetic sounds).

The development of automatized recognition of words with "regular" spelling has been hypothesized to be associated with the recognition of words that are orthographically "irregular" (i.e., the letters used to spell these words do not correspond to sounds typically associated with their primary phonetic sounds). The recognition of irregularly spelled words requires memorization that can only be brought about by repeated reading practice. The rapid, if not automatic, recognition of lexical tokens is of paramount importance to reading comprehension in native speakers as well as individuals learning to read in a foreign language. As such, researchers and educators alike have been interested in understanding how oral/aural and orthographic phonological awareness shapes reading comprehension in different languages (Bhide et al., 2020).

For English as a foreign language (EFL) learners, both oral/aural and orthographic phonological awareness of the English language may vary considerably. Possible reasons for this variability include the age at which EFL learners were first exposed to English as well as the age at which they were first taught to read and write in English (Waked et al., 2023). Phonological awareness may also vary among learners with different native languages. If English contains phonemic contrasts (i.e., differences in linguistic sounds that can change word meanings) that are not found in their native language, EFL learners may encounter difficulties in acquiring awareness of particular phonemes of the English language. As such, it is essential to identify such contrasts to facilitate EFL students' reading comprehension (Bhide et al., 2020).

Arabic is one language that does not possess some phonemic contrasts found in English. For instance, the Arabic language possesses only three vowels that are phonemically contrastive in

English (i.e., vowels whose use can change the meaning of a word). These are /æ/ (e.g. "at"), /u/ (e.g., "boot"), and /i/ (e.g. "eat"). Yet, both the long and short forms of these vowels are primarily used for inflection and do not carry meaning. Thus, for native speakers of Arabic who are EFL learners, vowels that are phonemically contrastive in English will be unfamiliar and not necessarily noticeable (Abdelgadir et al., 2021). Additionally, while Arabic has 28 distinct consonant sounds, certain sounds that are phonemically contrastive in English are not perceived as such by native speakers of Arabic. One consonant sound that is not phonemically contrastive in Arabic is /p/ (e.g., "pat"). In oral production of English, when a word includes the sound /p/, native speakers of Arabic often perceive the related phoneme /b/ (e.g., "bat"), which is contrastively meaningful in Arabic. Numerous minimal pairs in English rely on the contrast between the phonemes /p/ and /b/ (e.g., "pin" and "bin"; Ezz, 2018). As such, awareness of both the consonant phoneme /p/ as well as other unfamiliar phonemes may impact reading comprehension in EFL learners who are native speakers of Arabic.

Although studies have examined the unique and shared features of learners' first language and English, most have focused on pronunciation competencies and have included EFL learners classified as beginners (e.g., Al-Zoubi, 2019). In contrast, the present study aimed to examine the relationship between reading comprehension and phonological awareness of English-language vowels and consonants that are not found in EFL learners' native language (e.g., Arabic). To ensure sensitivity to such a relationship, learners' English language proficiency ranged from moderate to proficient (as measured by the International English Language Testing System, IELTS). Among the English-language phonemes considered, /f/ (e.g. "fish") was deemed ideal to serve as the baseline condition since it is found in both Arabic and English. Instead, /p/, a consonant (e.g., "play"), and /ʊ/, a vowel (i.e., "under") were used for testing EFL learners' phonological awareness of unfamiliar phonemes not found in Arabic. We hypothesized that the lower the EFL learners' phonological awareness of such unfamiliar phonemes, the lower their reading comprehension.

2. Methods

Participants included a convenience sample of 51 undergraduate female students enrolled in general education courses at a Saudi Arabian university. The selected university follows an American curriculum with a student-centered paradigm. A minimal overall score of 6.0 and a writing score of 5.5 on the IELTS are required for admission to undergraduate programs. Participants' scores classified them as either moderate or proficient users of English. Participants ranged in age from 18 to 23 years, with an average age of 19.5 years. Students who reported attending secondary schools in which Arabic was the primary language of instruction constituted 63% of all participants. The remaining 37% reported attending secondary schools in which English was the primary language of instruction.

Following informed consent, the study entailed two tasks. The first task was a variation of the FAS Test, a production task used to test phonemic fluency. This test measures participants' ability to rapidly retrieve English-language words from long-term memory and produce them orally in response to a phonemic prompt (Jansson et al., 2020). As in the original FAS test, after participants were provided with an English-language phoneme, they were given one minute to produce English-language words beginning with that sound. Testing began with the control phoneme, /f/, to obtain a baseline measure as well as to ensure that participants understood the task. Participants were then tested using the novel consonant phoneme, /p/. Following the testing of these two consonants, participants were then tested using the novel vowel phoneme /ʊ/ (e.g., "under"). The sound /d/ (e.g., "dog") was used to familiarize participants with this task. Like /f/, /d/ is present in both Arabic and English.

Correct and incorrect responses to each phonemic prompt were recorded. After completing this variation of the FAS Test, participants were given twenty minutes to read a passage from the reading comprehension portion of the Test of English as a Foreign Language (TOEFL) and then answer standard questions (Rina & Tiarina, 2021). In the TOEFL, reading comprehension assessment relies on five distinct types of queries for each passage: factual information questions, negative factual information questions, rhetorical purpose questions, vocabulary questions, reference questions, and sentence simplification questions. As such, the TOEFL provides a holistic assessment of an individual's reading comprehension as required for academic success in higher education. All testing took place in a sound-attenuating room located in the Cognitive Science Research Center at Prince Mohammed Bin Fahd University. Debriefing was offered at the end of each session.

3. Results

Pearson correlation coefficients were calculated to determine whether a relationship existed between reading comprehension and phonological awareness of English-language consonants and vowels that are not found in Arabic. Prior to conducting any analyses, percentage correct scores were converted to rationalized arcsine units (RAU) to fulfill the assumption of normality. A post-hoc Bonferroni correction was applied to reduce the inflation of experiment-wise alpha. Table 1 displays the results of these analyses. Significant correlations are marked in bold and with an asterisk.

Table 1. Pearson Correlation Coefficients (*r*) of the relationships between reading comprehension scores and phonological awareness scores of /f/, /p/, and /ʊ/ sounds.

Phonological Awareness Measure	Reading Comprehension (*r*)
Number of Correct /f/ Words	0.004
Number of Incorrect /f/ Words	0.075
Ratio of Correct to Incorrect /f/ Words	0.056
Number of Correct /p/ Words	**0.415***
Number of Incorrect /p/ Words	**-0.292***
Ratio of Correct to Incorrect /p/ Words	**0.386***
Number of Correct /ʊ/ Words	0.262
Number of Incorrect /ʊ/ Words	-0.042
Ratio of Correct to Incorrect /ʊ/ Words	0.066

These results did not entirely support the hypothesis that a relationship exists between EFL learners' reading comprehension and phonological awareness of consonants and vowels not found in Arabic. More modestly, only learners' phonological awareness of the novel consonant /p/ was correlated with reading comprehension. Namely, as reading comprehension increased, learners' correct responses increased and incorrect responses decreased. This finding suggests that, for native speakers of Arabic, phonological awareness of phonemically contrastive consonant sounds in the English language may play a more relevant role in reading comprehension than phonological awareness of phonemically contrastive vowels.

4. Discussion and Conclusion

Our study examined the relationship between EFL learners' reading comprehension and their phonological awareness of phonemes not found in their native language. Participants included native speakers of Arabic who were judged to be moderate to proficient English-language users. These speakers exhibited a significant correlation between reading comprehension and phonological awareness of a phonemically contrastive consonant in the English language, but no relationship between reading comprehension and a phonemically contrastive vowel. Our results agree with those of Alharbi and Aljutaily (2020) who found that EFL learners of Arabic descent confused the perception of /p/ with /b/.

The measure of oral/aural phonological fluency used was a variation on the FAS task in which participants were presented with a phoneme and were given one minute to list as many English-language words possible that begin with that sound (Jansson et al., 2020). Adult EFL learners

who are native speakers of Arabic were expected to have difficulty identifying non-native phonemes, even though their proficiency was not that of beginners. For instance, when orally using words in English containing the phoneme /p/, native speakers of Arabic would be likely to substitute the input with a phoneme from their native language that is subjectively similar to the target English-language phonemes (Alshaboul et al., 2014).

As a pre-reading linguistic skill, oral/aural phonological awareness is presumed to lay the foundation for later complex linguistic skills, such as learning to read (e.g., Zugarramurdi et al., 2022). Given that oral/aural phonological awareness necessarily precedes orthographic awareness (Anthony & Francis, 2005), the relationship between phonological awareness of the consonant /p/, as measured by the FAS task, and reading comprehension is unsurprising. It is surprising though that it is present in EFL speakers who represent the upper levels of the proficiency continuum. Persistent difficulties can hinder learning to read words that include this and similar non-native phonemes. Specifically, it may prevent the rapid, automatized recognition of words, which is required for fluid reading and reading comprehension.

Interestingly, unlike the non-native consonant sound used in this study, the vowel sound, /ʊ/, was not significantly correlated with reading comprehension, even though it is also not present in Arabic. One potential explanation for this finding is a form of negative language transfer known as vowel blindness. Vowel blindness leads native speakers of Arabic to essentially ignore the vowels present in a written word and instead focus primarily on consonants (Alhamzi et al., 2019; Almobadi, 2023). In English, even though there are only five written vowel letters that are directly associated with both a long and short form, there are in fact over twenty vowel sounds that are contrastively recognized by native speakers of English (Abdelgadir, 2021). Unlike English, Arabic contains 28 unique consonant sounds and only three contrastively meaningful vowel sounds. These three sounds exist in both a long and short form. Written words in Arabic are primarily comprised of three core consonants which are then inflected in ways that include these limited vowel sounds (Waked et al., 2024). As such, vowels are less essential than consonants for reading comprehension in Arabic. It follows that vowels may be less likely than consonants (such as /p/ and /b/) to be confused with other sounds.

EFL instructors are often faced with the challenge of working with several native languages throughout their careers, each of which possesses its unique phonological structure. The way that these languages compare to the English language poses diverse challenges to EFL educators worldwide. Particular linguistic differences may contribute to the difficulties EFL educators face when teaching reading to native speakers of Arabic. Our findings, together with those of Alharbi and Aljutaily (2020), suggest that not all non-native sounds may be problematic for EFL learners, thereby promoting an approach to EFL instruction that focuses on non-native sounds that can be confused with others. Most importantly, they suggest that EFL learners' competency level may be a critical factor in the likelihood of phoneme confusion.

The relationship between phonological awareness of non-native consonant sounds and reading comprehension found in this study indicates that a production test, such as language-specific variations on the FAS Test, can be used as a diagnostic tool for reading comprehension under the assumption that semantic processing may be disrupted by non-automatized phonemic processing. The potential presence of vowel blindness also suggests that native speakers of Arabic may use a reading strategy that differs from that of a native speaker of English. As noted earlier, awareness of differences in the phonological structure of the two languages can help EFL educators of native speakers of Arabic to better address the unique needs of their student population.

Training devoted to phonological awareness may also ameliorate students' motivation and emotional state, thereby broadly contributing to students' academic success. Specifically, it can not only impact performance in courses where the English language is the dominant mode of communication but also reduce anxiety and other negative feelings that are often present in EFL students (Hanifa, 2018; Waked et al., 2023). Another way that training in phonological awareness can be beneficial to academic success is by fostering in EFL learners an opportunity rather than a threat approach to foreign language learning tasks (Chen & Qu, 2021). These approaches are two separate mental states that reflect learners' subjective assessment of task demands and personal resources when performance is relevant. A task such as reading is likely to be framed as a challenge if a learner's resources are assumed to meet task demands, thereby motivating the learner to devote effort to the task. Conversely, a task is likely to be framed as a threat if task demands exceed the learner's resources. The latter approach may lead to avoidance of the task, thereby reducing students' opportunities to learn English.

Of course, the extant literature contains several suggestions regarding training in phonological awareness (e.g., Sodoro et al., 2002; Torgesen et al., 1992), each of which remains to be examined for its effectiveness with Arabic speakers. If these types of training are proven to be effective with native speakers of Arabic, focusing instruction and practice on consonant awareness may also considerably improve reading comprehension levels in such speakers. Yet, individual differences, such as those involving learners' confidence and motivation (Pilotti et al., 2023), may also be critical in administering efficacious training in phonological awareness.

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Invisible Intersections: Cultural and Disciplinary Diversity Among Faculty in the International Classroom

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Abstract
Scholarly literature on the international classroom frequently emphasizes the importance of making implicit beliefs and norms explicit in order to equalize all students' ability to succeed. However, faculty members from varying cultural contexts may not share the same underlying norms, values, procedures, and educational standards. Likewise, faculty members may differ in educational and disciplinary backgrounds. This study uses interviews to assesses the experiences and academic norms of faculty members teaching in the interdisciplinary English-track of the Media and Culture Studies BA at Utrecht University in the Netherlands. This study finds that the effects of both discipline and culture function invisibly and most participants overestimate the degree of agreement between faculty members about core elements of the curriculum. As a result, we suggest that it is necessary for departments to actively foster awareness of disciplinary and cultural norms and to seek consensus between teachers across the curriculum.

Keywords: *international classroom; faculty; diversity; interdisciplinarity*

1. Introduction

Scholarly literature about the international classroom frequently emphasizes the importance of making implicit beliefs and norms explicit in order to equalize all students' ability to succeed (Carroll, 2005). If students come from many different cultural, linguistic, and academic backgrounds, they may also have different assumptions about core academic competencies and procedures. In international classrooms, pedagogical procedure thus must be taught explicitly to equip all students with the knowledge needed to comply with the educational norms of their institution.

However, this literature less often considers diversity among faculty. The notion that teachers can more explicitly and consistently explain disciplinary structures and local academic norms

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to students assumes that they have a shared, stable, and coherent understanding of the disciplines and academic culture in which they work. In other words, most models of international education assume cultural differences between students, but not between faculty. Likewise, most models of interdisciplinarity assume an interaction or borrowing between two or more stable disciplines, but do not account for instability within disciplines themselves or national and cultural differences in how disciplines are understood or constructed. Yet, in an international, inter-, trans-, or multidisciplinary program, faculty may struggle to present a coherent vision of shared academic values for international students to understand and rely upon throughout their degree trajectory. Unevenness and disagreement between teachers in the same program may undermine students' ability to adapt and construct a coherent interdisciplinary perspective.

This study assesses the experiences and academic norms of faculty members teaching in the interdisciplinary English-track of the Media and Culture Studies BA at Utrecht University in the Netherlands (known as MAC). Higher education in the Netherlands has been rapidly internationalizing, adding English programs at both the BA and MA level. Recent debate on internationalization has led to a critical examination of English language programs in Dutch universities and the experience of students and staff in these programs. Through faculty interviews, the MAC program in Utrecht provides a useful case study as it integrates traditional humanities, digital humanities, and social sciences approaches taught by an interdisciplinary, culturally diverse faculty to a multi-national student body. Thus, this study seeks to understand how disciplinary and cultural backgrounds intersect in teachers' experiences of the international classroom. We find that the effects of both discipline and culture function invisibly and most participants overestimate the degree of agreement between faculty members about core elements of the curriculum. As a result, we suggest that in the context of what Machura calls "superdiversity," it is necessary for departments to actively foster awareness of disciplinary and cultural norms and to seek consensus between teachers across the curriculum (2021).

2. Method

In order to gain better understanding of teachers' own implicit beliefs and academic perspectives this study utilized ethnographic interviews. As argued by Michrina and Richards the humanistic tradition of ethnographic interviewing enables the interviewer to enter the interviewee's worldview (1996). They further argue that by maintaining full openness to new information ethnographic interviewing attempts to transcend cultural differences and the interviewer's preconceptions, making this method a good match for cross-cultural research. In particular, Frank and Langness emphasize that the dialectic between self and other in ethnographic exchange elucidates both the opacity of cultural difference but also the hidden layers of the interviewer's own mind (1981). As a result, Behar notes that the particularity of the ethnographer is also inescapably part of an ethnographic inquiry (1999). This project benefits

from this bidirectional focus partly because the interviewers are both also academics from different disciplines working at Utrecht University, with their own migration histories. Both Kustritz and Hacopian are originally from the United States, but Hacopian was trained in the USA and Germany and Kustritz trained in the USA and UK. Because norms function as a largely invisible and implicit backdrop to everyday life, the juxtaposition of cultural and disciplinary positions within the context of an ethnographic exchange in this study facilitates making these normative assumptions visible for both the interviewees and interviewers (Michrina & Richards, 1996).

The parameters and protocol for this interview project were developed in connection with the Utrecht University FEtC-H (Faculty Ethics Committee of the Humanities). The study population includes all teaching faculty members of the MAC program. Because university staffing is a matter of public record, care has been taken to report results holistically and limit linking details that together may inadvertently identify individual participants. The exact number of faculty members varies per year depending on staffing levels and changes in the student population. For the purpose of the study the number of available, relevant staff was approximately 45 and the number of interviews completed was 23. Although statistically slightly less than half of the total population is a high proportion, it is not appropriate to generalize ethnographic data, which precisely seeks to better understand the particularity of lived experience. As such we position our findings as suggestive but not definitive and the beginning of a conversation both within the department and within the scholarship on the international classroom regarding the interface between an international student body and a culturally and disciplinarily diverse academic staff.

Semi-structured interview questions were chosen to maintain the balance between the shared focus necessary for the interviewers and interviewees to compare their cultural assumptions versus the openness necessary to protect a genuinely ethnographic encounter with cultural alterity. Thus, for comparative purposes some of the same themes were introduced in nearly all interviews, including a request that participants reflect on their understanding of some of the core competencies of the program tested in the BA thesis (that is research question, academic relevance, method, etc.). However, to maintain room for participants to shape the interview process and introduce genuinely new themes and concerns the interviewers may not have foreseen the interviews were conversational with no set structure and primarily utilized open questions with spontaneous follow-ups.

3. Outcomes

Results of the interviews clustered around two themes: the invisibility of disciplinary and cultural norms, and lack of consensus between colleagues about academic skills. One of the most interesting phenomena during the interviews was the difficulty some participants had in reflecting upon or even defining their own discipline(s), the disciplines most central to the MAC

program or the Media and Culture Studies department, and differences between the domestic and international classroom. Although many faculty members eloquently commented on issues of interdisciplinarity and the international classroom, others found these questions challenging or silencing. There are both procedural and structural reasons for this silence. First, all interviews depend on rapport and can be undermined by mismatches in personality and comportment. It is entirely possible that the protocol of individual interviews rather than a series of interviews over a longer span of time impeded the development of trust with some participants. Secondly, the mere act of noticing cultural differences may, under some circumstances, be positioned as culturally insensitive or xenophobic. This impediment may have led some participants to deny noticing any difference between domestic and international classrooms, while it resulted in a pattern of disclaimers from other participants with a structure like: "I've noticed that Italian students tend to –well, not all Italian students, of course ..." Further, the professional identity expected of professors, especially in the neoliberal academy, requires both constant growth and "professionalization," but also absolute competence with no limitations or weaknesses (Hall & McGinity, 2015). As such admitting to problems in their classes or the MAC program may have been experienced as a professional threat for some participants. Of course, there may also be no confounding effect related to the study procedures and this result could indicate a frequent lack of time or inclination to reflect upon the role of discipline and/or culture in pedagogy. However, regardless of the reasons, the lack of awareness or direct denial of problems and differences also undermines opportunities for change and improvement.

Fewer explanations related to the procedures of the study help to explain difficulties some participants experienced in reflecting upon disciplinary and interdisciplinary identities and boundaries, yet they are indicative of cultural differences in disciplinary formation. In his article "Debating Disciplinarity" Post argues that disciplines construct a barrier between acceptable and unacceptable knowledge practices via several institutions (2009). He names academic departments, scholarly societies and associations, peer-reviewed journals, and the prestige hierarchy between publishers. However, Post writes from within American academia and does not explore the specific institutions that construct and legitimate disciplinarity in other cultural contexts. In the humanities in America grants have almost no importance within the formation of disciplinary priorities or career progression, whereas in other international contexts national grant funding models like the NWO in the Netherlands or SSRHC in Canada, or intranational granting such as the EU-level Horizon program, are central to the selection of research topics and scholars' promotion to higher ranks within humanities fields. When such granting systems strongly drive the hiring, tenuring, and promotion processes, they may fundamentally supplant the institutional role Post identifies in disciplinary formation (2009). This may be even more starkly different within the Dutch context as grants also determine most PhD positions and topics, and institutional pressure to adopt "open science" practices often prioritizes open access

publishing, disrupting the disciplinary and disciplining role of the prestige hierarchy between journals and publishing houses. As a result, disciplines form themselves very differently in various international contexts and may not always function as the most important structure of academic life or identity.

A second significant area of interview findings cluster around teachers' broad agreement about problems with student language levels and writing skills and disagreement over the definition and importance of key components of the curriculum. Yet, there is a curious lacuna between these two topics regarding broad lack of reflection on the cultural and disciplinary training required to meet the standards of Dutch academic writing and classroom speaking in the humanities. As is common in the academic literature on the international classroom, most teachers noted that international students who are non-native speakers of English often struggle with expressing themselves in speech and writing but, with some exceptions, most also felt that language instruction is not the job of subject-specific professors in a university setting (Machura, 2021). Because only a few participants were first-language English speakers, many also expressed reservations about their competence to teach or extensively correct students' English, as also noted by Machura (2021). Although many participants commented on the difference between grammatical issues in English and the ability to write well in an academic setting, many expressed or demonstrated difficulty in disentangling these two domains.

Further, participants overestimated the extent to which they understand, teach, and assess core components of the curriculum, including academic writing, in the same way as other colleagues in the MAC program. Participants' definition of core graded components of the BA thesis varied significantly as did their approach and standards when introducing these elements in class. Likewise, there was no broad agreement in their characterization of characteristics of "quality academic writing," and only a few participants commented at length about differences in how academic writing is taught in various disciplinary and national contexts. In other words, for many participants the elements of academic writing and central tested competencies of the program functioned as an invisible system of norms they assumed was shared with other colleagues, but in practice these varied significantly. Colleagues trained in or with significant research or teaching experience in other countries commonly had a greater awareness of variations in academic writing styles transnationally, likely because these cross-cultural academic experiences made their own norms more visible.

This dynamic was exemplified by one participant who explained quality academic writing as containing "those well-known ingredients from the '*Schijf van Vijf*.'" For those who are not familiar with the "S*chijf van Vijf*," it is a writing guide designed by Media and Culture Studies faculty member Professor Eggo Mueller in 2005, referenced widely but rarely directly taught throughout the department's curriculum. Because the title is a pun on a Dutch dietary guideline analogous to the "food pyramid" in the American context, it has been translated with some distortion into English as "The Five Question Pie Chart." Although the document circulates

freely online under a creative commons license, it is distinctly not "well-known" or commonly utilized internationally or even at other universities in the Netherlands or other departments within Utrecht University, apart from the sister program in Communication and Information Sciences. Likewise, its writing advice is distinctly Dutch, as many other national traditions of humanities media studies scholarship do not use a research question or method section. The classification of the "*Schijf van Vijf*" and its distinctly Dutch mode of writing as "well known" functions as what Warner would call the kind of normal that is not only statistically average but normative – a kind of slippage that normalizes nationally and disciplinarily contingent standards as universal (2000).

4. Discussion

Lack of curricular consensus may ultimately result in an absence of accountability for the care of international students at a departmental and institutional level. Participants, for example, reflected a widespread attitude demonstrated in existing research on instructors who teach international students in English track programs. This research reports that faculty frame the problem in terms of the student: when asked which challenges faculty face, instructors answer in terms of student deficiencies (Jin & Schneider, 2019, p. 91). Despite these deficiencies, faculty often indicate minimal interest in helping students with language skills, or in learning more about pedagogical methods for teaching linguistically and culturally diverse students (Chen, 2019; Jin & Schneider, 2019). Some instructors may even "resent" being asked to adapt teaching practices for linguistically diverse students (Jin & Schneider 2019, p. 85).

Existing literature identifies faculty indifference to cultural and disciplinary differences as a catalyst for confusion among native and international students alike. Yet, the confusion is greatest for international students. Research reports that international students tend to experience "greater adjustment difficulties and more distress" than domestic students (Poyrazli & Grahame, 2007, p. 29). Indifference toward their needs results in a neglect of care for international students in the international classroom, as well as a lack of accountability for international students within the academic structure of the university.

Yet, the very notion of care for international students also appears to be a cultural concept. Different cultures and subcultures frame the needs of international students differently. For American universities, research from the late 1970s and early 1980s recommended cultural sensitivity, awareness of communication differences and policy interventions for international students (Perkins, 1977; Dillard & Chisom, 1983; Surdam & Collins, 1984). Research also indicates that faculty members who are multilingual, immigrants, or have worked long-term in international tracks are aware of international students' needs and willing to adjust their instruction to accommodate them (Chen, 2019; Jin & Schneider, 2019). Among our participants, these same groups of instructors often described teaching in the international classroom as an

opportunity for cultural growth and exchange. Accordingly, these participants reported that they provided extra help to international students and drew on international students' cross-cultural knowledge to enrich the curriculum.

Faculty can be taught the necessary competencies for the international, interdisciplinary classroom. Training can increase the capacity for self-reflection, communication across cultural and disciplinary forms of difference, and awareness of instructors' academic norms and the role these play in the educational process. Consensus building would require instructors to agree on cross-cultural disciplinary tenets and practices. While some may experience consensus building as a threat to academic autonomy, practice indicates that disciplinary consensus is necessary for both interdisciplinary teaching and collaboration (Repko & Szostak, 2020). Finally, consensus building among faculty can increase faculty cohesion and effectively improve the experience of both international and interdisciplinary students.

5. Conclusion

Considering faculty in international programs as heterogenous and culturally diverse is a new approach. Likewise, the literature on interdisciplinary teaching rarely considers how disciplines (and thus interdisciplinarity) are formed differently in various national and institutional contexts. Bringing these two innovations together is necessary to understand interdisciplinarity within Dutch universities wherein both student and staff are increasingly international, and yet academic and cultural norms still function largely invisibly.

Crossing international boundaries often also involves crossing disciplinary boundaries, since the development of disciplines is culturally bound and depends on specific (national) institutions. As a result, a faculty with staff trained in different countries will likely understand their academic and disciplinary norms and standards very differently. The study urges us to consider interdisciplinary and international teaching as an intersectional matrix, as these modify each other within a diverse academic community.

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Integration of Practice-Related Empirical Research Projects in International Postgraduate Studies: A Case of the Master Program in Development Management

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Abstract

This paper engages with student-led empirical social research and the integration into the study curricula. The purpose of this work is twofold. First, we highlight the relevance of integrating practice-related research projects into postgraduate studies. Second, we illuminate this with the case of the English-language MA programme in Development Management offered at the Institute of Development Research and Development Policy at the Ruhr-University Bochum in Germany. For more than two decades, this international programme has propelled student researchers to define their own academic projects, collect and analyse data, and derive recommendations relevant for people and policy-makers in deprived regions globally. The findings are based on the experiences of students and lecturers from the program including M&E data and reports. This contribution derives take-away messages for postgraduate programmes in the social sciences on how to incorporate research projects and on how to create research outputs relevant to the real world.

Keywords: *Empirical social research; practice-related research; student researcher; research-based learning; field research; AI.*

1. Introduction

By providing new insights and refined up-to-date knowledge, the science system supports society to constantly adapt to upcoming challenges particularly in times of a rapidly changing world. This is particularly relevant in multifaceted contexts of crises, including wars, political unrest, diseases, extreme weather events, and displacement as well as dynamics of increasing inequality. Hence, it is one of the key tasks of academia to incorporate these and create a research landscape that allows for integration of pending global issues (Grabinger et al., 2011). Ideally, it takes over a pioneering role and addresses the most recent developments. In this

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context, empirical social research (ESR) can contribute up-to-date, theory-based, evidence-driven, relevant, hands-on, and practice-related insights by collecting and analysing real-world data (Jerabek, 2015). For instance, a simple survey on people's vaccination behaviour may provide insights into reasons for rejection or motivational factors to get vaccinated. Corresponding findings could be essential for improved vaccination campaigns.

Against this background, this paper argues that beyond large-scale and long-term research projects, research of smaller scope, directly linked to problems and realities on the ground becomes increasingly important. Amongst others, empirical research approaches require integration into postgraduate study curricula to allow students to apply their skills and ideally contribute to innovative mostly localised solutions. At the same time, practical application of ESR and the overall ability to design and implement such a project contributes to skills highly relevant in today's job market. Furthermore, in times of increasing usage of generative AI in academia, such projects present academic output truly depending on researchers' own contribution and restrict the misuse of AI.

Based on that, this contribution highlights the relevance and advantages of practice-focused research projects led by students in the first part. We refer to acquired skillsets benefiting students and future employers. In the main part, we present hands-on experience by introducing the case of the Master Programme in Development Management (MADM) offered at the Institute of Development Research and Development Policy (IEE) at the Ruhr-University Bochum in Germany. The MADM program aims to train experienced professionals in the field of development cooperation to deal with practical problems in this field of work and to meet the increasing demand for development experts in international development cooperation (IEE, 2024). In this context, the MADM integrated a complex research training into 18-month of studies equipping students with a solid methods' foundation and the ability to design and conduct highly practice-related empirical research projects. We conclude this paper with a short summary and key take-away messages calling for innovative teaching and research learning.

2. Relevance of Student Research and Practice-Related Empirical Social Research

ESR implies collecting and using data to analyse and describe social phenomena and in this way derive (new) knowledge from actual experience. Therefore, ESR can be considered as evidence-based research (Siebert, 2024). Common data collection tools are inter alia surveys, semi-structured interviews, and observations. Data collection is guided mostly by theory (deductive) and implies interaction with the people on the ground, i.e., the research subjects. This close engagement with lived realities and more broadly the social world is one of the biggest advantages of ESR as research findings ideally allow for practice-relevant insights and recommendations (Clark et al., 2021). Against this backdrop, skills in ESR are becoming more

important in the professional world, which is related to the increasing interest in impact and output measurement, customer-/client orientation, and relevance of monitoring and evaluation.

Hence, courses associated with ESR are included in many study programmes in the social sciences, e.g., statistical methods and data analysis courses. However, based on our experience at RUB as well as exchange with colleagues in this field and with other development-studies postgraduate programmes these offers are often insufficient and rather isolated – comprising only single courses – and students with lacking pre-knowledge rather perform poorly. At the same time, an increasing number of students considers a thesis comprising an empirical part as more interesting and beneficial in terms of career perspectives. Simultaneously, lecturers prefer empirical theses hoping for new perspectives. Some examination regulations even indicate that thesis projects require empirical research. This conflict between partly poor empirical course offers and a high demand in empirical student projects calls for new approaches. One way is to integrate comprehensive and well-guided student research projects based on a solid method training into the study cycle. Before illuminating this approach with our case study, we present five beneficial aspects accentuating the relevance of carefully integrating ESR and practice-related student research into study programmes. These aspects are derived from corresponding discussions in the literature, ongoing vital discussions in the German academic landscape, and from our own experience with the MADM and partner programmes.

2.1. Applying theoretical skills outside the classroom

In accordance with the idea of constructive alignment, the aim is to connect theoretical classroom knowledge with hands-on application of empirical research. A curriculum should be designed in a way that connects the subjects vertically and horizontally to empower the students to actively construct learning while reaching the intended learning outcomes and achieving educational coherence (Angelo, 2012). Hence, teaching activities in the courses build up on one another and are directly linked to students' research projects, which can be understood as one of the desired learning outcomes of postgraduate studies. An example is that students are equipped with theoretical skills of questionnaire construction and then apply these skills to design their own questionnaire for a small survey in practice.

2.2. Designing and facilitating entire research projects

Students need to be familiarised with each step of a research process to conduct ESR independently and in this way benefit from research-based learning. Häder (2022) defines five phases of an empirical research project. Accordingly, ESR reaches from the definition of a research problem, to preparing a survey, collecting and analysing data and finally the documentation of the results (Häder, 2022). Experience shows that guidance throughout each step of the research significantly improves the results of students. Hence, courses focusing on

good scientific practices, research methods, data collection and analysis as well as personal consultation are necessary for successful ESR alongside a master program.

2.3. Opportunity to use findings in the real world

ESR engages with real world problems and thus can provide related recommendations. In line with scientific standards, ESR gives practical insights and provides transferability beyond academia. As a tool to analyse existing problems and evaluate interventions and projects, ESR can be used to develop and refine those (Siebert, 2024). This can be exemplified by the earlier case of a vaccination campaign. Empirical insights on people's motivation to get vaccinated or not, are key to improve the campaign. Such practical relevance motivates students and enriches them with knowledge that they can also apply outside of the academic world.

2.4. Student-led research-based learning

In research-based learning students learn independently through their own research. They are supposed to actively take part in knowledge production instead of just being taught about results. While learning the relevant methods, students plan and carry out research independently and present their findings during their studies (Brew, 2013). To prepare and support students in this research process, it is worthwhile to design a research-based curriculum. Hence, students should be introduced to multiple research activities, have the opportunity to take part in knowledge production, and be encouraged in becoming critical thinkers (Zou et al., 2023). Particularly in times of text generative AI, empirical research projects offer an alternative assessment of students' classroom knowledge and hence helps students to improve these skills.

2.5. Essential career skills

In times of stagnating student numbers and decreasing rates of freshmen at universities in Germany (Statistisches Bundesamt [Destatis], 2021), calls for a stronger connection of study programmes to practice, particularly the real world application of theoretical inputs, are becoming louder. Clearly, study programmes incorporating a strong knowledge base for social empirical research and related application respond to such calls and offer highly hands-on skills required for many jobs. They empower students to conduct research projects independently and provide them with the tools necessary to carry out solid project evaluations, as one example.

3. Application of Practice-Related Empirical Research in case of the MADM

This part of the paper presents the experience of the MADM programme based at the IEE, a central research institute at the Ruhr-University Bochum. The English-language programme is an interdisciplinary course of study designed mainly for students from the global South and those who desire a career in development cooperation. The program is aimed at people, who

already successfully completed a first relevant university degree. Many students also have practical experience in development cooperation. The course teaches theoretical knowledge and empirical methods that prepare students for the demands of the labour market (IEE, 2022). The aim of the program is to enable participants to manage development projects with a sound academic knowledge-base. This comprises skills in ESR to analyse and judge real world problems as well as to report on the outcomes.

3.1. Methodological Approach of the MADM

Against this backdrop, a key element of the MADM is student's own empirical research project, i.e., their master thesis, which is initiated directly after admission to the programme and completed with the submission at the end of programme. Figure 1 provides an overview of the three semesters and related key steps shaping students research project, which are described in more detail in the following.

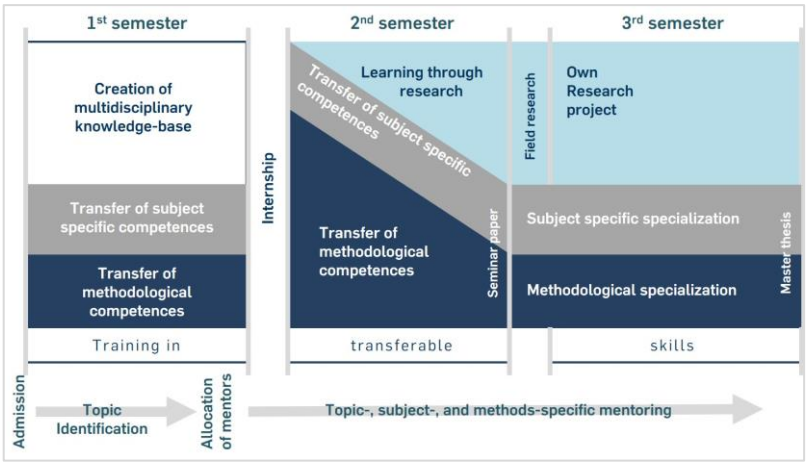


Figure 1. Study sequences, competences, and ESR related steps. Source: IEE (2020).

The first semester equips the students with a broad multidisciplinary knowledge base in the field of development cooperation and international relations; part of that are related dominant development theories and concepts. In addition, sessions on research logic provide students with insights on how to develop practice-related research questions and objectives. In this context, they are put in a position to define a research problem and conduct a literature review. At the same, students are familiarised with skills in statistical methods. While attending coursework, students are encouraged to identify their own research topic for their Master thesis, develop possible research questions and engage with relevant literatures at the very beginning of the MADM. Usually, they opt for a topic, which engages with a development intervention, realities of vulnerable groups, and/or actor constellations in their home country. In these steps of

initiating their own project, the IEE and fellow students provide feedback and students are assigned to a mentor who will supervise their research project throughout the studies.

The second semester builds on this foundation and provides specific skills in quantitative and qualitative research methods as well as a related module called 'How to Conduct a Field Survey'. This two-week block module usually takes place abroad, to allow students to apply their skills in practice. In this semester, students work further on their individual research projects; they particularly design the methodological part of it and prepare their field research abroad. All steps of the research project are to be presented in the seminar paper, an academic paper comprising problem statement, literature review, research questions, and methodology of the project. Students are moreover invited to defend their field research design in class as part of the continued research logic sessions and get feedback from their peers and the institute's researchers. At the end of this semester, student should be in a position to start the data collection in their field research destination. In addition to this semester's methodological training, IEE offers several multidisciplinary courses engaging for instance with financial management, planning, monitoring and evaluation of projects, or further topical developmental themes such as urbanization.

After a three-months period of field research, the last semester offers practice-related course offers and students work intensively with the collected data, e.g., preparing and analysing, and complete their Master thesis. Again, they have the opportunity to present preliminary field research findings to their peers and staff members in research logic sessions. A mentor guides the whole process of the research project including the finalisation. The final Master thesis ideally also comprises practical recommendations, which might be helpful for research participants, the development projects on the ground.

3.2. Case study of an empirical research project

In the following, we provide a brief example of a successful Master thesis project, which certainly benefitted extensively from the outlined concept. One MADM student conducted a quantitative empirical research studying if caregivers' perceptions of the influence of immunization on children's health affect vaccination uptake. The idea for the topic arose from his experiences with childhood diseases in his African home country. Despite existing vaccination options, the spread of childhood diseases could not be prevented. During classwork, the student learned e.g. to conduct a field survey as well as statistical method to analyse quantitative data. Guided by his mentor, he did a literature review to evaluate the status quo of scientific knowledge within the research area and to find a suitable theoretical approach. Using the health belief model, the student structured his analysis and operationalized his variables. The student designed his methodological approach in consultation with his mentor. Based on his own knowledge of the region and published statistics, he found a suitable location for the study and defined a reasonable sampling strategy. The student summarized the research steps

complied before his field research in a seminar paper. Subsequently, the student prepared and conducted his field research in the study location. The student designed a structured interview guide, which he pretested on site before he started the interviews. Over a period of ten weeks, the student conducted over 200 interviews. After his fieldwork, he returned to Bochum to analyse his data and write his thesis. Using factor analysis, the student found out that a lack in knowledge about childhood diseases exists which prevent the widespread vaccination of children. Based on that, he was in the position to derive a number of clear recommendations for local organisations and health agents operating in this field. His successful Master thesis project moreover opened up a unique job position in the field of health management with one Germany's well-established developmental organisations.

4. Concluding remarks

This paper derives four key take-away messages for postgraduate programmes in the social sciences on how to incorporate empirical research projects into study curricula, how to strengthen student-researchers, and how to create research outputs relevant and applicable in the real world:

(1) Applying classroom knowledge gained in postgraduate courses to a practical research project deepens the understanding and increases the motivation of students.
(2) Students require guidance through each step of ESR as part of the course work as well as the supervision.
(3) Small-scale research projects directly address problems and realities on the ground and help to develop practicable solutions for local people and organisations operating in this field.
(4) The integration of ESR in the master program prepares the students for a career inside and outside of academia.

The outlined case of the MADM intends to give an impetus for (re-)structuring postgraduate study programmes in a way that allows for a comprehensive learning experience in ESR. The MADM might function as a so-called prototype for other practice-related study programmes in the social sciences and might inspire lecturers and researchers to (re)consider student led research initiatives. It would be desirable to compare the results with similar programs in order to bring about further improvements and develop clear recommendations for curricula.

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Harnessing the power of cutting-edge technologies in flipped learning: A paradigm shift in university education after post-COVID-19 era

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Abstract

Flipped learning is an instructional approach that reverses the traditional classroom model, delivering instructional content outside of class and utilizing in-class time for interactive activities and discussions. In our university, the implementation of flipped learning has gained momentum, particularly due to the shift towards remote and online education during the COVID-19 pandemic. However, the level of experience and familiarity with flipped learning varies among students and teachers. This study investigates enhancements and methods to transform university education and enhance learning experiences in the post-COVID-19 era through flipped learning. Questionnaires are utilized to collect exemplary flipped learning experiences from students, while interviews are conducted with teachers nominated by their students for effective flipped teaching approaches. These findings contribute to the development of best practices and professional development opportunities for educators. Embracing these enhancements enables universities to create a transformative educational environment for fulfilling learning experiences.

Keywords: *Flipped learning; Post-COVID-19 era; AI-driven video production and automated narration; Online collaboration learning platforms; Flexibility in learning.*

1. Introduction

Flipped learning is an instructional approach in which the traditional model of classroom instruction is reversed (Al-Samarraie et al., 2020). In this approach, students are first exposed to instructional content, such as pre-recorded videos or online modules, outside of the traditional classroom setting. They engage with these materials independently and at their own pace, typically before attending in-person or synchronous virtual class sessions. By accessing the

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instructional content beforehand, students can acquire foundational knowledge and grasp key concepts independently. This pre-learning phase allows them to come to class prepared, ready to engage in higher-level activities and discussions facilitated by the teacher. During the in-person or synchronous sessions, the focus shifts from content delivery to active learning, collaborative problem-solving, and application of knowledge.

Flipped learning has proven to be a valuable approach as it has enabled educational institutions to adapt to remote and hybrid learning environments (Bredow et al., 2021; Låg & Sæle, 2019). In response to the challenges posed by the COVID-19 pandemic, teachers and educators worldwide have developed a wealth of instructional videos and online resources to support flipped learning (Divjak et al., 2022; Linling & Abdullah, 2023). During the pandemic, educators quickly shifted their focus to creating engaging and informative videos and online assignments that could be accessed by students outside of the traditional classroom setting (Deng et al., 2023).

In general, these videos served as primary instructional materials, covering a wide range of topics and subjects. Teachers embraced various video creation tools and platforms, including screen recording software, online video platforms, and video editing software to deliver content. The use of such tools allowed teachers to maintain a connection with their students, ensuring that learning continued even in remote settings. Students could access the learning materials at their own pace and review the content as needed. Furthermore, the abundance of instructional videos and online teaching materials created during the pandemic has resulted in a vast repository of valuable resources that can be utilized even in the post-COVID-19 era (Ibrahem et al., 2023). These resources can be repurposed and integrated into future flipped learning experiences. Educators can organize and curate videos based on subject matter, difficulty level, or learning objectives, making it easier for students to access relevant content.

To make the most of these valuable resources in the post-COVID-19 landscape, educators can leverage technology tools to categorize and tag the videos, making them easily searchable. They can also create playlists or modules that align with specific units or topics, providing a structured learning experience for students. Additionally, educators can encourage students to contribute to the resource pool by creating their own instructional videos or sharing external resources that they found helpful.

In this study, we aimed to gather insights into the experiences of both our students and teachers with flipped learning and teaching. To achieve this, we conducted university-wide surveys with teachers to explore how they made use of technology in their teaching practices. In addition to the surveys, we conducted interviews with teachers to gain deeper insights into their use of technology in flipped learning. These interviews allowed us to explore how teachers integrated technology tools, including GenAI, into their instructional strategies. In this paper, we discussed

their experiences with curating and delivering instructional materials, adapting resources for different learning environments.

2. Methods

The study involved a retrospective analysis of questionnaires that were distributed to all students and teachers in our university through mass email invitations in November of last year. The purpose of the survey was to explore which courses were implementing effective flipped learning approaches with the assistance of advanced technologies to support the learning and teaching processes. We received a total of 649 responses from students, including 90 postgraduates and 559 undergraduates. Additionally, 89 teachers also participated in the survey. The survey was conducted using the Qualtrics platform. The response rate for students was approximately 2.4%, while the response rate for teachers was approximately 4.5%. Interviews were also conducted with teachers nominated by their students for effective flipped teaching approaches.

3. Results and Discussion

The majority of teachers (approximately 57.3%) reported not using flipped approaches in their teaching. However, interestingly, 59.6% of students indicated that they have experienced flipped approaches. According to the results, it is evident that a significant portion of teachers (48.6%) use flipped teaching approaches for 0-25% of their courses, while only a small percentage (22.8%) employ flipped approaches for over 50% of their teaching content.

The table below displays the responses from students who have had flipped learning experience. Overall, students' opinions regarding their experience with flipped learning were very positive, with a strong agreement and agreement percentage of nearly 60% for most of the questions (Table 1). Notably, postgraduate students had even higher levels of satisfaction than undergraduate students (Table 2).

Unveiling the Positive Aspects: Students Embrace the Flipped Classroom

In addition to the rating questions, the student survey also featured several open-ended questions aimed at gathering insights into the strengths and weaknesses of the flipped learning approaches. Upon careful analysis of the feedback received, it is evident that students have expressed several positive aspects of the flipped classroom approach. They greatly appreciated the flexibility it offers for self-paced learning, allowing them to study at their own convenience and have access to course materials anytime and anywhere. As reported previously, this flexibility enhances comprehension and reinforces concepts, leading to a deeper understanding.

Table 1. Student responses on flipped classroom approach - undergraduate (UG) students

UG (n = 224)	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Flipped classroom approach can improve my learning experience.	19%	58%	17%	3%	3%
Flipped classroom approach can improve my learning outcomes (e.g. achieve better grade).	16%	48%	29%	4%	3%
Flipped classroom approach can make me more engaged in learning.	22%	48%	23%	4%	4%
Flipped classroom approach can promote active learning/make me actively engage in learning.	19%	59%	17%	3%	3%
I personally like the flipped classroom approach better than a traditional classroom setup.	17%	47%	23%	10%	4%
General speaking, I think flipped classroom approach is effective for my learning.	16%	56%	21%	5%	3%

Table 2. Student responses on flipped classroom approach - postgraduate (PG) students

PG (n = 90)	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Flipped classroom approach can improve my learning experience.	30%	44%	21%	2%	2%
Flipped classroom approach can improve my learning outcomes (e.g. achieve better grade).	22%	47%	21%	6%	3%
Flipped classroom approach can make me more engaged in learning.	32%	36%	24%	4%	2%
Flipped classroom approach can promote active learning/make me actively engage in learning.	27%	51%	14%	6%	2%
I personally like the flipped classroom approach better than a traditional classroom setup.	19%	40%	27%	10%	4%
General speaking, I think flipped classroom approach is effective for my learning.	23%	49%	21%	4%	2%

Moreover, students found value in the active and interactive learning facilitated by the pre-class materials, such as lectures, readings, and videos. These resources enabled them to familiarize themselves with the content prior to class, contributing to more meaningful and engaging in-class discussions. The flipped classroom approach encourages active participation, peer interaction, and collaboration on class activities, creating a dynamic and stimulating learning environment.

Students also expressed that the flipped classroom approach enhances their overall learning experience by reducing cognitive load, increasing involvement, accuracy, and motivation. They appreciated the opportunity to delve deeper into topics and gain a comprehensive understanding of the subject matter, leading to a more fulfilling educational journey.

Students' Concerns: Addressing the Flaws

Previous studies suggested that flipped learning is not fit for everyone (Gannon, 2016) , it is important to acknowledge the concerns raised by some students regarding low-quality materials and technical issues. They expressed dissatisfaction with poorly shot videos and lengthy, challenging-to-engage materials. Additionally, they encounter slow loading times and face specific device and environment requirements, hindering their learning experience. Unstable connections and difficulties in accessing and downloading materials further compound their frustrations.

Furthermore, students highlighted the lack of guidance and inconsistent teaching as areas of concern. The use of different platforms to present material led to variations in the quality of instruction, leaving students feeling uncertain and confused. The lack of clarity in materials added to their struggle, as they found it difficult to understand and question if they were studying correctly. Inconsistent teaching arrangements, where there are discrepancies between provided materials and class content, only exacerbate their confusion. Students also found that some contents were irrelevant or repeated, impeding their progress. In addition, students expressed a desire for more timely feedback and detailed explanations from their instructors, as well as increased opportunities for peer discussion and teacher-student interaction. They seek guidance and support to deepen their understanding and enhance their learning experience.

Lastly, students reported challenges with time management and distractions. The flipped classroom approach requires students to develop better time management skills and allocate more time for preparation. However, they felt a lack of sufficient guidance from teachers and peers, making it challenging to navigate the course effectively. Moreover, they find themselves easily distracted by other information or applications on their devices, compromising their ability to concentrate and fully engage with the class.

Strategies for Addressing Student Concerns: A Teacher's Perspective

To ensure the effective implementation of flipped learning approaches, we conducted interviews with experienced teachers who were highly regarded by their students for providing exceptional learning experiences. After summarizing the interview data, we have identified the following strategies to address the concerns raised by students:

To enhance the quality of materials, teachers can capitalize on AI tools to streamline video production (Sanchez-Gonzalez & Terrell, 2023). By utilizing automated narration, teachers can

save time and eliminate the need to personally read out content, and adding transcripts to videos improves accessibility and comprehension for students. Expanding the range of materials is also beneficial. Teachers can incorporate shared resources, such as YouTube videos, TED Talks, or reputable online sources, that align with the learning objectives. As an alternative to videos, teachers can also consider using conventional reading materials, like concise descriptions of case studies, to provide flexibility (Talbert, 2017).

Clear guidance and timely feedback are crucial for students navigating the flipped classroom approach. Teachers should communicate instructions and guidelines that outline the objectives and expectations of each class, providing students with a roadmap to follow. Additionally, offering prompt feedback on assignments and assessments, complete with detailed explanations and guidance, helps address any misconceptions or questions. Teachers should also make themselves available for one-on-one consultations or virtual office hours to provide further support and clarification.

Teaching time management skills is instrumental in helping students succeed in the flipped classroom model. Teachers can impart effective techniques and strategies, such as task prioritization and the creation of study schedules. By developing strong time management skills, students can effectively engage with the flipped classroom approach (Talbert, 2019). It's important to note that flipping the entire course may not be suitable in all cases, so both students and teachers should adapt the pace accordingly.

Promoting peer interaction and collaboration is essential within the flipped classroom environment. Teachers can create opportunities for peer discussion and collaboration through online forums, group activities, or virtual breakout sessions. By fostering a collaborative learning environment, students can actively engage with their peers, exchange insights, and learn from one another. Additionally, the use of AI-based chatbots can enhance the learning experience by providing personalized support and guidance to students, answering their questions, and facilitating discussions (Lo & Hew, 2023) . Incorporating AI-based chatbots into the flipped learning approach can further enhance student engagement and promote a deeper understanding of the course material.

This study has several limitations. Firstly, the findings are limited to our university and may not be generalizable to other institutions or educational settings. Additionally, the study faced a low response rate, which raises concerns about potential response bias and limits the representativeness of the findings. Furthermore, the analysis did not include a breakdown of sociodemographic characteristics, such as age, gender, or academic discipline. This lack of information hinders our understanding of potential variations and the impact of these characteristics on the effectiveness of flipped learning approaches. Future research with larger and more diverse samples, as well as follow-up studies involving teachers and students who have actively used the flipped approach to validate their experiences, is needed to address these

limitations, and provide a more robust understanding of flipped learning in different educational contexts.

4. Conclusion

Flipped learning has emerged as a valuable approach for educational institutions during the COVID-19 pandemic. Teachers have created instructional videos and online resources to support remote and hybrid learning. These videos have allowed for continued learning at students' own pace and have complemented in-class activities. The abundance of instructional videos and online teaching materials created during the pandemic can be repurposed and integrated into future flipped learning experiences. Technology tools can enhance searchability and provide a structured learning experience for students. Students can also contribute to the resource pool by creating their own videos or sharing external resources.

While students have a positive perception of the flipped classroom approach, they have raised concerns about the quality of materials, technical issues, lack of guidance, and inconsistent teaching. Addressing these concerns and providing timely feedback, detailed explanations, and increased opportunities for interaction can enhance the flipped learning experience. Flipped learning has proven to be a valuable tool in adapting to remote and hybrid learning environments. By leveraging the resources created during the pandemic and addressing student concerns, educators can continue to enhance the effectiveness of flipped learning beyond the COVID-19 era.

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Practicing Abstraction through a Top-Down Problem-Solving Framework in a CS1 Course

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Abstract

Mastering abstraction skills is a crucial learning outcome for computer science students. However, students often struggle with these skills and can quickly feel overwhelmed when required to apply them. In our Introduction to Programming (CS1) course, we explicitly teach abstraction by providing a framework where students must solve problems from higher to lower levels of abstraction. This paper presents this framework and demonstrates its application through a collaborative activity that simulates large-scale development projects. This paper also examines students' perception and performance at each level of abstraction over three sessions of the activity. The findings highlight the concepts that should be prioritized to better prepare students for each session. They also emphasize the importance of illustrating to students the function of abstraction in problem-solving and its relevance to their future work life, as a complement to traditional academic activities.

Keywords: *Abstraction; Team-based learning; CDB; CS1; Problem Solving.*

1. Introduction

Problem-solving is a crucial skill in the programming learning process (Medeiros et al., 2019). It relies on abstraction to capture all dimensions of a problem, represent them, and model a corresponding solution (Beecher, 2017). In practice, students entering the Computer Science (CS) program often lack mathematical skills. This can lead to poor abstraction abilities, which can hinder students' success in the CS curriculum (Zehetmeier et al., 2020). Previous studies have shown that, when seeking solutions, students tend to focus on the code rather than exploring higher-level abstractions (Ginat & Blau, 2017). Additionally, students may not be aware of abstraction (Böttcher et al., 2016). As a result, most introduction to programming courses (abbreviated as CS1) focus on the syntax and semantics of the programming language (Malik, 2018).

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In our CS1 course, however, we cover both programming language concepts (C language) and abstraction. To develop students' abstraction skills, we teach them a Top-down framework, which involves solving problems at different levels of abstraction. The theoretical and exercise classes provide clear details on these levels. For additional practice, students can participate in the *Collaborative Design and Build activity* (abbreviated here as "CDB") (Brieven et al., 2022). The activity aims to give students co-ownership and emphasize the purpose of each level of abstraction. In CDB, problem-solving is conducted through an assembly-line process where the solution needs to be designed (*Design Phase*) before getting implemented (*Building phase*). Teams of students are required to solve a problem at a given level of abstraction within a specific timeframe. The solution is then passed on to the next team, which takes over at a lower level of abstraction. This paper describes the Top-down framework and its compatibility with CDB.

It also examines students' ability to progress in the problem-solving flow. Previous studies (Brieven et al., 2022) have shown that CDB is motivating, but it also poses additional challenges such as time constraints, communication, and peer feedback. Many students cannot cope with these challenges, mainly due to a lack of knowledge about what is expected of them at the different steps (assimilated to levels of abstraction), leading to poor interactions. To mitigate this, this paper identifies the level of abstraction at which the problem-solving chain is the most fragile, in each CDB session. This allows for better preparation of students for future sessions.

2. Related Work

In Computer Science, Computational Thinking (CT) concepts are permanently mobilized in order to solve problems. These encompass problem decomposition, pattern recognition, algorithmic design, abstraction, data representation, algorithmic thinking, and generalization of patterns, simulation and evaluation (Rey et al., 2020). By proposing the Top-down framework, we frame problem solving in programming as a set of distinct stages, which promotes metacognitive scaffolding (Loksa et al., 2020). We also take up Wing (2006) argument that the essence of CT is abstraction and is of highest importance in a CS1 course (Sprague & Schahczenski, 2002).

Perrenet et al. (2005) define four levels of abstraction, from the highest to the lowest one: (1) *Problem* level; (2) *Object* level; (3) *Program* level; (4) *Execution* level. In this paper, we encapsulate the Problem and the Object levels in the Design phase and the Program and Execution levels in the Building phase of CDB. These Design and Building phases echo other frameworks from the literature. Namely, they map the two key tasks (modeling and implementing) of software development, identified by Zehetmeier et al. (2020). They can be also respectively associated to the "design" and "code" levels of abstraction, introduced by Waite (2018). Further, they match with two of the stages of Loksa et al. (2016), where students must translate some abstract representations of a solution into code.

3. Top-down problem-solving framework

Although there is a strong motivation to teach abstraction, it does not come with a universal definition (Mirolo et al., 2021; Zehetmeier et al., 2019). Similarly, there is no standard method for teaching it (Zehetmeier et al., 2019).

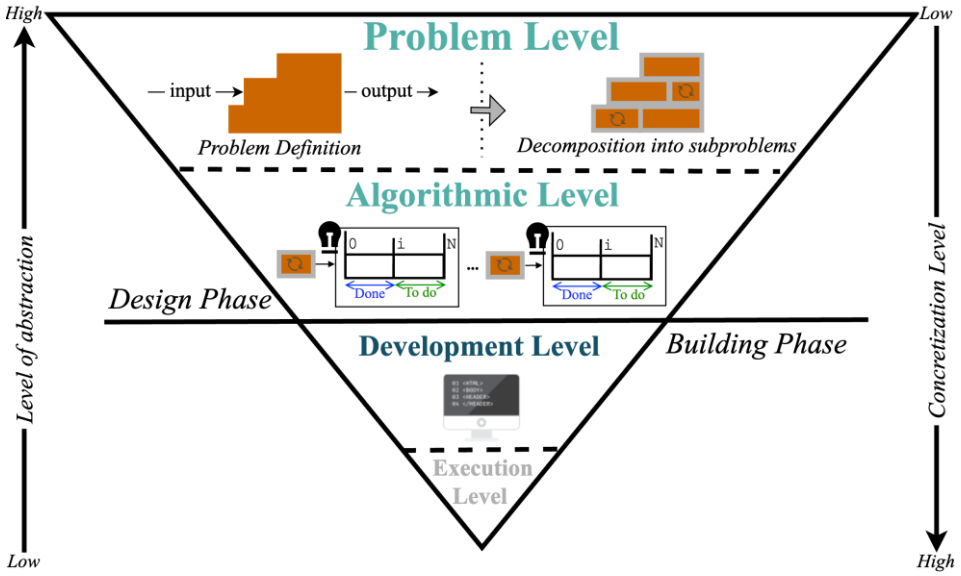


Figure 1. Top-down framework to solve problem.

In our CS1 course, we define the Top-down framework. It consists of approaching a problem from a high perspective (to avoid being overwhelmed by specific problem instances) and approaching the solution step by step, making it more and more concrete. In our course, we rely on four stages, illustrated in Fig. 1, to solve a given problem:

1) *Problem Level.* Students must define the problem by identifying its inputs, its outputs, and the relationships between them by reading a statement. They must then identify the key subproblems and show how they should be articulated.
2) *Algorithmic Level.* For each subproblem whose solution relies on an iterative process, a Graphical Loop Invariant (Brieven et al., 2023) should be drawn. It consists of using drawings to show important relationships between the variables involved in an iterative process while ignoring unnecessary aspects of the problem (Seel, 2011).
3) *Development Level.* Students must write the code (in C programming language) based on the two previous steps.
4) *Execution Level.* The code is tested with respect to the initial problem.

4. Collaborative Design and Build activity (CDB)

The CDB activity (Brieven et al., 2022) is made up of two phases: the *Design* phase and the *Building* phase. Fig. 2 shows how CDB is setup.

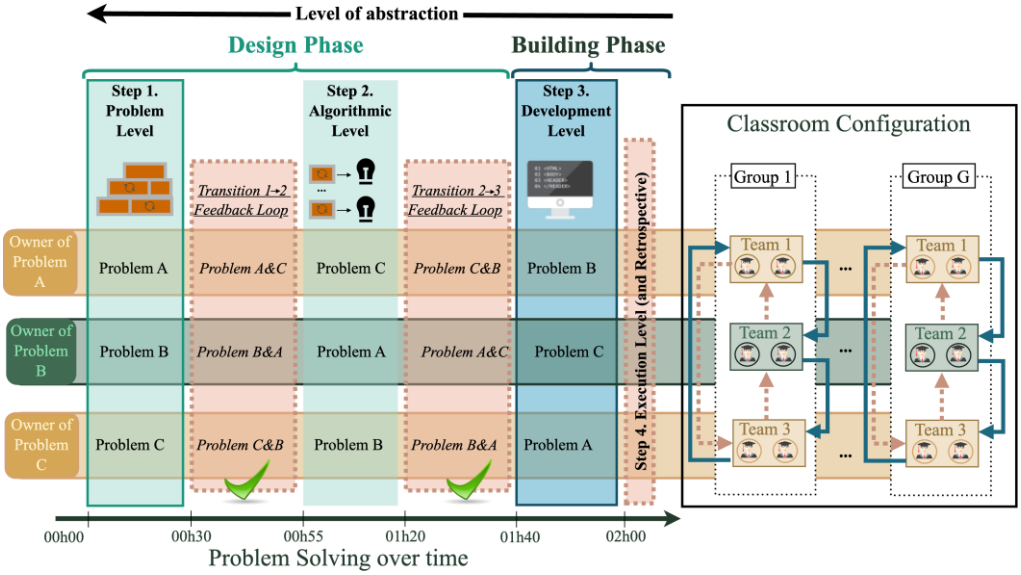


Figure 2. CDB set-up (adapted from (Brieven et al. 2022)). G groups are defined, where G=N/6 and N is the number of participants.

The right side of Figure 2 ("Classroom Configuration") illustrates that the CDB activity is based on G groups of students, each group being divided into three teams (each team comprising S students, where $S \geq 2$). The goal of each group is to solve three problems in a limited amount of time. The left part of Fig. 2 shows how the three problems are solved step by step, in parallel, by standing at one level of abstraction at a time. This approach is inspired by real professional life, as in large development projects, the problem and its solution are handled at different levels of abstraction by different teams. Here, each level of abstraction belongs to the Top-down framework (Fig. 1). The first step is to define and decompose the problem (Problem Level). During the second step, students must model the solution (Algorithmic Level) before moving on to the third step, where the solution is implemented. Once this development step is completed, each team verifies that the final code related to the problem they own correctly answers the initial question. Then, the three teams join together and share their conclusions.

Further, a transition period (Brieven et al., 2023) is dedicated to allow each team to provide feedback on the previous team's work. The objective is to reduce the impact of a "bad work" on subsequent productions that rely on it. Feedback is given using a rubric checklist with the same criteria used to evaluate the midterm and the final exam.

5. Method

During the academic year 2023-2024, 101 students enrolled in our CS1 course. Of these students, 47% had more than four hours per week of Maths in Secondary school. Additionally, 18% of students had some prior programming experience. From a content perspective, our course emphasizes the Top-down framework. Fifteen hours of theoretical and traditional exercise sessions are dedicated to it (roughly half of the course schedule).

During the semester, three CDB sessions were organized, with an increasing level of complexity from session to session. Participation was not mandatory and a team consisted of two or three students. In the first session (*N=62, G=10*), students were tasked with drawing a geometric figure. In the second session (*N=43, G=7*), they were required to print the numbers that met a specific property. In the last session (*N=32, G=5*), they were presented with problems related to managing a store selling different products. The decreasing number of participants (from 62 to 32) is mainly due to the students feeling discouraged after the midterm (which follows the first session). From that point on, they stop taking part in any academic activity. Data was collected during each session. First, a survey was addressed to the students at the end of each session. Then, all the students' productions were collected and their quality was evaluated by a supervisor. The grades vary from 0 to 5, where 0 means that the team has done a poor job, while 5 reflects a completely correct production. The criteria used to assess the productions are those of the checklists that support the transition phases of CDB (Brieven et al., 2023). Moreover, if the previous productions were too poor, only the syntax errors are considered.

6. Results

This section answers the question: "*At which level of abstraction is the problem-solving chain most fragile (for each CDB session)?"***.** To answer this, on the one hand, the quality of what students produced at each level is illustrated (Figures 3 to 5). On the other hand, Figure 6 shows which level of abstraction students found the most difficult at the end of each session.

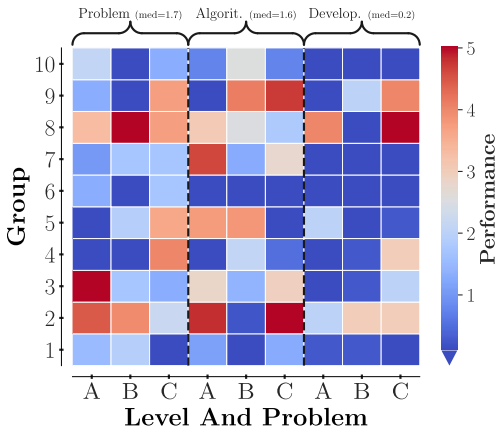


Fig 3. Students' performance during session 1.

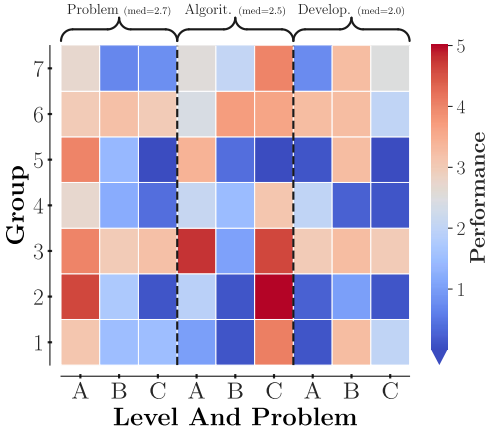


Fig 4. Students' performance during session 2.

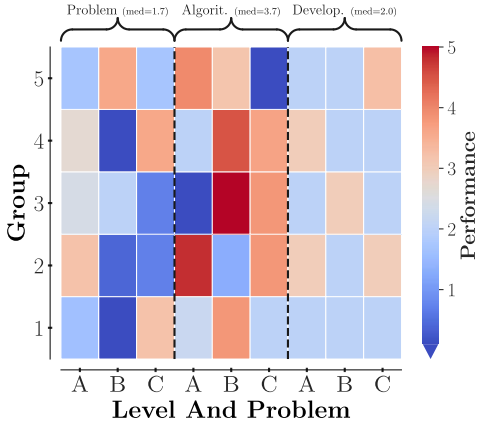


Fig 5. Students' performance during session 3.

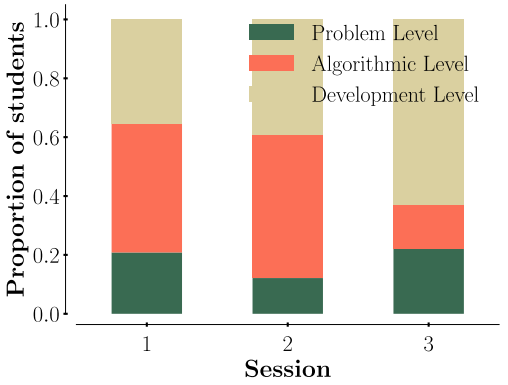


Fig 6. Most difficult level of abstraction for students.

Overall, Figures 3 and 4 show that performance deteriorates across the levels of abstraction (see the median indicated at the top of the figures for a higher level vision). This makes sense because problem solving is cumulative here. This is not the case in the third session (Figure 5), where students were able to design a solution despite a low quality problem analysis. In this last session, students were actually asked to formally define the problem and its subproblems, which was quite new to them. This probably led to a lower performance, but it did not block the next levels because the next students could understand what to do, despite the lack of formalization.

Next, performance improves slightly across sessions (the red color is spreads to the right when we compare Figures 3, 4 (and to a lesser extent, 5)). This confirms previous suggestions (Brieven et al., 2022) that emphasize the importance of running the activity several times to familiarize students with it. Again, the only exception is the last session, where the difficulty of

the statements was increased not only at the problem level, but also at the development level, where students had to use new functions and syntax. This is subtantiated in Figure 6, which shows that this is where the students felt most uncomfortable, while in the first two sessions, the difficulty was upstream (at the Problem and Algorithmic Levels). Finally, contrary to what the performance results may suggest, Figure 6 illustrates that the Algorithmic Level is the one where students struggle the most compared to the Problem Level. This is likely due to the additional difficulty of having to understand and adopt a partial solution at the Algorithmic Level, whereas initiating it at the Problem Level gives more freedom with a clear start.

7. Perspective and Conclusion

In conclusion, this paper presents the Top-down framework, which involves solving a problem from a high to a low level of abstraction. CDB is a great opportunity to practice it because it requires solving a problem step by step to obtain to a final concrete solution. In CDB, the levels of abstraction are defined as sequential steps that form an assembly line. At each step, students must take the solution under construction and think it further only within the level for which they are responsible, abstracting from where it comes from and what the final results should be.

The results show that CDB enhances problem solving through the Top-down approach, as performance increases across sessions. However, the performance remains limited. To mitigate this, it is essential to enhance students' preparation for CDB by revisiting our traditional exercise sessions. Currently, during these sessions, students are provided with a brief theoretical reminder to assist them in solving a series of exercises, with some guidance from a supervisor if they request it. In practice, many students do not engage in these sessions due to a lack of interest in the framework, until they attend the CDB session and realize why abstract reasoning is relevant by facing more complex problems and feeling the group effect. Our new challenge is to create exercise sessions that are closer to CDB. We should propose easier tasks, but still encapsulate them in time and maintain peer feedback for social motivation. In particular, our results show that students should be more familiar with the Problem and Algorithmic levels before the first session, while we should emphasize more the Algorithmic level before the second session. Finally, before the last session, students should practice more the problem formalization as well as the new function calls they are expected to make.

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Connecting Hand and Mind: Fostering student creativity and confidence through makerspace projects

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Abstract

This study explored the experiences of undergraduate students enrolled in an interdisciplinary humanities course conducted in a university makerspace. Foundational topics of learning psychology and design of learning environments were combined with activities utilizing design software and maker tools (3D-printing, laser cutting, woodworking, vinyl cutting, and other crafts). The aim was to help students better understand and gain confidence while reducing anxiety in approaching creative projects, as well as apply experiential learning approaches to course content. Qualitative analysis of weekly reports and surveys revealed student challenges in balancing design complexity with limited time, but overall appreciation for creative problem solving. Students also highlighted strengthened social bonds, mentorship, and diminished student-teacher power hierarchies. Significantly, findings showed students valued applying course concepts through hands-on making for deeper learning and personal growth in confidence, communication, and self-awareness. Recommendations include more concerted support for interdisciplinary makerspaces to reach more students outside of STEM disciplines.

Keywords: *Makerspaces; experiential education; student agency; hands-on learning; undergraduate education; collaborative learning.*

1. Introduction

The emergence of makerspaces within educational contexts has garnered significant attention as promising hands-on learning environments that encourage experimentation and learning beyond the classroom (Hoople et al., 2020; Lagoudas et al., 2016). These spaces connect to improvements in design self-efficacy, innovation orientation, and a sense of belonging within the makerspace environment (Carbonell et al., 2019; Soomro et al., 2022; Morocz, 2016). Furthermore, Wilczynski (2015) and Sheridan et al. (2014) underscore the unique attributes of academic makerspaces in fostering complex design and making practices.

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Facilitator roles are integral to the maker experience, as Hilton (2018) provides evidence of a positive correlation between makerspace involvement and increased confidence and enthusiasm among teachers. This process is further enhanced through the dynamic nature of proper guidance, as increased faculty involvement helps students achieve higher levels of innovation as they experience failure-based learning (Supraja et al., 2022).

While many of these sources are extremely informative and relevant to numerous contexts, it is worth noting that most of them focus on the STEM fields. This inquiry aims to advance the distinctive potential of makerspaces as interdisciplinary and inclusive environments, beyond the predominant STEM contexts.

2. Methods

2.1. Population & Setting

This study draws on data from 180 undergraduate students at Wake Forest University enrolled in a Learning & Cognitive Science course offered through the Department of Education between 2021 to 2023, with the initial research presented in this paper focusing on the first group of students, made up of 43 students enrolled in 3 sections of the Fall 2021 semester. The course served as a divisional (general education) requirement for the university, with students coming from a wide variety of majors, and having had no previous experience with maker tools. All sections were led by the same professor, from the Department of Education.

The first half of the semester took place in a standard classroom and focused on the more customary topics of a foundational learning psychology course. Classes then moved into the university's makerspace, known as the WakerSpace (see Figure 1), for the second half of the semester. The space has a dedicated staff director and is administered by 25 student volunteers. The revamped course placed a strong emphasis on experiential learning and the design of learning environments. This was achieved by incorporating a significant maker project, fostering an active learning environment that bridged hands-on experience with theoretical concepts.



Figure 1. Facilities and tools of the WakerSpace.

2.2. Study Design

Students first completed laser cutting, 3D printing, and space safety workshops. They were then tasked with designing and creating innovative learning spaces. In small groups, students decided on a theme that tied individual spaces (e.g., preschool, arts high school, university athletic facility, etc.) and also co-created one space together. Spaces measured roughly 16x24 inches.

Within the phases of the project, there was an initial stage for brainstorming, idea creation, and planning. This took on a variety of forms with students choosing whether to sketch by hand, utilize floor planning design software, or create more complex drawings through 3D modeling software (see Figure 2). The next phase required moving plans into the software programs that connect to the maker tools. The final phase involved constructing the models (see Figure 3).

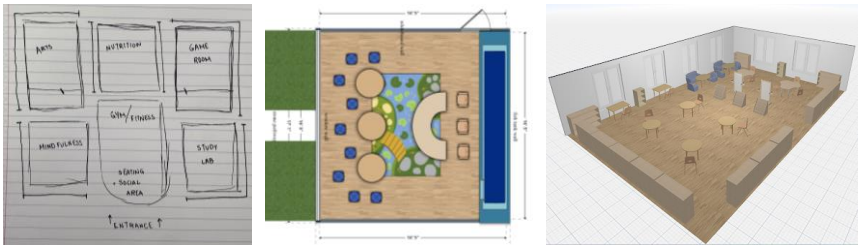


Figure 2. The variety of options for examples selected by students for the initial design stages.



Figure 3. A collection of final learning spaces created by students.

A foundational aspect of the design of the project was the recognition that this was not an engineering course, where students might be expected to master the software and tools for academic and professional environments. With most students coming from the humanities, the design and scoring of the project required an alternative structure. Therefore, the framework for the study was created with the intention of moving beyond simply serving as a grading rubric, instead capturing the genuine process of project creation (see Figure 4). As such, the first stage, *Ideas*, was intended to allow for students to experiment, take risks, and make mistakes, all foundational aspects of experiential and maker learning. Similarly, *Participation* can often be an elusive aspect to assess. This was primarily captured by the instructor taking notes throughout all class meetings and the use of weekly reports and surveys for capturing progress and logging of use of time. *Support* materialized in a variety of ways within this project, with students

repeatedly accounting for the narrative reasoning behind their designs. Lastly, *Process* was included to encourage the skills at the heart of sustained inquiry that are desired throughout the academic and professional careers of students.

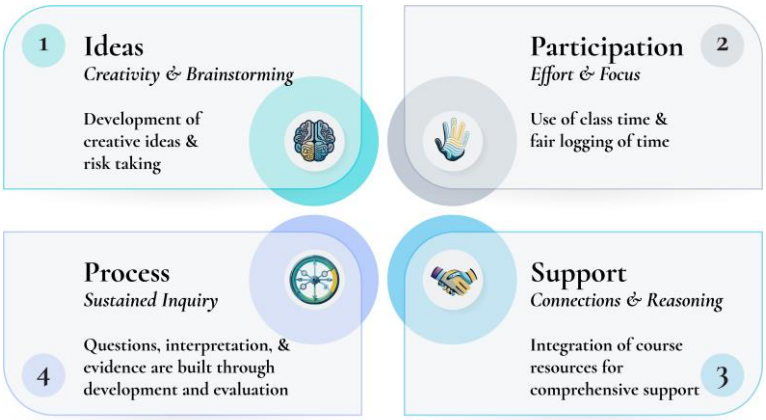


Figure 4. Study Design, Process, and Rubric.

2.3. Data Collection & Coding

The data driving this research came from five weekly reports and surveys that were assigned to students over the eight weeks of the project. Reports consisted of open-ended questions documenting use of time, reflections regarding the learning experience, connections to sources, and extensive inclusion of images to capture the making process. Surveys mainly consisted of Likert-scale questions capturing student sentiments regarding workload, stress, time management, and excitement as compared to experience with past learning environments, with some open-ended questions for clarification.

A qualitative analysis of the data was conducted through thematic coding (Gibbs, 2013), utilizing MAXQDA 2022 as the coding software. The codes derived in order to assess student learning experiences in makerspaces included: design process (time challenge and problem solving & flexibility), learning (deep learning and maker tool learning as well as self-realization and motivation), and relationships (student to student and student to instructor; see Figure 5). It is worthwhile noting there is a fair degree of overlap between these codes, and as such, some responses were double-coded. In those cases, the researchers distinguished between primary and secondary codes for the specific segments.

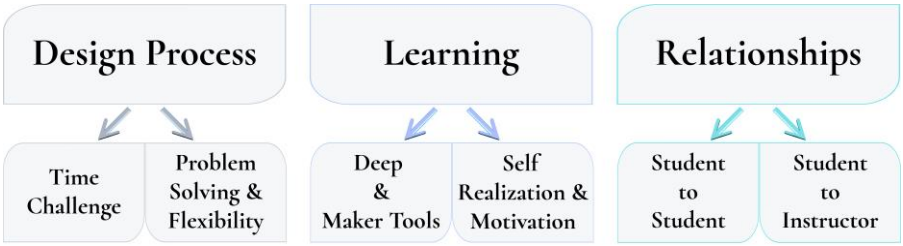


Figure 5. Coding Scheme.

3. Analysis & Findings

The analysis revealed three overarching themes: the design process, academic and personal growth, and relationship dynamics within the context of the makerspace. All themes are discussed in more detail below, arranged by their frequency of occurrence.

3.1. Creativity is liberating… but takes a lot of time!

Reports and surveys captured frequent reflection regarding the design process. Specifically, students addressed how they balanced attention to detail and kept the larger picture in mind by planning accordingly, frequently addressing time. Analysis of the coded segments revealed a broad consensus that time was constraining in many ways. For one, many students noted how hard it was to coordinate scheduling, for both group and individual components, with one student expressing how finding time to print… was "proving to be a challenge because of my busy school schedule and the guess-work that went into showing up to the makerspace and hoping there was room available." Facility hours often posed challenges for students, forcing them to compromise elements of their project.

Similarly, worry was also prevalent among students. Worries largely revolved around how time-consuming the project was. One student wrote in an early report, "I felt as though I was racing the clock and it was consistently winning." Another striking example from a student's first report noted their "brief mental breakdown… because it really hit me how much time this project was going to take to complete." However, in their final report, the same student expressed feeling "so proud" of the work they had accomplished, suggesting an overall positive evaluation of the experience, despite the initial immense worries.

Student views were predominantly positive and attributable to the creative and flexible aspects of the design process. Many students elaborated on problem-solving, utilizing trial and error, and anticipating future challenges effectively. One student noted how they "had to erase and redraw the tables for their design many times before coming to a final design," going on to acknowledge, "it did not decrease or increase the value of your ideas," but was rather valuable to the design process. This embrace of learning and growing from errors is powerfully reflected

in one student's recognition that "the execution of this project taught me a lot about being open to change and learning to embrace opportunities for growth." Such an open mindset and appreciation of creativity coalesced with students growing in confidence throughout the project. The journey from apprehension to excitement was characteristic of the many student commentaries regarding growing empowerment and confidence.

3.2. Relationships matter

The importance of collaborative interactions and genuine relationships amongst students and between students and instructor were revealed throughout the data. Almost every student highlighted positive aspects of their group dynamics by recognizing peers as resources. One student noted that their classmates were "helpful in walking me through certain steps because I tend to forget certain things when working on the software," addressing the shift they experienced moving from self-doubt to self-confidence. Other students addressed the role of their peers as sounding boards and motivators, with a student expressing gratitude that their group members "used techniques and design elements that I hadn't thought of" because they "gave me inspiration and pushed me to try new things."

Many student noted the makerspace environment providing unique opportunities to cultivate friendships with their peers, with one student articulating they "really felt like part of a community in the maker environment in being able to form connections with new people that I wouldn't otherwise have gotten a chance to talk to." Another student remarked on the conducive nature of the space for allowing "more casual and deep conversations while also working on our projects that helped to build relationships."

Similar themes emerged with student-instructor relationships, with reports often citing interactions that fostered meaningful connections. One student noted the importance of the instructor as a resource saying, "there were times when I doubted whether or not I would be able to make something, but with the help of [the instructor], I found a way to do it using the tools." Another student discussed how the setting allowed for "more opportunities to get to know the professor and understand his level of commitment" on a personal level.

Power dynamics were often addressed by students noting how the traditional student-teacher hierarchy was less prevalent. One student remarked how "it was a collaborative space where I felt like the professor was working with me to learn, develop my ideas, and succeed together." A few students even commented that the power hierarchy shifted towards the students, with one student saying, "It became an environment where we were more in control and the professor was there to help when needed," capturing greater levels of student autonomy.

3.3. The power of hands-on learning for academic and personal growth

Students experienced both academic growth and personal development through the context of hands-on learning. In regard to academic growth, students experienced deep learning of the course content. A prime example of this came in a report that lauded how "being able to truly put.. readings to use in a synthesized way not only helped me to retain more information from them, but also just made me more interested in them in general." Others echoed similar points, with one student noting they were "confident that the concepts I learned and proceeded to utilize within my model will not soon be forgotten… because rather than just memorize the information, I actually put it to use and interacted with it in ways that I have not in any other class thus far in college."

Hands-on learning in the space fostered personal growth beyond academics. One student's reflection stands out: "This project told me I am too hard on myself... I am going to try to be nicer to myself not just in school but in all aspects of my life." Another realized, "I need to be a little bit less impulsive." Students vocalized their intentions to apply their new maker skills beyond this project, into other academic and social contexts. These reflections demonstrate how the makerspace experience helped students balance short and long term goals, adapt calmly to changes, communicate effectively, foster relationships, and enhance self-awareness.

4. Study Insights & Moving Forward

The study findings highlight many of the powerful and unique elements of makerspaces through the voices of participants, while also capturing the realities that can often lead to many individuals never experiencing makerspaces. As Budge (2021) argues, makerspace integration requires acknowledgment of their complex and often messy ecosystems. This insight calls for more adaptable instructional and institutional policies. Supporting the unstructured, creative chaos of makerspaces and fostering creativity in lieu of conventional, compartmentalized approaches means instructors must allow sufficient class time for nurturing an authentic and sustained learning process. Institutional roles here can contribute by housing makerspaces in interdisciplinary locations, bridging formal and informal learning (Hoople et al., 2020).

There are also significant costs attached to creating makerspaces that can often inhibit access. While most university makerspaces are available at little or no cost to students, supplies (e.g., 3D filament, wood, or vinyl) are not always provided. The maker machinery can also be extremely expensive, with the medium-sized WakerSpace containing two laser cutters ($25K), ten 3D printers ($60K), a CNC router ($17k), as well as woodworking tools, vinyl cutters, sewing and embroidery machines, a podcast room, circuitry and soldering stations, as well as extensive arts and crafts (costs listed in USD). These machines are complex and require constant maintenance and specialized knowledge, making the dedicated staff director and the 25 student volunteers pivotal to the success of the space. While there is a large diversity of specialized

institutional academic makerspaces (Wilczynski, 2015; Sheridan et al., 2014; Hoople et al., 2020; Forest et al., 2014), access for more students of diverse backgrounds and academic interests is key to ensuring the success of makerspaces.

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Identifying Potential for Improvement in Computer Science Degree Programs from the Student Perspective

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Abstract

We want to pick up students where they are – but we don't even know where they are since we may not know enough about the status of our students and their needs and wishes.

In this paper we share experiences on a workshop that we performed together with students to let them reflect on their situation and thus gain insights into what students need and want to study successful – and to foster their self-reflection competences accordingly. A student-centered workshop can help other faculties and teachers learn about their students' perspectives on their organizational processes and their teaching. In addition, such a workshop helps students to identify deficits in their metacognitive skills.

Based on the results of the workshop, we were able to identify various starting points for improving teaching as well as administrative and organizational processes.

Keywords: *Student expectations; student perspective; self reflection; heterogeneity.*

1. Introduction and Motivation

As many technical degree programs worldwide, our program on Computer Science suffers from high dropout rates of around 50% (Böttcher et al., 2020). Even so, we are convinced that we could contribute to preventing many students from dropping out, if we were able to timely identify those students who are at risk of dropping out and provide them with the specific support that they individually need at their time of doubt. To achieve this, we need to better understand why our students struggle or even fail. Final exam grades and failure rates in introductory courses are only an observable symptom. However, the *causes* of failure are

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manifold and include, e. g., a lack of mathematical and technical knowledge as well as underdeveloped meta-cognitive skills.

A hypothesis about another cause is that several of our students already possess considerable programming skills, while several others do not, and that we do not appropriately meet the different needs of this highly heterogeneous cohort. This hypothesis is supported by Figure 1, illustrating the results of a survey of two subsequent cohorts, performed three to four weeks after the start of the first semester in the course on Software Development.

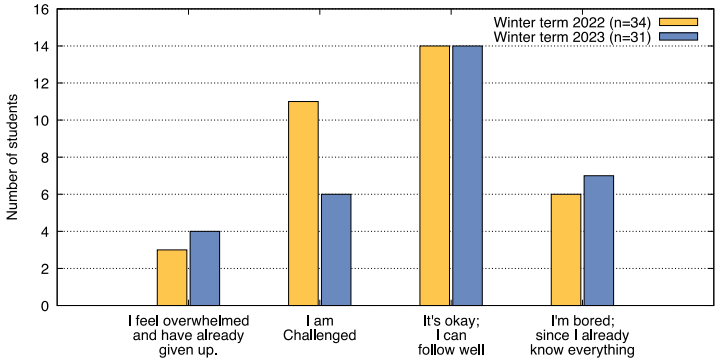


Figure 1. Students' perceived degree of challenge about three to four weeks after start of the semester.

For us teachers, the heterogeneous initial skill set is a severe challenge, since we are in danger of loosing one third of the cohort while still boring a major part. Yet even worse: teachers might feel obliged to increase the pace of the course, because some of the students already have some experience (Petersen, 2016). Experience shows that this non-majority students rather loudly request more input, or even tend to ridicule the perceived "snail's pace" at which concepts are introduced that they already have down their belt, e. g. from previous studies or apprenticeships, while they conveniently block out their memories of how they themselves struggled when they initially learned these skills. As a consequence, they risk to drown out the rather quiet albeit greater group of students that struggles – usually silently, as they are often too ashamed or even scared to explicitly voice their struggles.

Obviously, the goal of our teaching is to increase our students' skill sets, in all parts of the cohort. Therefore, to keep on board the significant share of students that are already challenged or even overwhelmed, we must properly understand the causes of their struggle, and which kind of support they really need. Specifically, if we design interventions to address and hopefully resolve existing difficulties, we must be sure that our students really benefit from these offerings, i. e., we must know and understand what they want – or make them want what they need.

In this paper, we report on our experience with a workshop format that we have created to provide a safe and protected environment for eliciting student wishes and needs. This workshop format requires moderate effort in terms of preparation, implementation, and evaluation. It can help other faculties and teachers learn about their students' perspectives on their organizational processes and their teaching. Furthermore, it helps students to discover deficits in their metacognitive competences.

2. Related Work

Exam pass rates and drop-out rates in STEM and computer science degree programs are often reported as unsatisfactorily low and needing improvement, throughout different countries and institutions. A fundamental study with a broader geographic and institutional context is e. g. (Simon et al., 2019). The authors claim that overall exam pass rates are at around 75%. Corresponding to these observations, dropout rates from our degree program are usually even higher.

On their way to writing and passing exams especially in the entry phase of a degree program, students must master a multitude of cognitive and metacognitive skills. Underdeveloped meta-cognitive skills need to be developed (Falkner, 2014). Investigations on deficits in metacognitive skills are often done with questionnaires and interviews, e. g. (Petersen, 2016).

3. Goals

Our goals are twofold. Firstly, in our roles as teachers, we want to recognize and understand what our students need to effectively learn. In addition, in our roles as faculty staff, we want to identify general potential for structural improvement of our institution and our offerings. Secondly, students need to enter into a process of self reflection that helps them recognize their own development needs, and they should become aware of improvement potential in their self-organization. Gaining insight into our students' needs in all these aspects will help us to develop interventions that effectively support our students. Carnegie et al. (2014) report positive experiences in developing an engineering program by addressing more than just academic issues. We also have such measures in mind, including a kind of "pastoral care".

4. Approach, Design, and Results

To identify the students' perspective, we specifically designed a workshop format which we embedded into our first semester course on software development. We dedicated one afternoon in the week just before Christmas to work with our students on a meta-level, to help students detect their needs, and to simultaneously offer them a chance to recognize how they can better organize their course of study and improve their self-organization. For this workshop, we

designed four stages that addressed "organizational aspects", "personal issues", "self-competences", and "professional topics related to software development", respectively. Each stage was accompanied by a teacher or a coach. In order to prevent any personal biases in the future student-teacher-relationship, it is important to accompany those stages where students reflect on their personal or even private situations by staff who are not (and never will be) directly involved in teaching and grading of the participating students.

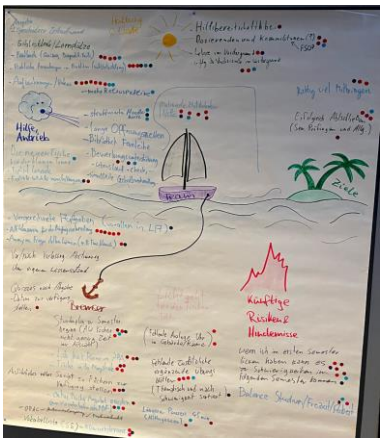
For the workshop, students were divided into groups of four to five persons each, which stayed together throughout the entire workshop, rotating from stage to stage as a group, similar to a circuit training. Stages were distributed around the entrance hall of our building, which was unusually uncrowded due to the approaching holidays, thus offering both space and sufficient privacy. Each stage was equipped with flip charts or pin boards, sticky dots and pens. Thus, students were actively engaged and documented their issues and findings themselves and in their own words. Every 30 minutes, each student group moved on to their next stage.

We started the workshop with a short plenary session where we elicited our intentions and goals and gave an overview of the general structure. At the end of the workshop, we gathered all groups back into a plenary, to do a final reflection on lessons learned and open issues. After that, we invited all students to a Christmas snack, to say thank your for their time and effort. Overall, 14 students participated, corresponding to hardly half of the active cohort, which was notably lower than expected. Nevertheless, all participating students were highly engaged throughout the entire workshop, so that we still were able to gather respectable results.

4.1. Organizational Aspects

Inspired by Luke Homann's Innovation Game "Speed Boat" (Homann, 2006, pp. 118-125), we designed thie stage addressing organizational aspects of the study process along six questions shown in Table 1. After having collected all issues that concern students' situation, they used adhesive dots to opt for which issues they deem to be most important to them.

Table 1. Oranizational issues and final result on chart generated by students.

Symbol	Issue	Resulting chart
	Who is an essential part of my study team?	
	What helps me during my studies?	
	What has slowed me down so far?	
	What goals do I want to achieve with my studies?	
	What has helped me emotionally so far?	
	What obstacles do I expect in the future?	

The most important findings out of this stage are:

- Most students see kind and motivated fellow students as an essential part of their team. *This is a positive insight; coming back to the physical classroom after the pandemic can be considered as helpful and should be maintained.*
- Nine students think that having video recordings of the lectures would help them. *Doing this would involve some additional effort on the teacher's side, or preferably some staff support (which unfortunately our institution does not offer). However, we have some experience with recordings. As teachers, we agree that the availability of recordings might help students in case of sickness, and when teachers demonstrate programming details in an integrated development environment, thus enabling them to reproduce the teacher's actions step by step and in one's own speed.*
- Several organizational details were named that brake and slow students down, e.g. issues regarding timetables, equipment in lecture rooms, accessibility of material on the e-learning platform, and problems with registering for electives.
  We will take these to the relevant committees of our faculty and the university.
- Unsurprisingly, the unanimous goal is to pass the first semester finals and then the entire program.
- Students receive emotional support from other students and also from lecturers.
- Eight students have concerns that knowledge gaps from the first semester are obstacles that will lead to problems and additional pressure in later semesters.
  At our institution. exams in the mandatory courses of the first semester must be taken at latest in the second semester. In case of failure, they must be repeated in the semester immediately following the fail. We are aware of these issues. However, removing this pressure makes students push difficult exams further and further to later semesters,

thus incurring the risk to fail the entire program after several years due to a fundamentals class. Nevertheless, this issue is an indication for us to provide more support during the study entry phase.

4.2. Self Competences

At the stage on self competences, students were guided to reflect on 21 items. The results of seven of them are shown in Table 2. We see that guidance is required with respect to self competences such as self-organization. According to these results, students obviously are not sufficiently well prepared by school in these competences.

Table 2. Students findings on their self-competences (n=14, not all answered every question).

	never	rarely	often	always
I do prioritize my daily tasks	2	9	1	1
I consciously start into my free evening	9	3	1	1
I can concentrate on my work	0	4	7	2
I make a note of when I do which tasks	7	4	2	2
I know from which activities I draw my energy	0	3	4	6
I am aware of my competences.	0	4	5	6
I use failures to learn from them.	0	4	9	1

4.3. Personal Issues

The most important findings for us teachers at this stage are that students …

- often do not feel that they are taken seriously enough by teachers..
  This is a serious problem that we need to address at the next lecturers' retreat.
- need sufficient time for themselves e. g. during weekends – which they often do not have.
  This is a tricky issue because the ECTS credit system imposes a certain workload. Especially students with no previous experience in the topics at hand (especially programming skills) need a significant amount of time for their studies.

4.4. Professional Topics (Related to Software Development)

At the stage on technical topics and the content related to software development (the topic of our class), we let students reflect on which technical topics they feel good at, and on which topics the feel less good. As we knew that the cohort is extremely heterogeneous with respect to prior knowledge in programming, we were happily surprised that *all* students claimed to have gained competences in some areas. (So our efforts as teachers were not in vain – every student learned something new and content-related.) To visualize our students' increase in technical competences, we let them draw arrows on a white board representing their estimated learning

progress for three main subject areas of the class. The starting point of each individual arrow represents the corresponding student's initial knowledge prior to the class; correspondingly, the head of the arrow represents the individual student's current skill set with respect to the communicated learning objectives of the course.

Figure 2 illustrates that all students have the impression that they have learned something during the course. The smallest initial skill set and highest increase of skills during the class seems is located in the subject area of testing. Specifically, this indicates that even those students with some initial programming skills prior to the class are not well founded in unit testing – which indicates some improvement potential in the established apprenticeship programs.

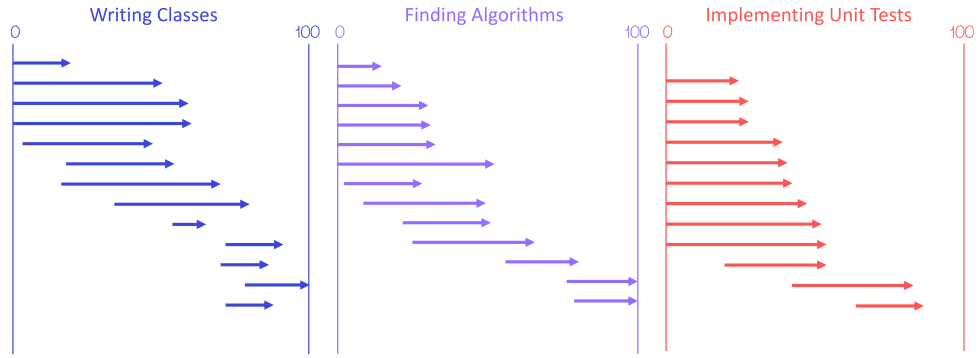


Figure 2. Subject-specific learning progress differentiated by three subject areas (in terms of estimated percentage of learning objective fulfillment).

On the other hand, a couple of students claimed in the second part of this stage that they need to practice more (see Table 3). Therefore, we conclude that we need to increase our efforts to take better account of the differences in prior programming knowledge between students in our cohort. As one active measure to resolve this issue, we already offered additional tutorial lessons for those students that identified themselves as challenged or overwhelmed at the beginning of the semester (as was depicted in Figure 1).

Table 3. Students' self-assessment of professional skills.

	Here, I am good at	**It's okay for me**	**I need more practice**	**Is difficult to me**
Building classes	11	1	1	0
Writing methods	12	0	1	0
Formulating test cases	3	5	6	0
Finding algorithms	4	4	4	1
Detecting bugs	5	4	2	1

5. Conclusions

We introduced a concept of a workshop that enquires into the causes why first-year students struggle with their work in a holistic way and from a student's perspective. In addition to professional issues that students struggle with, we have also included reflection on self-competences and personal issues, and we addressed organizational aspects.

The workshop described in this paper is only one activity to gain insight into student perspective. We accompanied this by interviews with students in first semester and with alumni.

Based on these insights, we are now better able to adjust both our programs and our support offerings to better dedicated support our heterogeneous students in their respective needs.

Acknowledgement

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Recent Advances in VR Labs for Use in STEM Education

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Abstract

Virtual Reality (VR) is increasingly being used in the gaming and entertainment sectors. It has also been gradually finding its way in the industrial training sector. But its potential in the education field has yet to be fully recognized. Recent breakthroughs have made head-mounted displays (HMDs) for virtual reality (VR) accessible to the educational institutions and to the public at a low cost. Similar breakthroughs are on the horizon in the haptic gloves technology, which are likely to lead to low cost and functional haptic gloves. Combination of VR with haptic gloves is expected to significantly change the user experience for the better. This paper seeks to explore the untapped potential of VR technology in education, specifically focusing on its applications in STEM laboratories. After a review of our past work in the development of VR labs for STEM subjects, we will describe recent advances made in the development and implementation of VR STEM labs in engineering.

Keywords: *virtual reality; STEM laboratories; head-mounted displays; haptic*

1. Introduction

Innovative technologies are increasingly contributing to the teaching and learning missions of K-12 and higher education. One group of such innovative technologies is comprised of "*virtual reality*" and 3D gaming technology. VR's niche, in our opinion, at the high school and university levels is more in visualization and in supplementing practical experiences—as in lab courses—via video-game-like modules rather than in imparting abstract concepts. Pedagogical benefits of various forms of VR applications in education (both teaching and learning) and training continue to be evaluated and debated (Mayer et al., 2023). Matovu et al. (2023) reviewed a range of VR studies—a total of 64 that appeared over 2016-2020—on the teaching and learning of science. Makransky et al (2019) suggested that adding immersive VR to a science lab simulation

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lead to more *presence* but *less learning*. They also suggested topics that are more suitable for VR-based education than others.

While the use of VR technology has been maturing for courses that rely on, and benefit from, extensive 3-D *visualization* (such as human anatomy), its use to support the *laboratory* experience in STEM courses is still maturing. We believe that XR (collectively referring to VR, AR and MR) technology, if appropriately deployed, holds substantial potential to significantly enhance (supplement) students' lab experience. Not only does this potential exist in existing state of the XR technology, rapid improvements in XR and associated technologies, such as AI and machine learning, haptic gloves, etc., stand to improve the overall student learning experience even more significantly.

Several virtual labs have been created in the Virtual education and research laboratory (VERL) in the Department of Nuclear, Plasma, and Radiological Engineering at the University of Illinois, representing various experiments in the undergraduate curriculum. These include a calorimetry lab to measure the specific heat of metal specimens, a shielding lab to measure the attenuation coefficient of shielding material, a chemistry lab for safety training, and a radiation lab to measure the half-life of radioactive substances (Karancevic et al 2004; Dixon et al, 2007; Haddish et al, 2013; Satoh et al, 2015; Rizwan-uddin, 2018).

Before we describe recent developments, we first in the next section briefly describe the state of technology in the field of XR. This will be followed by a description in Section 3 of two of the virtual labs developed by our group. In Section 4 we describe the most recent advances introduced in these and other virtual labs. Our ongoing and future work is described in Sec. 5.

2. Brief overview of VR technology

VR hardware over the last few decades has evolved rapidly, as has the software for application development. Rapidly changing technology has necessitated new terminologies. Matovu et al (2023), for example, used the terms "*desktop virtual reality*" (DVR) and "*immersive virtual reality*" (IVR). This distinction has partly been necessitated by the simplicity with which a generic 3D model developed in one of the development platforms (Unity, Unreal, etc.) can be easily compiled for use on desktops, in immersive HMDs, and on smart phones. Hence, in any discussion of VR applications it is important to keep in mind the hardware on, or in, which the 3D model is to be experienced. The experience may or may not be immersive. The hardware include: desktop computer with a keyboard and a mouse, touchscreen tablet, cell phone, cardboard box with a slot for a cell phone, HMD, and AR device such as a *HoloLens*. These are shown in Fig. 1.



Fig. 1. Hardware for 3D models, DVR, and IVR display



Fig. 2. Devices to interact with 3D VR models

The major difference in these platforms is not only the "view", but also the way user interacts with the virtual model and manipulates objects in it. The entire keyboard and mouse are available for interactivity on a laptop or desktop. Interactions on a touchscreen tablet or a cell phone take a different form. Ways to interact with objects in a cell phone are limited. Smart phones, however, may provide interaction modes not immediately available on a desktop, such as tilt or turn. Interactions with objects in a 3D model in a HMD device is through a controller. The physical shapes of these controllers change rapidly from one model to the next. Controllers have a few keys, knobs (mini joysticks) and triggers. Note that these controllers can also be used with desktop and laptop computers. The controller-driven actions can be displayed in the digital model as human hands performing actions such as pressing a key or grabbing an object. Most advanced of these interactivity modes is via a haptic device, usually a glove. A haptic glove may not only allow the user to interact with the digital world in the same way one interacts with the physical world, it may also provide the sensation of touch to the user. Figure 2 shows the devices that can be used to interact with the digital world in DVR or IVR on, or in, different platforms.

Interactivity in VR over the years has been slowly improving. As an example, consider an action such as pouring water from a jug into a measuring cup. Such actions (interactivity) in VR labs executed on desktops are performed using the mouse and the keyboard. With touchscreen monitors, fingers can also be used to manipulate objects. In immersive version of these labs (conducted in a head mounted display (HMD) setup), interactivity is via an HMD *controller*.

3. VR Education labs

In this section we briefly describe two STEM labs developed in our group. These labs have been developed and tested on various platforms (Fig. 1) and using different devices for interactivity (Fig. 2). Simple models based on the physics of the experimental setup are coded in the STEM labs to evaluate the numerical values of the quantity to be measured. These mathematical models get their input parameters interactively from the users of the VR lab.



Fig. 3. Side-by-side comparison of a 3D model (left) and its physical counterpart (right).

A model of a physical lab space in our department was developed first. Figure 3 shows a side-by-side comparison of the 3D virtual model (left) and a picture of the physical lab (right). Having a virtual model of a physical lab is expected to help those students who will eventually do some of the experiments in that physical lab, and only supplemental labs in VR. For those students who will have no exposure to a corresponding physical lab (if one exists), there is likely to be no benefit of similarity between the physical and virtual labs. Lab has virtual models of apparatus needed to conduct the experiment. These devices may have buttons, switches, knobs, and digital data display windows. Some of these knobs and switches in these virtual models are "*live*", i.e., a user can use them to turn the equipment on or off, or set parameter values (by clicking). Data are displayed in either digital display windows or on a virtual computer monitor. Step-by-step instructions appear at the bottom of the screen.

3.1. Calorimetry Lab

The virtual calorimetry lab is designed to measure the specific heat of metals. This laboratory has virtual instruments (like a scale and hotplate) and virtual monitors. Virtual instruments in the model are interactive and can be moved and/or operated by the player. For example, the metal specimens in the experiment can be moved. When a specimen is placed on the scale, the virtual scale displays its weight in its digital window. Thermocouples can be connected to objects. Step-by-step instructions can be displayed through GUI. In the virtual lab, the student first walks into the lab. TA walks in and sets up the experiment table. The student then starts the virtual experiment. Experiment is conducted as follows:

1) Identify the equipment to be used in the experiment; **2)** Measure specified amount of water; **3)** Measure the temperature of the water; **4)** Pour the water in the inner tube of the calorimeter; **5)** Weigh the specimen; **6)** Pour water in a beaker; **7)** Place the beaker on the hotplate. Boil the water; **8)** Place the specimen in the water to bring it to 100 C; **9)** Attach thermocouple to the specimen; **10)** Place the specimen in the inner tube of the calorimeter; **11)** Close the lid; **12)** Observe the water and specimen temperature on the monitor; **13)** Stop the experiment when the two temperatures are nearly equal. Note the final temperature; **14)** With known water mass, specimen mass, specific heat of water and the final temperature, calculate the specific heat of the specimen. Figure 4 (left) shows the setup of the calorimetry lab.

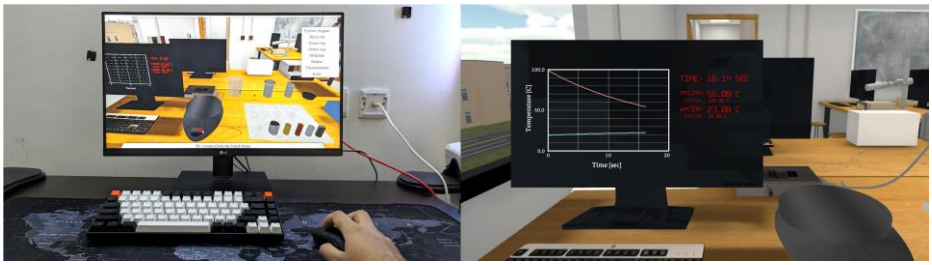


Fig. 4. Calorimetry lab on a computer monitor (left), and zoomed view of the virtual monitor showing temperatures as a function of time.

Note that in this version, the lab is expected to be conducted in DVR, using the keyboard and mouse. For example, clicking on the beaker filled with water moves it to the hotplate. Clicking on the knob turns the hotplate on. Clicking on the thermocouple connects it to the specimen, and so on. The physics model coded in the virtual model is used to calculate the temperatures of the water and the specimen as a function of time. The temperatures of the specimen placed in the calorimeter and of the water in the calorimeter are displayed as a function of time on the computer monitor, as shown in Fig. 4 (right). Students wait till the two temperatures become nearly equal. This equilibrium value is noted down and is used to estimate the specific heat of the specimen. Experiment can then be repeated for other specimens.

3.2. Shielding lab

The player in this virtual lab can measure the attenuation coefficients of different shielding materials. A screen shot of the virtual model is shown in Fig. 5. Users can manipulate shielding blocks made of different materials, place multiple blocks between the radiation source and the detector, thus effectively changing the thickness of the shielding material, and operate the radiation measurement equipment.

The student *clicks* on the shielding blocks placed on the table, which moves them next to a scale, allowing the student to measure their thickness. Next, clicking on the block moves it to the space between the radiation source and the detector. Counts can then be measured by setting the time interval (by clicking on the required buttons) and clicking on the counter button. The process is

repeated for different numbers of shielding blocks, thus obtaining data for different thicknesses. The entire process can then be repeated for blocks made of different materials. The physics model is based on the attenuation model $(e^{-\mu\Delta x})$, where Δx is the thickness of the shielding material. The count data displayed in the virtual LED display is realistic and can be used to estimate the attenuation coefficient of the shielding material. Figure 5 shows two of the shielding blocks placed in between the radiation source (on the left) and the detector (on the right). Other shielding blocks (C, D and E) are placed on the table. Collimator blocks and the detector can also be seen. Detailed steps to execute this virtual lab are omitted here.

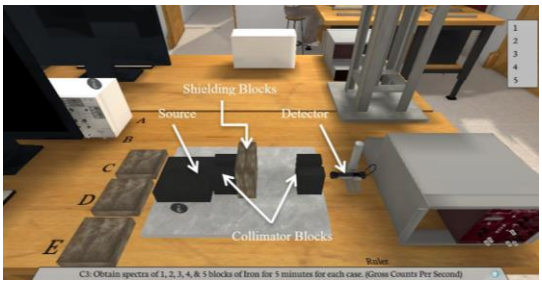


Fig. 5. 3D model of the shielding lab

4. Recent developments in STEM VR Labs

As mentioned above, the early models of the VR labs have several limitations. Some of the improvements over the last few years are described in this section. Most of the improvements have been to make the visual as well as the user interaction more realistic:

1) Rather than a single-click action, when an object is to be moved, we now can grab the object by clicking on it, and then moving it to the spot where it needs to be placed. **2)** Pouring water in a beaker is now a more realistic experience with appropriate motion and tilting of the hand. **3)** Wires and wire handling is now much more realistic. (In the older version, a single click connected a wire (such as a thermocouple) to its intended location.) **4)** The VR lab now allows users to *manually* connect wires to ports or objects. The user in the new version can "grab" the tip of the wire and then "insert" it at the desired port or on the object where it needs to be connected. **5)** As the water temperature reaches boiling point, bubbles appear in the beaker. **6)** All the apparatus and their functions are to be identified before starting the experiment by clicking on them. **7)** Additional videos have been embedded for on-demand instructions.

In addition to these, three other major developments are described in more detail below.

The first is the extension of these VR STEM labs to be conducted in the immersive environment of a HMD, and operated using a game controller, instead of by using the mouse and keyboard. 3D immersion makes the lab experience more realistic, and the game-controller-based operations provide an improved level of interactivity. Another significant achievement was

attained through enhanced haptic feedback using the new Quest controllers. By leveraging the *Virtual Grasp API*, objects can be held using both hands, and can also be tilted. Two-handed operations include steps such as tilting a water jug held in one hand and pouring the water in a beaker held by the second hand. An example is shown in Fig. 6 (left). Sensation of different weights when using the game controller can be replicated using strong or gentle haptic vibrations. Though the player is using the VR controller, the actions are shown in the HMD (or on the computer monitor) being carried out by two virtual hands. This is shown in Fig. 6 (right).

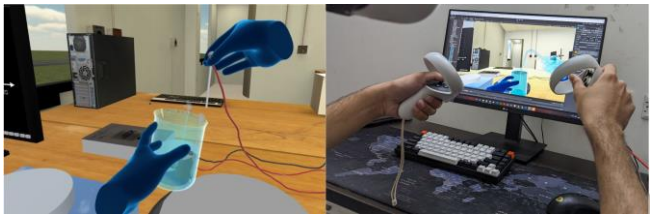


Fig. 6. Sensation of weight through haptic feedback(left) and two handed operation using VR controllers(right).

The second and third major recent developments are those of the development of virtual 3D models of two new physical facilities. The (physical) undergraduate lab in NPRE has recently been moved to a new facility. With the benefits of the virtual model being similar to the physical space in mind, a virtual 3D model of the new physical facility has been developed. Using pictures of the actual facility to extract textures, the detailed 3D model of the physical lab resembles the physical lab, and improved lighting further enhances immersive feeling. A side-by-side comparison is shown in Fig. 7.

We have also developed a 3D model of a new (physical) reactor simulator lab. This simulator lab mimics a reactor control room. The lab has a classroom setting and glass-top simulators. This simulator room is designed for training and evaluation of human responses in various scenarios in a nuclear control center. The corresponding 3D model (Fig. 8 illustrates a side-by-side comparison.) and the VR capabilities of this lab can be used to supplement training in the physical control room, for design alterations of the control room setting, human factors studies, and for tracking of control room operator actions through HMDs eye-tracking feature.



Fig. 7. Side by side comparison of the new lab (left) with its visually improved virtual model (right)

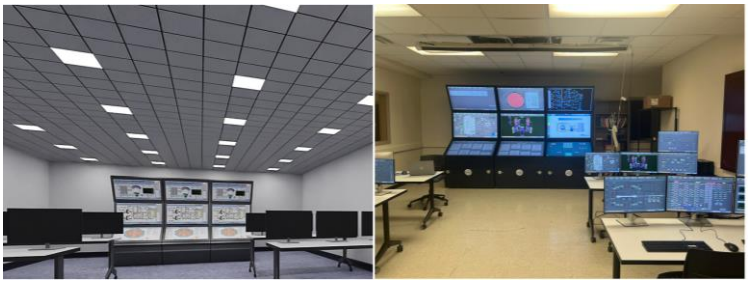


Fig. 8. Side by side comparison of control room simulator lab (right) and its virtual model (left)

5. Ongoing and future work

The use of VR in STEM lab education, and XR technology in general, is still in its infancy. With new technological advances constantly on the horizon, VR lab experience in STEM fields is likely to continue to improve. Several areas need improvement. Pedagogical assessment of STEM VR labs is also needed. Our current focus is, in addition to the general improvement of the VR experience using currently available technology, on exploring haptic gloves for improved sensation and more realistic operational experience. Haptic gloves, by simulating tactile sensations, offer a nuanced and responsive touch interface. They will allow the students to interact with virtual experiments, manipulate objects, and experience a heightened level of engagement in educational activities. This evolution not only will enhance the sense of presence and interactivity but will also facilitate a more intuitive and hands-on learning experience. We also plan to implement VR labs in courses and use systematic assessments to evaluate their efficacy in engagement, learning, and retention.

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ChatPLT: An intelligent tutoring system for teaching Physics in Higher Education

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Abstract

The application of artificial intelligence (AI) has attracted great interest in higher education, highly influenced by the development of information and communication technologies. Integrating artificial intelligence into learning ecosystems is one of the biggest challenges for higher education.

In this work, an intelligent tutoring system based on AI has been designed but with control of the possible responses. For this, a first diagnostic phase was carried out that determined the selection of initial material that will be used by the neural network or classifier algorithm, so that the teacher has control of the answers offered, limiting the sources of information used. Subsequently, this selection of documents is part of the input, together with the question in a large language model (LLM) ChatGPT-type conversational network. All developments have been done using open access resources. It is the first stage of a project to obtain a predictive analysis of each learning studding.

Keywords: *Artificial intelligence; autonomous learning; intelligent tutoring.*

1. Introduction

With the rapid advances in technology and science, new paradigms have emerged in Education. These involve the Information and Communication Technologies (ICT) and artificial intelligence (AI) as pedagogical resources.

The realizations of ICTs that present the greatest educational potential are those that facilitate the presence of instructors in the student's learning process, providing immediate and relevant support (Sánchez-Azqueta, 2019). In particular, they emerge as a privileged tool to accomplish

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the monitoring, supervision, guidance, and support that the teacher can and should provide for the student's work and autonomous learning (Zúñiga, 2012; Olmo, 2012). In this way, the tasks of supervising and tutoring the student's activity can be carried out without the need to coincide with them in space and time.

In turn, AI is transforming every facet of our lives, from communication to the workplace, and it is being proclaimed as a tool that can be used to enhance and advance all sectors of our lives (Górriz et al., 2020). In the field of education, the use of AI technologies or application programs is expected to revolutionize the dynamics of learning, teaching, or decision-making, particularly taking into account the great influence of ICTs in education in the last years (Alajmi et al., 2020). As a consequence, the use of AI in higher education (HE) has risen quickly in the last 5 years (Chu et al., 2022a;b), with a concomitant proliferation of new AI tools.

In the literature, we can find numerous works exploring both the challenges and threats, as well as the opportunities that AI presents in this context (Crumpton et al., 2023; Ouyan et al., 2022). In this work, we will focus on the opportunities that AI can provide in higher education rather than the ethical and legal challenges that must be faced when implementing such a strategy.

Among the exploratory works, Borge (2016), regarding AI and its application in the educational field, propose as main advantages that AI can automate basic activities in education, such as the grading system, and that students can receive personalized learning. Integrating AI into learning ecosystems is one of the greatest challenges for higher education.

In this work, we propose the development of an AI-based tool that enables more personalized, flexible, and engaging learning, allowing not only to respond to what is being learned but also to how it is being learned.

2. Intelligent tutoring systems (ITS)

Educational technologies provide opportunities for personalized learning, tailored to individual styles. In turn, the implementation of virtual tutoring systems offers educational support that is more accessible from the student's perspective. The automation of administrative processes improves the operational efficiency by freeing up time and resources. Alongside the optimization of academic management through AI, it enables teachers to have quality time at their disposal. Among the various applications of AI in higher education, we will focus on those targeting students. This category includes adaptive/personalized learning systems or recommendation systems, virtual FAQ assistants, and the automation of repetitive tasks and progress analysis.

The identification of concepts that students find difficult to understand is a key element in constructive learning and also allows for the development of specific intervention actions. In

line with the above, one of the most critical issues is how to facilitate access to such interventions at the moment and in a way that is relevant to the students.

Academic tutoring serves as a tool for this purpose. Its mission should be to individualize and personalize teaching for the student seeking it: expanding and deepening information, resolving doubts and difficulties, etc. This ongoing guidance by the teacher allows for determining the level of success in various assigned tasks, adjusting initial objectives if necessary, and guiding autonomous learning. It should also foster a personal relationship between teacher and student, provide professional guidance, motivation towards the subject, and facilitate assessment.

An update of this tool is necessary to achieve an effective classroom intervention in the current technological scenario. This new form of academic tutoring, compatible with face-to-face (F2F) interactions, provides students with the advantages of availability and on-demand repeatability, allowing for ubiquitous learning in the emerging new learning environments. Among the new didactic tools to strengthen education, we have intelligent tutoring systems (ITS), which are designed to enhance learning both inside and outside the classroom, replicating the effectiveness of human tutoring in digital tools.

An ITS is a computational system designed to provide instruction and intelligently support the teaching-learning processes through the interaction with the student (Arias et al., 2009). An intelligent tutor, therefore, "is a software system that uses AI techniques to represent knowledge and interacts with students to teach it" (Minn, 2022; Ouyang et al., 2022).

Nevertheless, it should not only create a digital profile of a student and provide them with a personal tutor; the primary objective of ITS should be the identification of the learning level in a specific area to offer support in the teaching-learning process to stimulate students. This work presents the development of an AI-based ITS as the first stage of a process that elaborates a predictive analysis of the student.

3. Proposed AI application

Intelligent tutoring systems have coexisted with conventional methodologies for some time, in the form of seminal intelligent tutoring systems like cognitive tutors (Anderson et al., 1995) or AutoTutor (Graesser et al., 2004); or the ASSISTments program, which combines intelligent tutoring with assessment to provide real-time feedback (Heffernan and Heffernan, 2014). Nevertheless, it has been in recent years, with the advent of AI in our lives, that intelligent tutoring systems have been claimed to have the potential to become key tools to enhance the teaching-learning process. In this respect, it has to be noted that the most widely used AI implementations to provide contextual responses, such as those expected for a tutoring tool, like ChatGPT, still suffer from a lack of accuracy or even mistakes in the responses provided, which demands its users to be proficient in the topics for which information in sought. Therefore, it is

advisable to develop scaled versions of those tools, specific for certain topics, with the control of the instructors, both in the selection of sources to extract information for the answers, as well as in the supervision of the answers provided. In addition, this allows to add tools to carry out a predictive analysis of the learning process of the students so that the information given can be tailored to his/her needs, in an open-access and free way.

One of the main concerns of educators should not be whether students use AI applications fraudulently, but rather the quality and timeliness of the responses they obtain within the framework of the subject. AI can provide questionable information, it can generate incorrect information or be influenced by biases present in the data with those who were trained. It is crucial that teachers should act as professional managers of AI resources for the benefit of students. It is also important to consider that AI responds to a process that simulates human intelligence to solve problems by learning from the surrounding data, and its effectiveness depends on how its tools are used.

In this work, an Intelligent Tutoring System based on AI has been designed, but with control over the possible responses which increases the reliability of the answers received and that the questions asked allow students' doubts to be analyzed to continue improving the AI system. It also represents the first phase of a project where a predictive analysis of each student's learning can be obtained.

3.1. Participants and scope

Participants are the students enrolled in the course Physical Techniques I, which is part of the second academic year of the Bachelor degree in Physics at the authors' institution. The course aims to provide basic skills in metrology and electronic instrumentation for the measurement of physical magnitudes. In Physical Techniques I, students must be able to analyze basic electronic circuits, determine specifications and tolerances for a measurement, and design the full setup to carry out a measurement, calculating the contribution of every stage to the uncertainty. In this subject, students face basic concepts of Electronics and, in particular, Circuit Theory for the first time, are asked to analyze an electronic circuit using the complex variable *s*, to find out tolerances and specifications for the equipment, to design conditioning stages to carry out measurements, and calculate their contribution to the final uncertainty. Furthermore, the laboratory sessions require the utilization of several instruments that students are not used to manipulate. As a consequence, students often need guidance by the instructors. This project seeks to identify which are the theoretical concepts that appear to be the most difficult to understand by the students in the framework of the course Physical Techniques I.

3.2. Methodology

As detailed above, this project seeks to identify which are the theoretical concepts that appear to be the most difficult to understand by the students in the framework of the course Physical Techniques I. To achieve this, we worked on a previous project where an extensive survey had been conducted, covering both general aspects of the student's situation and their perception of the subject and concepts addressed (Sánchez-Azqueta, 2019). The specific concepts presented in the new survey were primarily based on a prior selection made according to inquiries from previous years in F2F academic tutoring sessions. Contents related to conceptual errors detected in the correction of written tests were also included, which were sometimes not identified by students as errors, as they did not appear to have apparent complexity. These contents influenced the selection of initial material that our neural network or classification algorithm will use, ensuring that the teacher has control over the responses by narrowing down the sources of information employed.

Once a broad (ideally unlimited) set of reference documents is selected (including classroom notes, articles, open-access books, etc.), the classification algorithm generates a selection based on the user's question. Subsequently, this selection of documents becomes part of the input, along with the question, in a conversational network large language model (LLM) like ChatGPT. Since training the network is not the goal of the work, a pre-trained network from an open-access repository is utilized (Crompton and Burke, 2023). The developed information processing scheme can be seen in Figure 1 and the ChatPLT user interface in Figure 2.

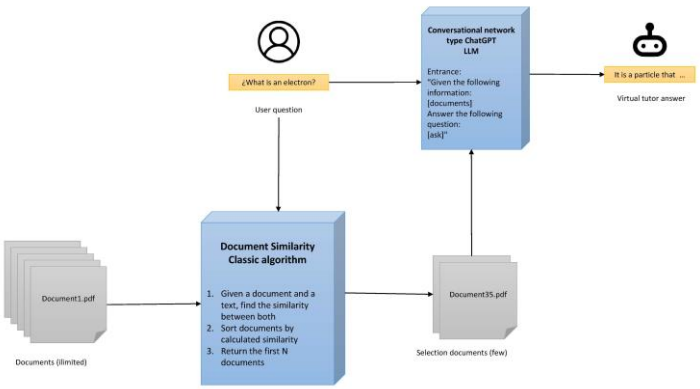


Figure 1. Block diagram of the virtual tutor AI based

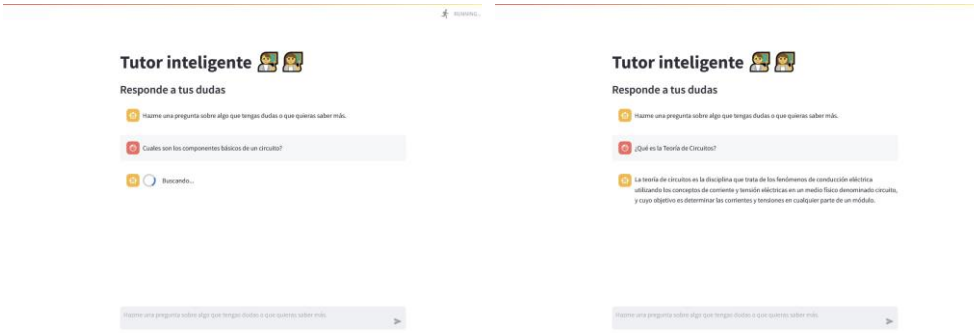


Figure 2. ChatPLT user interface

4. Description of the ITS developed

As can be inferred from Figure 1, this application has two clearly differentiated elements. On the one hand, Ollama [https://ollama.ai/] is used to load and execute a publicly available model designed for the retrieval-augmented generation task (RAG). The second part is the classification algorithm, where we use LlamaIndex [https://www.llamaindex.ai/] and, most particularly, an out-of-the-box vector store database to extract and store the information of the documents (or excerpts). Vector databases work by transforming text into vectors that 'identify' their contents. By transforming the input text into another vector, it can be quickly and efficiently compared with the stored ones to rank and return the most similar documents.

One of the benefits of LlamaIndex, a Python framework specifically designed to implement ChatGPT-like apps and interact with multiple LLM related components, is that both Ollama and vector store are already included. Everything is done in the background and the code just needs to initialize and configure the elements, and provide the folder with specific and controlled documentation. To conclude, StreamLit [https://streamlit.io/] is used to generate a user interface for the application, in this case for the students of the subject.

A preliminary test has been carried out by analyzing the responses to 40 different questions related to the documents fed to the application. These responses have been classified in three different categories according to their accuracy. As it can be seen in Table 1, 31 questions (77.5%) have yielded correct answers, 8 questions (20%) have yielded answers with missing or incorrect information and 1 one question (2.5%) have yielded an incorrect response. These results show that, although the accuracy of the application is not perfect, it could have a great potential.

Table 1. Analysis of the responses to 40 different questions.

Category	Number
Satisfactory responses	31
Missing or incorrect information	8
Incorrect or unrelated answers	1
Total questions	**40**

5. Expected results and Conclusions

In this phase of the project, the first two stages have been covered: the identification of challenging concepts and the development of an AI-based tool with accurate bibliographic references using reliable sources that caters to specific needs of the students. The next phase is currently underway, focusing on introducing the tutor to the students as a complementary tool to their learning, especially in preparation for the June exams. This will be a dynamic process that will contribute to building a more refined and tailored database, along with the gradual introduction of improvements to the tool's functionality. Finally, the project will expand to include the development for implementation in the next course, focusing on analyzing the evolution of the students' profiles to enable predictive analysis and timely interventions.

The way our students acquire information nowadays differs significantly from consulting the bibliography recommended by the professor. Internet and YouTube are often the usual sources due to the way they interact with technology, and, of course, the use of ChatGPT. We believe that integrating AI as a useful tool in the educational environment should be part of the teaching responsibility, assessing the sources and references our students use to give greater value to the generated responses. Leveraging the power of the tool to add value to this interaction, such as personalizing the learning experience, is crucial.

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A "cost-effective" approach for the photoelectric effect experiment

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Abstract

A novel approach to investigating the photoelectric effect is proposed, it is affordable and accessible for any typical school laboratory. This cost-efficient measurement, using a series of digital multimeters, normally available in all the schools, facilitates the understanding of the photoelectric effect but also encourages creative problem-solving attitude among students and democratizes the access to quality physics education. By embracing this approach, schools which lack funds for expensive instrumentations can enrich their physics curriculum ensuring that every student has the opportunity to test the quantum nature of photons. The results of photoelectric effect measurements with this "cost-effective" approach, made by the students of the Liceo Scientifico Leondardo da Vinci of Trento, are presented. The inferred values of the Planck constant and of the work function are compatible with the ones obtained using the standard approach involving an "expensive" Galvanometer.

Keywords: *Photoelectric Effect; Planck constant; low-cost.*

1. Introduction

The photoelectric effect, first observed by Heinrich Hertz in 1887 and later elucidated by Albert Einstein in 1905, stands as a cornerstone in the field of modern physics. Teaching the photoelectric effect holds paramount importance in physics education, as it serves as a fundamental concept bridging classical and quantum physics and allows a laboratory measurement of the Planck constant, ***h***. Beyond its significance in theoretical physics, the photoelectric effect underpins numerous technological innovations and scientific advancements. From solar cells and photodetectors to digital imaging devices and spectroscopy techniques, the practical applications of the photoelectric effect permeate modern technology and scientific research.

The typical setup for the experiment of the photoelectric effect uses a light source, a set of monochromatic filters, a vacuum tube (photoelectric cell), a Galvanometer for current

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measurements and a tunable voltage source (see fig. 1). The laboratory measurement correlates the reverse voltage necessary to nullify the current in the circuit and the wavelength of the filtered light.

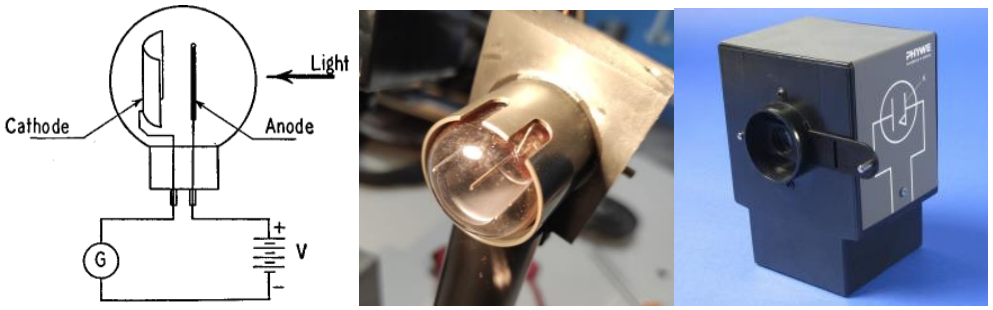


Figure 1. Drawing of the typical set-up for the photoelectric effect experiment (left). Pictures of the PHYWE-06778 PbS cell (center) and of the cell external housing (right).

In this experiment the sensitivity and internal resistance of the Galvanometer plays a crucial role. In particular, considering the intensity of a typical light source (avoiding damages related to excessive material heating) a current of few nA must be measured by the Galvanometer that should provide a negligible resistance in the circuit. The cost of such a device is not negligible, moreover the low internal resistance of the Galvanometer puts its integrity at risk in case of circuit mistakes during the assembling. For this reason an alternative approach for the measurement of Planck constant, ***h***, with the photoelectric effect experiment is proposed. This approach replaces both the Galvanometer and the variable voltage source with a series of identical digital voltmeters that are low-cost and rugged devices. Typically, a series of ~15 identical multimeters is available in most school laboratories to allow experiments related to the Ohm law and basic electromagnetism.

2. Measurement of the Photocell I/V curve

The idea is to replace both the Galvanometer and the tunable voltage source with a series of N voltmeters (see fig.2, bottom panel) and to characterize the I/V curve of the cell by varying N at fixed light intensity and wavelength. For our measurements we adopt the METEX M-4650 multimeters, setted at the lower scale, as a DC voltmeter. All of them are characterized by an inner resistivity of ~10MΩ, this can be verified by direct resistance measurements pairing the multimeters. Having a similar inner resistance, all the multimeters provide very similar voltage measurements in the series. The (loaded-) cell voltage, $\mathbf{V_{cell}}$, is obtained by summing the N multimeter voltage values. The current provided by the cell, $\mathbf{I_{cell}}$, is given by the average of the N multimeter voltages divided by the known average multimeter resistance. In the example shown in fig.2 bottom panel, $\mathbf{V_{cell}}$ = 394 mV and $\mathbf{I_{cell}}$ = 5.63±0.05 nA are measured. By adding or removing other multimeters in the series, part of the I/V curve of the cell can be traced.

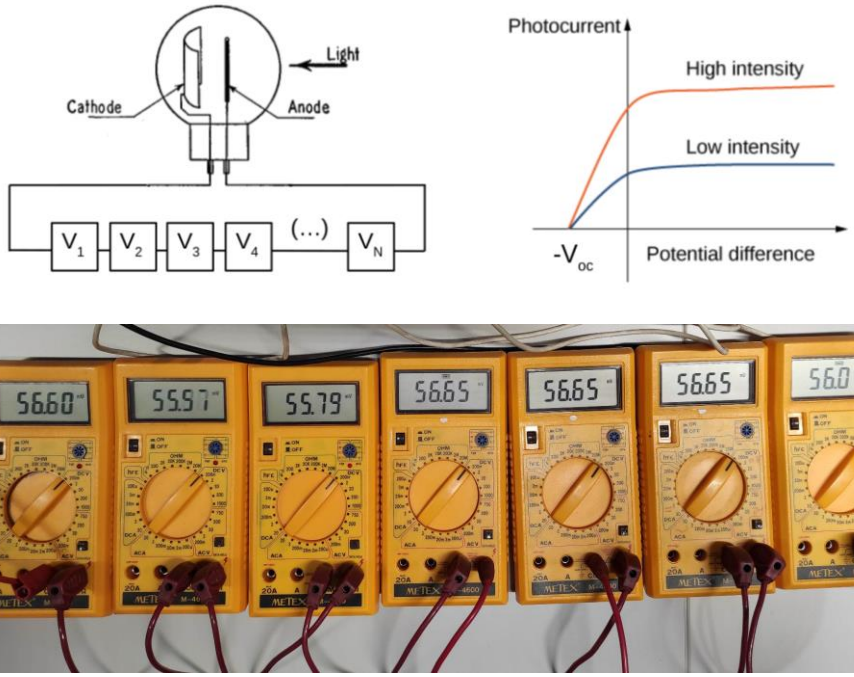


Figure 2. Drawing of the proposed set-up for the photoelectric effect experiment (left-picture). Expected behavior of the I/V characteristics for the photocell for a fixed light wavelength (right panel). An example of current and voltage measurement made with a series of 7 multimeters (bottom panel)

It is important to note that the exact knowledge of the average inner multimeter resistance is not really necessary for the photoelectric effect experiment. The uncertainty of the current measurement (mainly due to small departures of the internal resistance of each multimeter from the average one) can be inferred from the RMS of the values reported in the multimeter series. We found it is useful to take several pictures of the multimeters series during the experiment to minimize the measurement time, this allows to postpone the relatively slow data-entry process. The measurement has been taken with four filters selecting light with wavelengths of: 436, 546, 578 and 740nm. The I/V photocell characteristics, as measured by different student groups, are plotted in fig.3 (left plot) with colors: magenta, green, yellow and red, respectively. Different tonality of the same color in the data points plotted in fig.3 (left plot) marks different measurements using the same wavelength filter provided by different groups of students. It is important to note that the condition $\mathbf{I_{cell} = 0}$ cannot be tested directly due an high, but finite, resistance of the multimeter series. However, for each wavelength, the open cell voltage ($\boldsymbol{Voc}$) can be inferred by linearly extrapolating the I/V characteristics to the zero current values. A systematic uncertainty (green error bars of fig.3 right plot) in the extrapolation procedure can be inferred by adopting different data ranges in the extrapolation fit. A linear relationship of open-cell voltages and expected light frequency, $\boldsymbol{\nu}$, has been verified in fig.3 (right-panel). The

expected relationship: $\mathbf{V_{OC} = (\nu-\nu_{min})h/e}$ allows the measurement of the Planck constant. Moreover $\boldsymbol{\nu_{min}}$, the minimum light frequency exceeding the work function $\mathbf{W=h\nu_{min}}$ can be measured. For this PHYWE-06778 PbS photocell, the expected $\boldsymbol{\lambda_{max}=c/\nu_{min}}$ = 908 nm value is provided by the cell manufacturer ($\boldsymbol{\nu_{min}}$ = 330 THz).

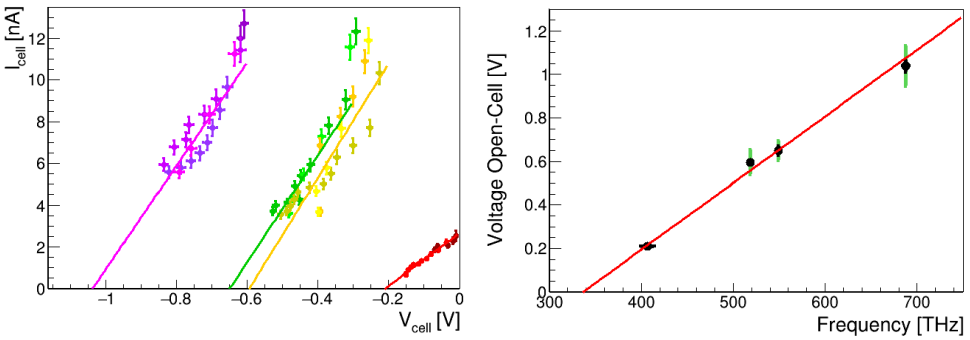


Figure 3. Left panel: Measured I/V characteristics by different student groups for different light wavelengths. The colors are encoding the different wavelengths: 436 nm (magenta points) 546 nm (green points) 578nm (yellow points) and 740nm (red points). Right panel: extrapolated open-cells voltages as a function of the frequency of the light, green error bars represent the systematic uncertainties of the fit.

The measured $\boldsymbol{\nu_{min}}$ = 336±12 THz, is fully compatible with the expected value for this PbS photocell, however the measured **h** = 3.1±0.3 x 10^{-3} eV/THz is only marginally compatible with the expected value of Planck constant (4.136 x 10^{-3} eV/THz = 6.626 x 10^{-34} Js).

This, typical, ~20% lower **h** value inferred from the measurements of open cell voltages is reported also for the PHYWE-06779 photocell coated with Cs-Sb. From the PHYWE photocell documentation it is correctly suggested that "the errors are partly due to unavoidable photoemission from the anode" and from a simple comparison of the cathode and anode geometric surfaces (see fig.1) a correction factor to the measured currents (and voltages) of the order of ~10% due to the fraction of electrons flowing from anode to cathode should be applied. In particular it is interesting to comment to students that no net current flow is expected in the case of an hypothetical photocell that is perfectly symmetrical among anode and cathode.

3. Conclusions

The proposed approach for the photoelectric experiment, replacing the (expensive) Galvanometer and the tunable voltage source with a series of (low-cost) digital multimeters, normally available in the school laboratories, has been tested. The quantitative measurements of Planck constant and work function agree with the precision expected by this type of experiment using the "standard" (Galvanometer) equipment. The proposed approach allows this

important measurement of modern physics also in schools where funds for expensive instrumentations are not available.

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The Importance of Entrepreneurship Education for Startup Creation in Thailand

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Abstract

Data has shown that Thailand lags other countries in the region for start-up creation and success, with the limited provision of Entrepreneurship Education cited as a main reason. We investigated using qualitative research the views of existing entrepreneurs and students planning on starting a business on the education they received. We specifically looked at the content of Entrepreneurship Education, extracurricular activities, and opportunities for networking. We found that both agreed experiential learning and practical experience worked best, internships were an underutilized resource and founders were more aware than students of how to network and how it could help them. We suggest some recommendations to refine the current Entrepreneurship Education offering based on these results including modernizing the curriculum and making more use of internships and extracurricular activities for both experiential learning and networking, free from the constraints of assessments.

Keywords: *Enterprise, entrepreneurship, extracurricular education, student start-ups, Thailand.*

1. Introduction

Entrepreneurship Education (EE) is a structured pedagogical method to develop entrepreneurial capabilities in students including knowledge, skills, and attitudes (Brussels, 2014). This educational model combines theoretical foundations with experiential learning to empower students to navigate ambiguity, solve complex problems, and make informed decisions (Gibb, 2002; Hytti et al., 2010; Neck & Corbett, 2018). Thailand's startup ecosystem lags that of its Southeast Asian counterparts with a lower number of startups compared to Indonesia, Vietnam, and Singapore, which have seen significant growth in recent years (Startup Blink, 2022). One of the obstacles hindering the growth of Thailand's entrepreneurial ecosystem is the limited effectiveness of EE (Juasrikul & Vandenberg, 2022). This paper seeks to understand what aspect of EE is insufficient and what can be done to improve the offerings available. This paper can

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also help similar economies optimize their EE for the benefit of entrepreneurial students who wish to start a business, and for those choosing to enter employment. The World Economic Forum (2020) highlights the importance university plays in fostering students' entrepreneurial mindset, and universities can play a significant role in creating an optimal startup ecosystem (Stagars, 2014; Gupta & Phillips, 2019). However, the effect of EE is often difficult to measure, with researchers using entrepreneurial intention (Fayolle & Gailly 2015), self-efficacy, skills gained and actual venture creation (Phillips, 2019). Outcomes can be affective (changing in attitude to want to start a business) and cognitive (understanding information and why they want to start a business) (Ratten & Usmanij, 2021). Longitudinal studies are often needed which delays the ability to make rapid informed decisions on what is effective (Duval-Couetil, 2013). Universities can provide EE thorough taught units (Sanchez-Romaguera & Phillips, 2018), extracurricular activities such as venture competitions, hackathons and bootcamps (Papadopoulou & Phillips, 2019 and 2020; Phillips, 2017; Phillips, 2010) and allow networking between students - especially useful if mixing between different subject areas. Experiential learning is considered the most effective EE using real-world settings (Ferreira et al., 2018). EE is particularly important at university since it often allows students to draw upon their subject knowledge to identify business opportunities (Adeel et al., 2023). However, some evidence such as Oosterbeek et al. (2010) suggest a negative correlation between EE and plans to become entrepreneurs due to the programs' realistic portrayal of entrepreneurship making students less likely to start their own businesses. Three areas were considered for EE - Course content, extracurricular activities, and networking. Course content is important for basic understanding such as finance and intellectual property although is often criticized as being "about" entrepreneurship rather than "for" entrepreneurship, extracurricular activities are often seen as being very effective since they are not constrained by the need for assessment and the focus can be on gaining skills and can even be learning "through" entrepreneurship if students try to start their business and get funding through venture competitions, other seed funds, or an accelerator programme. Networking is crucial for the success of a business (Larson & Starr, 1993) and can take many forms, such as alumni associations (e.g., with MBA graduates), local business clubs, online networking (such as Facebook or LinkedIn), and connections through friends and classmates. It is also linked to finding funding or backers for projects such as crowdfunding (Hou & Phillips, 2022; Islam & Phillips, 2020). However, it is possible one could spend valuable time engaging in networking activities that are not relevant to their objectives (Salamzadeh & Kirby, 2017). There is currently a lack of research examining the significance of EE in relation to startup creation in Thailand and this study follows the approach of Heinonen & Poikkijoki (2006), which focused on three fundamental pillars: knowledge, skills, and attitudes and makes use of a typology created by Johnson & Majewska (2022) which divides EE programs into three categories: (1) Formal Education (curriculum-based); (2) Non-Formal Education (extracurricular activities designed to supplement formal learning); and (3) Informal Education (networking opportunities and mentorship programs that provide experiential learning). This

multifaceted approach to EE attempts to fully prepare aspiring entrepreneurs for the startup ecosystem. This study aims to examine which areas are most important for fostering entrepreneurship and to understand what elements might be lacking in current provision. This will be of use not just in Thailand, but any similar economies and educational systems that wish to boost entrepreneurship.

2. Methodology

Due to the highly individualized nature of entrepreneurship, qualitative analysis using semi structured interviews used. The interviews involved 12 participants, 6 business students currently pursuing bachelor's degrees motivated to start a business and 6 alumni startup owners in Thailand. The data was managed and analyzed using NVivo software. An inductive approach was employed to identify themes that emerged from the data, allowing the exploration of the research questions without preconceived ideas. This resulted in 363 initial codes, 186 were retrieved from the transcripts of students, and 192 from startup founders. These codes were then organized systematically into three unique groups.

3. Results and Discussion

Basic Business Understanding addresses the core knowledge acquisition from course content. This knowledge is better retained when contextualized through hands-on assignments. Nonetheless, the curriculum occasionally falls short with students and startup founders preferring hands-on assignments over lecture-based learning. They found value in applying course knowledge, and presenting for professor's feedback, which enhance cognitive thinking; In contrast, participatory activities, especially term-long business plan projects, facilitated deeper understanding. Overall, students believed that using assignments over exams would optimize learning. "*A lot of exams at the end of term, but it was mostly rote learning. I had to memorize things just to pass the exams. After taking them, I pretty much forgot everything.*" Startup founders, on the other hand, emphasized the value of projects derived from real client cases, as they provide more realistic feedback compared to professors lacking practical experience *"courses shaped our thought process to be a business leader, but it did not teach growth hacking, analytics, or necessary technical knowledge. I feel like the university gears students up for a professional career path, but it doesn't really give them the tools to be an entrepreneur*" Students suggested that project-based modules offer valuable insights into strategy development "*The curriculum incorporates innovative business models, enriched with diverse ideas and real-world case studies, enabling students to anticipate business risks. I had to do group projects, creating innovative business models that are new to the Thai market.*"

Table 1. Summary of qualitative findings from the interviews

First Order Concepts from the interview responses	**Second Order Themes**	**Aggregate Dimension**
The courses shape the mindset to be more systematic, and provide essential groundwork and elements required to initiate a business, lecture-based learning often results in forgettable knowledge, few courses that actually fit the bill, learn better with hands on experience, projects are realistic, the University should incorporate emerging technologies into the curriculum for relevant skills	The on curricular courses provide business basics useful for underpinning founding a startup but often lack practical application or up to date skills training	Basic business Understanding
Learned new things from doing and validating my knowledge in practical classes, extracurricular activities provided real-world insights, the university innovation hub promotes external events and helped connect me with entrepreneurs, broader exposure to career paths, allows for self-exploration	Extracurricular allow exploration of novel experiences, networking opportunities and career development	Opportunities for growth – personal and professional
Like minded friends make ideal co-founders, collaborate with diverse individuals, funders were secured from case competitions, interacted with successful entrepreneurs, found an entrepreneur to advise my startup, alumni business guidance, a case competition mentor has led to my current internship	Essential business connections for startup or business career, startup collaborators and co-founders	Opportunities for networking

However, feedback from startup founders suggests a need for content more attuned to modern business realities, with many founders acquiring entrepreneurial knowledge outside formal education, they acknowledged the value of certain skills from their courses, such as customer-centric problem-solving, basic coding, Excel proficiency, and negotiation. Translating academic knowledge into practical application was identified as crucial. All agreed that the curriculum lacks integration of emerging technologies and is perceived as outdated, partly due to some faculty members' resistance to updating content. "*The university didn't teach me about this, so I had to learn from other sources, like free courses online*." The founders suggested the curriculum offers basic business knowledge with limited contemporary applicability. The

second aggregate dimension is the opportunities from extracurricular activities, which encompass knowledge validation from classroom, novel experiences, networking, and the ability to translate academic knowledge into practice. One participant noted, "*Joining optional extracurricular activities unexpectedly provided me with valuable learning and experience*." Students emphasized having a variety of experiential learning experiences. Case contests strengthened their analytical, decision-making, and presentation skills as well as team, negotiation, management, and leadership skills. They provided students with opportunities to apply analytical frameworks, highlighting the importance of careful analysis and contingency planning. The backgrounds of participants frequently defined their duties, e.g., finance students typically handled financial predictions. Internships mentioned provided practical experience, and extending internship durations was recommended allowing insights into positives and negatives of experienced entrepreneurs presents a holistic view of entrepreneurship with examples of resilience and learning from challenges. Founders noted the value of university-sponsored workshops with influential speakers, despite potential scheduling challenges. *"I recognize that these individuals are typically very busy, and the university may need to allocate a budget for this type of workshop in order to bring them in*." Business plan competitions were highlighted for their insights into investor expectations and fundraising, although founders emphasized that not all academic strategies are applicable in real-world settings, and sometimes startup competitions could be too theoretical and have limited real-world applicability. Job opportunities were facilitated by internships and guidance from competition mentors significantly influences career directions. There was a consensus on the value of networking opportunities provided by alumni and entrepreneur workshops, facilitating connections with accomplished entrepreneurs, especially motivational talks detailing entrepreneurial journeys. Additionally, mentorship programs allowed students to interact with peers from diverse disciplines and engage with alumni. This was echoed by startup founders e.g., "*While academic insights from professors are invaluable, there's an indispensable need for experiential knowledge from seasoned entrepreneurs.*". The final aggregate dimension is the influence of networking, both within and beyond the classroom. The extent and value of these networks varied among individuals, often contingent upon their proclivity to engage with new acquaintances. Entrepreneurs view their fellows as vital networking resources, as articulated by a founder, "*My university acts as a hub of talent, catalyzing business collaborations.*". Although the eventual significance of these connections might initially be ambiguous, nurturing diverse relationships can be crucial. Conversely, students often overlook the potential of peers although some engage in case competitions to collaborate with diverse peers, valuing interdisciplinarity. Rather than relying on professors, they placed greater trust in individuals with direct practical experience and observed that practical solutions showcased in case competitions attracted potential investors and mentors acquired through these competitions became sources of advice and career opportunities. While students underrated networking's importance, founders had a nuanced understanding of its role for their startup. For founders, peer connections became

collaborators, initial clients, and negotiation facilitators "*In the early phases, my clientele largely comprised classmates, some of whom leveraged their friendships to assist in negotiations with restaurants*." Furthermore, founders recognized the university's role in facilitating external networking opportunities, particularly through extracurricular engagements, promoted by the university's innovation hubs. In summary, it was found that whilst the curriculum imparted basic business knowledge it was extracurricular that gave the chance for more practical experience and networking which was seen as vital for successful EE. In terms of the formal taught curriculum, there is the opportunity to update with modern tools and skills. Interestingly, internships were mentioned as a very positive measure to gain practical business experience for entrepreneurship, so it is recommended more are made available, especially with entrepreneurial companies. Both students and founders agreed that learning by doing was best, emphasizing hands-on experiential learning in diverse environments, but students primarily valued extracurricular activities as the most crucial component. Meanwhile, startup founders emphasized the informal learning experiences gained within the university context, giving them the resources needed in startup creation as well as link them to further connections necessary for growth. Founders appeared more aware of the value of networking, suggesting universities should give more opportunities to network with alumni and entrepreneurs and signpost to external events to encourage active networking.

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The challenges of implementing Course-Based Undergraduate Research Experiences (CURE) in Hong Kong universities for healthcare-related professional students

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Abstract

This study aims to explore the challenges and implications of implementing Course-based Undergraduate Research Experiences (CURE) in biomedical science and healthcare-related programs at universities in Hong Kong. The main results reveal that resource constraints, time limitations, and traditional assessment methods pose significant challenges in the integration of CURE. The study emphasizes the importance of developing tailored assessment strategies to effectively capture the multifaceted skills and competencies developed through research experiences. Additionally, creating a supportive learning environment that encourages student input and involvement in experimental design is crucial. The findings highlight the need for strong teacher-student partnerships to foster collaboration, enhance students' critical thinking skills, and promote their overall academic and professional development. In conclusion, addressing these challenges and incorporating best practices in CURE implementation can better prepare students for real-world research and promote their holistic growth.

Keywords: *Course-based Undergraduate Research Experiences (CURE); Biomedical science and Healthcare-related programs, Teaching laboratories Challenges, Assessment strategies; Teacher-student partnerships.*

1. Introduction

There has been a growing interest in incorporating Course-Based Undergraduate Research Experiences (CURE) into higher education curricula (Calède, 2023). Previous studies have

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highlighted the benefits of CURE, such as enhancing critical thinking, problem-solving skills, and bridging the gap between theory and practice (Bangera & Brownell, 2014; Shortlidge et al., 2016).

In Hong Kong, the availability of well-paying jobs for most healthcare professional students after completing their undergraduate studies may discourage them from pursuing postgraduate education and research. As a result, there is a limited pool of qualified individuals who choose to become teachers in the healthcare field, leading to a long-term shortage of instructors. This issue underscores the importance of exploring the opportunities and challenges associated with implementing CURE in tertiary institutions in Hong Kong, particularly for healthcare-related programs. By understanding the specific obstacles faced by teachers and students in this context, appropriate interventions can be developed to address the shortage of teachers and promote the integration of research experiences into the curriculum.

Two years ago, we conducted a preliminary study at one of the Hong Kong universities, which revealed that CURE stimulate the interest of healthcare professional students in pursuing postgraduate studies, thereby addressing the shortage of healthcare professional teachers(Yau et al., 2022). However, the specific challenges faced by teachers in implementing CURE in tertiary institutions in Hong Kong, particularly for healthcare-related students, have not been extensively explored. Consequently, this follow-up study aims to investigate the opportunities and challenges associated with implementing CURE in this context. To gather data, questionnaires and interviews were administered to teachers, enabling an exploration of their experiences and difficulties in implementing CURE within Hong Kong universities, with a focus on biomedical science and healthcare-related programs. Additionally, a follow-up study involved distributing questionnaires to students to validate the findings. By collecting perspectives from both teachers and students, we seek to develop a more comprehensive understanding of the opportunities and challenges associated with implementing CURE in Hong Kong universities.

2. Methods

The study encompassed a retrospective analysis of undergraduate practical teachers (n=27) and their students (n=39) enrolled in healthcare-related professional programs across four tertiary institutions in Hong Kong. To ensure the anonymity and objectivity of responses, blind questionnaires were developed and administered to both teachers and students through MS Form. This data collection approach aimed to gather quantitative data on teaching approaches and practical experiments. Additionally, semi-structured interviews were conducted with teaching staff from healthcare-related programs to obtain qualitative insights into the challenges faced during the implementation of CURE. Descriptive statistics were utilized to analyze the quantitative data, while thematic analysis was applied to the qualitative data. By incorporating

these methods, the study intended to gain a comprehensive understanding of the practical application of teaching approaches, the effectiveness of various tools, and the obstacles encountered in facilitating hands-on learning experiences in healthcare education.

3. Results

According to the teacher survey, approximately 48% of practical sections followed step-by-step protocol approaches, with varying levels of detailed instructions. Additionally, around 33% of practical sections were based on teacher demonstration. These findings suggest that a significant proportion of teaching laboratories still rely on traditional approaches, limiting hands-on experience for students.

Building upon the findings from the teacher questionnaires, the student questionnaires provided further insights into the challenges faced by students in their practical experiences. It was revealed that approximately 43% of teaching laboratories still rely on classical approaches, where students are expected to follow step-by-step protocols to obtain the expected results. Moreover, the student survey indicated that only about 25% of practical sections involve hands-on experience, often through teacher demonstrations. This lack of hands-on experience was identified as a significant issue by the students.

Table 1. Description of teaching style during practical sections as reported by teachers and students.

Response by	Teacher	Student
Step-by-step Protocol: Teachers provide students with a detailed procedure or protocol to follow, emphasizing precise instructions and sequential steps to ensure accuracy and reproducibility.	48%	43%
Demonstration-based: Teachers demonstrate the practical procedure themselves, explaining each step and highlighting key concepts and techniques while students observe and take notes	33%	25%
Inquiry-based: Teachers encourage students to explore and discover knowledge through hands-on experimentation, allowing them to generate their own questions, hypotheses, and experimental designs.	3%	17%
Problem-solving Approach: Teachers present students with real-world scenarios or challenges, guiding them to apply their knowledge and skills to find solutions and make informed decisions.	7%	10%
Others	7%	2%

Interestingly, the data revealed a discrepancy between teachers' perception of providing detailed manuals and students' perception of receiving detailed instructions. Most teachers believed they provided very detailed instruction, but most of their students agreed only Moderately detailed instructions were provided. Nevertheless, 71% of the students agreed that the level of detail

provided in the instructions or protocols was just right and helpful. Only 15% of them felt it was not detailed enough and preferred more guidance, while 12% reported it was too detailed and restrictive.

Table 2. Description of the level of details provided in the instructions or protocols as reported by teachers and Students.

Response by	Teacher	Student
Very detailed instructions	51%	35%
Moderately detailed instructions	33%	53%
Brief outline-style instructions	14%	7%
Others	0%	2%

The student questionnaires also highlighted concerns about proposing alternative approaches or thinking creatively during experiments, as students feared it might lead to deductions in their marks. However, approximately 55% of students reported that their teachers would consider their input and give them credit if they provided explanations for unexpected results. This indicates an opportunity for incorporating more flexibility and student involvement in experimental design and execution.

Regarding assessment, the teacher survey indicated that about 23% of teachers graded assignments based on students' proficiency in obtaining expected results, while approximately 64% graded assignments based on their ability to interpret and explain the results. This finding suggests that the emphasis is placed on comprehending the underlying principles and effectively communicating the outcomes, rather than solely achieving predetermined results. It is encouraging to note that students also provided similar feedback, reinforcing the importance of understanding and articulating the significance of their findings.

Table 3. Description of the performance in practical sections as assessed or graded by teachers and students.

Response by	Teacher	Student
Based on their ability to obtain the expected results	23%	25%
Based on their ability to explain their results, even if they did not achieve the expected outcome	64%	55%
Based on their performance in tests or exams	8%	17%
Others	2%	1%

In addition to the questionnaires, interviews conducted with teaching staff provided further insights into the challenges of implementing CURE. Firstly, there is a lack of resources and infrastructure required for successful implementation, including laboratory facilities,

equipment, and funding. This resource constraint poses a significant barrier to the widespread adoption of CURE initiatives, particularly in resource-limited settings.

Secondly, time constraints and the demands of the curriculum present challenges in integrating CURE into existing programs. Healthcare-related professional programs often have dense curricula, leaving limited space for additional research experiences. Therefore, careful curriculum mapping and coordination are necessary to ensure that students can effectively balance their academic workload while participating in research activities.

Lastly, assessing and evaluating student learning outcomes within the context of CURE can be challenging. Thus, it is crucial to develop appropriate assessment tools and strategies tailored to evaluate student learning in CURE, allowing for a comprehensive assessment of the impact of these experiences.

4. Discussion

In addition to the challenges of limited resources and time constraints, assessment, and evaluation of student learning outcomes in the context of CURE pose significant challenges (Kleinschmit et al., 2023). Conventional evaluation approaches may not comprehensively encompass the diverse range of abilities and proficiencies cultivated through research encounters. (Tai et al., 2023). This highlights the need for developing appropriate assessment tools and strategies tailored to evaluate student learning in the context of CURE. By implementing comprehensive assessment approaches, educators can more accurately measure the impact of CURE experiences on student learning and growth.

Furthermore, creating a supportive learning environment that encourages student input and creativity is crucial for the successful implementation of CURE (Goodwin et al., 2022). The findings indicate that students have concerns about proposing alternative approaches for fear of mark deductions. However, a significant majority reported that their teachers would consider their input and give them credit for explanations of unexpected results. This suggests that there is potential for incorporating more flexibility and student involvement in experimental design and execution. By fostering a supportive and inclusive learning environment, educators can empower students to think critically, propose innovative solutions, and actively engage in the research process (Golden, 2023).

The findings of the study emphasize the significance of cultivating strong partnerships between teachers and students. Collaborative and open communication between educators and learners can establish a supportive learning environment that fosters active engagement, nurtures creativity, and promotes mutual respect (Könings et al., 2021). By forging strong teacher-student partnerships, teachers can gain a deeper understanding of their students' needs, provide effective guidance and mentorship, and foster a sense of ownership and responsibility for the learning process. Valuing student input, encouraging their ideas, and involving them in

meaningful participation within the practical sections, teachers empower students and facilitate their active involvement in experimental design and execution. By incorporating students' perspectives and involving them in decision-making processes, teachers not only cultivate a sense of ownership but also enhance students' comprehension of scientific concepts and methodologies (Geurts et al., 2024). This collaborative approach enhances critical thinking skills, problem-solving abilities, and contributes to students' overall academic and professional development. Importantly, these positive changes can be implemented without significantly altering the current educational settings.

Furthermore, fostering teacher-student partnerships contributes to a more holistic assessment of student learning outcomes. By establishing regular feedback loops and constructive dialogues, educators gain valuable insights into students' progress, challenges, and areas for improvement (Carless, 2019). This feedback informs the development of tailored assessment tools and strategies that effectively capture the multifaceted skills and competencies developed through research experiences. By incorporating diverse perspectives and engaging in ongoing communication, teachers can ensure a comprehensive evaluation of student learning outcomes while providing targeted support and guidance to facilitate continuous growth and development.

However, it is important to acknowledge that this study has certain limitations. Firstly, the sample size was relatively small, consisting of a specific group of students and teaching staff from healthcare-related programs in Hong Kong. Therefore, the findings may not be generalizable to other contexts or disciplines. Additionally, the study focused on self-reported data obtained through questionnaires and interviews, which may be subject to response bias. Future research with larger and more diverse samples is needed to further explore the effectiveness and generalizability of CURE implementation in different educational settings.

In addition to addressing the shortage of healthcare professional teachers at Hong Kong, we believe the implementation of CURE can also contribute to the advancement of medical research and innovation. By actively engaging students in research projects, universities can create a pipeline of talented individuals who are equipped with the necessary skills to pursue postgraduate studies and contribute to groundbreaking research in the healthcare field. This may lead to the development of new treatments, diagnostic tools, and healthcare technologies, ultimately benefiting patient care and improving overall healthcare outcomes.

It is important to acknowledge that implementing CURE does require time and effort. However, once a culture and system of collaboration are institutionalized, remarkable results can emerge. By creating an environment that encourages and supports collaboration, universities can foster a culture of innovation and excellence, leading to significant advancements in healthcare research and practice. The benefits of this collaborative approach outweigh the initial investment, as it propels the field forward and nurtures the next generation of healthcare professionals and researchers.

5. Conclusion

In conclusion, addressing the challenges of limited resources, time constraints, and assessment strategies is crucial for successfully integrating CURE into educational programs. Additionally, promoting a supportive learning environment and fostering strong teacher-student partnerships are essential for enhancing the educational impact of CURE initiatives. By incorporating these principles, educators can effectively prepare students for real-world research, promote their overall academic and professional development, and ensure a meaningful and transformative learning experience. Tailored assessment tools and strategies can accurately evaluate student learning in CURE by capturing the multifaceted skills developed through research experiences. Creating a supportive environment that values student input and encourages critical thinking fosters their understanding of scientific concepts and overall growth. Strong teacher-student partnerships enable collaboration and active student participation in the research process, facilitating successful CURE implementation. By addressing challenges and following these principles, CURE programs equip students for real-world research, contribute to medical advancements, and foster interdisciplinary collaboration. Ultimately, these initiatives provide students with a transformative educational experience that enhances their academic and professional journey.

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The challenge of unprepared students in inverted classroom teaching scenarios

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Abstract

In higher education the more and more common teaching method "inverting classroom" comprises of 2 phases: the self-study phase prior to the course and second the in-class or online sessions where discussions take place and students work on projects, extended hands-on lectures or exercises in class. First year mechanical engineering students are offered different teaching materials (mainly lecture videos, lightboard videos and micro-module lectures) to study from a distance and comprehend the principle underlying science in theory. Presence or online plenary lectures offer the opportunity to apply knowledge and transfer different scientific aspects of the course to get the bigger picture. However, there are always students unprepared causing huge diversity, irritating the lecturer and classmates and therefore threatening to imperil the desired learning outcome. This paper offers different practical experiences with no, little and sufficient success from 10 years of experience with teaching inverted.

Keywords: *inverted classroom, flipped classroom, online teaching, unprepared students.*

1. Introduction

Inverting the classroom: Seteren et al. (2019), Pfennig (2021), Walsh, O'Brien, Costin (2021), Haynes and Currie (2020) is now a well known teaching approach where students are given more responsibility for their learning progress which was found to encourage critical thinking: CSU (2015) resulting in deeper learning outcomes: Goto and Schneider (2010). Inverting the classroom has a positive effect on self-efficacy beliefs and intrinsic motivation: Thai et al. (2017) especially in MINT courses: Setren et al. (2019) courses where fact-based teaching dominates such as introductory science courses: Pfennig (2021).

The principle of inverting the classroom requires students to study the science on their own before class or online session. Advantages are: no time limit and place independency. In class usually lecturers answer questions and discuss details. Students solve hands-on problems,

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perform group work and master difficult problems. Because the method clearly enables students to discuss early and communicate in equal measure: Pfennig (2021).

1.1. Practical leads for inverted classroom teaching

During self-study periods of the blended learning: Eryilmaz (2015) – and in summer semesters SS2020-2021 fully online Material Science course at HTW Berlin approximately 45-70 students per semester individually chose, combine and study alone or in study groups from a distance. Exercises, worked solutions, self-assessed tests and peer-instruction during present time help students to check on their learning progress. To meet the course`s learning outcome and overcome the diversity of a first year class different practical leads have been proven important to turn flipped classroom teaching into success related to formative assessment: Pfennig (2021):

1. Start with low threshold tasks when assessing the first flipped classroom lecture.
2. Close guidance of students` self-study period is highly advised.
3. The learning outcome is more successful in homogeneous study groups.
4. Transparency of learning outcome, assessment and workload right to the begining.
5. Organize the online course formally (not by content). Alternative: arrange by week.
6. Use templates to summarize the learning outcome of each study session.
7. Use (online) face-time for interacting hands-on problems not content transfer only.

2. How to deal with unprepared students

Gulley et al. (2016) state that the understanding and retention of course material was improved along with effective use of time in class. However, the effective use of time in class is decrepid when students do not use the self-study period to thoughtfully and comprehensively prepare for in-class activities or even do not study at all → even if all practical leads are followed. The following practical experiences describe 4 different approaches to motivate students to prepare well during self-study periods.

2.1. No success: Relying on students` self-employment

Just because young adults entered (applied) universities does not turn them into fully self-relying individuals taking assignments as an offer to brighten their insight. When pandering to their matureness approximately 40% of the students are not or insufficiently unprepared. There are various reasons (all comprehensible) such as: too little time, too little understanding, familie/friends duties, lacking skills to work the content management system cms, etc.. Most of the time only the highly intrinsically motivated students are prepared and often those are the ones who are ahead of the class anyhow. Even if lecturers deny their role as in-front teacher a fully cooperative approach fails most of the time.

2.2. Little success: external guidance and assessment of self-study periods

Clear guidance of the weekly workload is necessary to give students a guideline of necessary learning items and transfer skills. However, even if announced early the formative assessment of the self-study period puts extra stress on students and is threatening to most of them because they are always insecure wether they studied the right content and amount. This extra pressure "brings them to work" but will lead to a disliking of subject, no inner understanding, lack of transfer skills in the long term.

2.3. Sufficient success: formative assessment after face-to-face or online time and clear routine during present time

The self-study routine and frequent testing has to be announced right from the beginning of the course. All grade-relevant activities need to be outlined and explained in detail to students ahead of the course and ahead of the destinct self-study period. It is highly advantageous to give students the learning objectives of each assignment and its arrangement in the entire course. Guiding questionnaires or questions for lectures, lecture videos, papers, etc. help students to stay focused. Clearly, the lecturer should encourage students to ask questions arousing during the assignments or self-study periods so that she/he receives difficulties from many students that may be solved in class. Students appreciate that they are able to distribute the workload according to their own schedule and learning styles.

The face-to-face time should follow a clear routine. Lecturers should always give feedback and and respond to questions in an appreciating manner, so that students may get used to the teaching method, adapt easily and loose timidity. Right from the beginning of the class or online-session students and lecturer get the picture of the class knowledge using questionnaires via class response systems such as: invote (https://invote.com/), kahoot (https://kahoot.com/), mentimeter(https://mentimeter.com/), etc. Answering questions is crucial after the self-study period. Also, important issues need to be explained individually – either by fellow students or by the lecturer. Soon students start to be less timid because they know, that this is their time to fill knowledge gaps without being judged or assessed always following the class rules. It is often advantageous when the lecturer keeps out of sight of the students and has two students moderate and take notes at the black board so that no question remains unanswered. Even break-out sessions in online courses are helpful because students collect questions, discuss answers and then contribute to the plenum. From experience students usually prepare questions well from the second inverted teaching scenario on. Therefore, it is helpful if the first topic covers introductions and explaines the teaching method while performing it.

Even in the pandemic semester of 2021 there were students who stated that the micro exams and graded activities throughout the semester forced them to work during the semester when they usually would not do this intrinsically motivated. Testing students after every inverted

classroom scenario cuts the workload into small pieces easier to handle for most of the students. Students are aware of the lecture objectives and their assessment (% of total grade), have enough time to adapt and organize their learning procedure and focus on the testing/questioning afterwards. Moreover, one failure does not effect the entire grade. However, formative assessment throughout the semester puts extra stress on some of the students and might hinder them to perform equally as they would in a final exam.

2.4. Sufficient success: extra assignments, templates and appreciation of work

Along with the homework assignment (Moodle online micro-lecture, memory sheets and voluntarily reading of a simple and short scientific research paper) one specific technical term has to be explained in a topic related glossary. This is commented and corrected by the lecturer during the self-study week of the homework assignment. Here, students were able to offer their learning progress and understanding and collect easy points adding to the total grade.

Again, class response systems and time for questions and answers give the lecturer an overview of the student`s knowledge and help students to assess their learning progress. Then students were divided into groups with 4-6 students each. As part of the inverted classroom scenario a special template had to be used to summarize the results (Figure 1) during face-to-face time or results were presented via a miro-board (https://miro.com/) or padlet (https://padlet.com/). Later these templates are used to gain class knowledge and provide short and correct learning material for every student.

To ensure nearly homogeneous working groups in terms of scientific background knowledge students who were not able to work properly at home were asked to form a separate group. The manner of announcing has to be very valueing so that unprepared students do not feel ashamed, excluded or even mobbed. The most successful route to address students is self-evident, e.g.: “Those who were not able to prepare sufficiently at home form group G. You will work on the problems from a different angle and enrich the other groups with new perspectives and fresh knowledge”. There has never been a problem with any students up to now. However, next time most of the students are prepared. Talking to students in these separate groups the most important incentive to study properly during self-study time is to later work with their peer-group and friends. Also, some did not like that their fellow classmates knew that they did not prepare. At the same time did not want to bother those who worked at home because they still wanted to contribute to the group assignments.

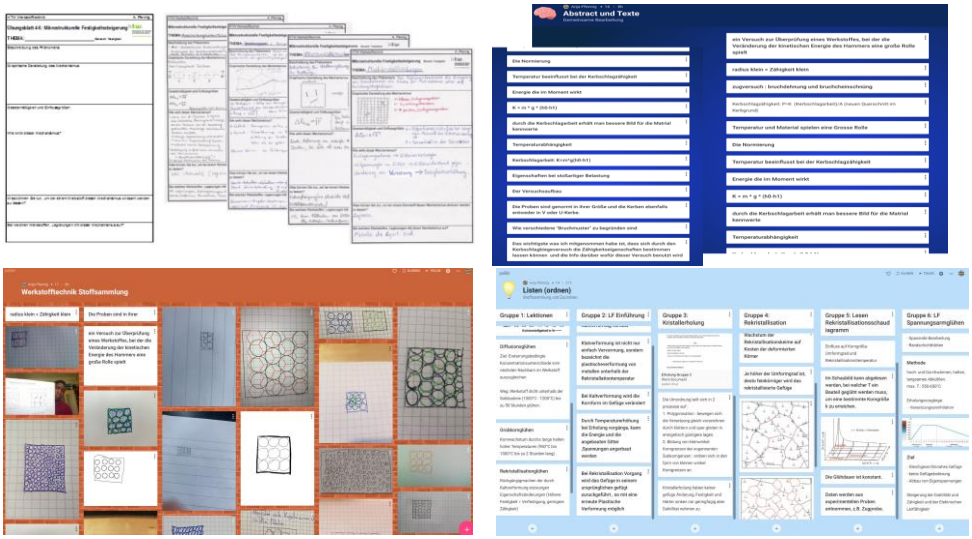


Figure 1. Securing learning outcome using templates during group work or break-out sessions and padlet/miro boards to visualize results.

The assignments in the "extra"-group is generally more basic and circumferencial with distinct focus on certain aspects depending how large the group was. Later these students were then intermixed with groups working on the hands-on problems.

During presentation of the results most of the time students volunteered to moderate who were part of the "unprepared" group before. The lecturer collaborates and cooperates with the presenting student groups. Formerly unprepared students in general contribute equally. Advantage of this class peer-review system is that students work indepentently on their summaries and learning basis for preparation of the micro-assessment. The lecturer only intervenes if there are scientific mistakes or insecurities and in the end approves the outcome. The revised templates and learning summaries are made available for all students. After the presentations usually more advanced micro projects were performed in groups of two students where usually all students – prepared and unprepared – performed equally well.

3. Evaluation of methods with sufficient success

Testing the following day proves sufficient understanding and delivered little diversity of prepared and unprepared students when considering high performing students. But, more of the unprepared students fail (Figure 2) because time and deep understanding seems to be crucial to perform well which may not be achieved in a four hour face-to-face or online session. As an example the overall grades of the covid 19 summer semester 2021 (Figure 2) are in alignment with other semester. However, the topic heat treatment is one of the most difficult topics of material science in the first semester and therefore grades are mediocre – especially in the

pandemic semester of 2020 and 2021. Note, that these practical experiences do not show summatively wether unprepared students are turned onto prepared other than feedback from collegues teaching advanced courses who confirm improvent during the last semester.

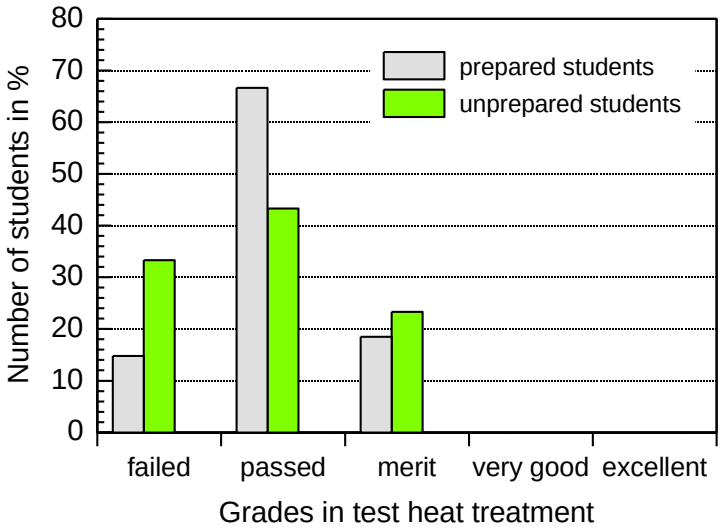


Figure 2. Example of typical results of compulsory online exam on hardening mechanisms SS2021 (chosen to demonstrate the performance of students in fully online semestes due to the Covid-19 pandemic)

Generally, students rate the self-study periods useful to get self-organized and learn complicated scientific issues according to their own independent time schedule and learning velocity (Figure 3). Self-study periods prepare well for class are not too difficult or enhance insecurity upon correctness of the study contents but are time consuming (Figure 3). There are many reasons for students to not prepare well for face-to-face time during assigned self-study periods such as: lack of self-efficiacy and attentiveness, inefficient learning habit, family to take care, lack of motivation and/or interest for the subject, missing of the connection to mechanical engineering, missing seriousness of studying, etc. No matter what reason, there will always be unprepared students who are hard to integrate and may spoil an entire face-to-face time –even a carefully planned course session. Pressure or exposure of those students is no solution at all because the embarassment normally disencourenges students and negatively influences their study motivation. However, even if intrinsic motivation of students remains the overall objective, formative assessment accompanied by clear and open advice and discussions is sufficiently successful to reach the desired learning outcome. The well prepared extra topic for unprepared students that are intermixed with the regular working groups later seems to be one of the best choices to deal with unprepared students. They study during class and contribute their newly gained knowledge to enrich the group work. Hence, mild pressure and special assignments along with forthrightness of the course structure and assessement as well as learning outcome seems

to be the best option – even if it requires more time to prepare these inverted classroom teaching scenarios. The author wants to note that these strategies also help prepared students but aim at integrating unprepared students into ongoing activities throughout the semester.

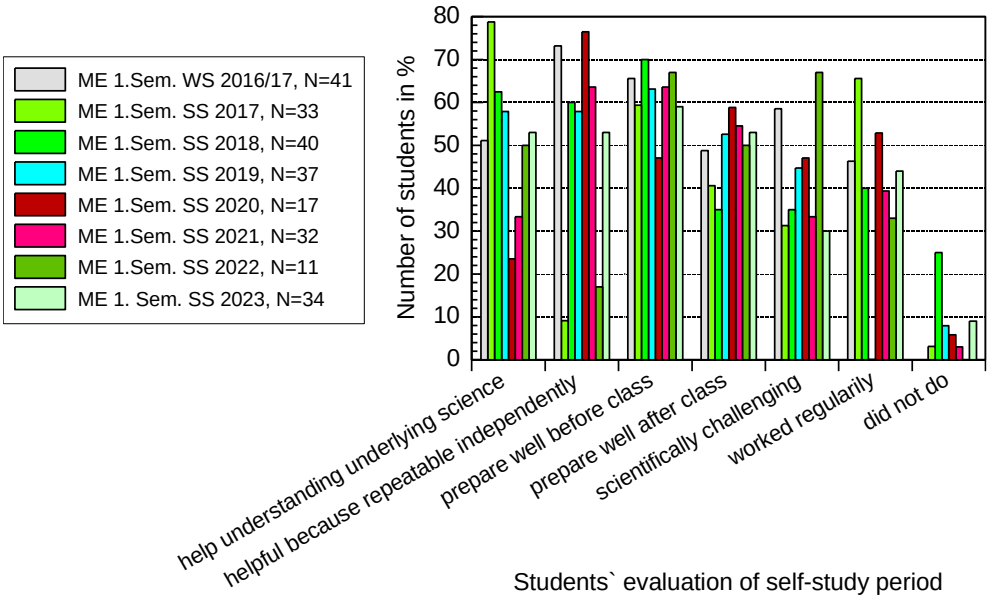


Figure 3. Students evaluation upon the self-study periods in inverted classroom teaching SS2016 to SS2023. Note, SS2020 and SS2021 were fully online semestes due to the Covid-19 pandemic.

4. Conclusion

Inverting the classroom challenges lecturers because unprepared students may spoil an entire face-to-face session leaving frustrated lecturers and even more important frustrated fellow students. This teaching method, however, offers a profound solution to achieve a more homogenous learning outcome with students individually choosing, combining and studying alone or in study groups during self-study periods. To meet the course learning outcome there are possibilities to deal with unprepared students besides relying on students` self-employment which is unsatisfying most of the times. External guidance and assessment of self-study periods (formative assessment) offers little success only addressing conscientious, ambitious and high-achieving students. Formative assessment and clear routines in class are a good approach to meet the desired learning outcome. However, the mild pressure of formative assessement and special assignments for unprepared students along with forthrightness of the course structure and assessement as well as learning outcome seems to be the best option – even if it requires more time to prepare these inverted classroom teaching scenarios.

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Rethinking language teaching for engineering students

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Abstract

In today's globalized world, foreign languages, particularly English, have become imperative for engineers. However, traditional language classes, even specialized technical classes, often lack the opportunity for students to practice and acquire the necessary linguistic skills for their professional lives. These skills include the ability to extract information from technical texts, communicate with co-workers of different native languages and varying competencies in the foreign language, and express technical concepts in an understandable way. Changing the approach of technical English classes to a more practical and hands-on method, while also providing tandem language learning tailored to the needs of engineers by pairing students from the same or related academic disciplines, has been shown to significantly improve students' writing and speaking abilities. Additionally, students feel more confident using the foreign language in a work environment.

Keywords: *foreign language education; engineering education; tandem language learning, technical English*

1. Introduction

In the rapidly evolving landscape of modern engineering, the ability to communicate effectively across borders and cultures has become an increasingly valuable skill for professionals. As the world becomes more interconnected, engineers are finding themselves collaborating on international projects, participating in global teams, and engaging with a diverse range of stakeholders. In this context, proficiency in foreign languages has emerged as a critical asset for engineers (Johri & Jesiek, 2014). Learning foreign languages and improving language skills have therefore become an important addition to subject-specific engineering courses at university.

Universities still predominantly prioritize traditional language classes as the primary method for imparting language skills to engineering students. These classes typically follow established curricula, emphasizing grammar, vocabulary, and general language proficiency. While these

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foundational language courses provide a structured approach to learning, there is a growing recognition of the need for more practical and context-specific language training including intercultural competences tailored to the demands of the engineering profession (Rus, 2020). The prevailing emphasis on regular language classes may not fully address the nuanced communication challenges that engineers encounter in a globalized work setting. As the engineering field continues to evolve and emphasize international collaboration, there is a growing call for innovative approaches, such as tandem language learning and specialized engineering communication courses, to complement traditional language education and better prepare students for the complexities of cross-cultural communication in their future professional endeavors. In response to this need, a language teaching concept has been developed to cater to the needs and interests of students. This approach integrates traditional language teaching methods with innovative approaches, resulting in a significant improvement in participants' linguistic proficiency in both written and spoken communication.

2. Problem statement: current situation and challenges

Engineering students, aspiring to thrive in a globalized industry, must recognize the importance of linguistic competence, especially in English. Beyond the technical aspects of their discipline, the ability to articulate ideas, convey technical concepts, and understand diverse perspectives in a foreign language can significantly enhance an engineer's effectiveness and career prospects. In addition to English, any further language will make it easier for them to collaborate on an international stage.

In a globalized work setting, engineers face significant challenges. English is often used as the predominant language for international communication, serving as a lingua franca. While this facilitates collaboration among professionals from diverse linguistic backgrounds, it also presents the challenge of effective communication. This pertains to situations where non-native speakers are the majority or where there is communication between native and non-native speakers, resulting in an imbalance. Technical discussions and the expression of complex engineering concepts may be challenging for those who are not fully proficient in English, which can lead to misunderstandings or misinterpretations. The differing linguistic abilities of communication partners can be a significant obstacle. Engineers frequently interact with colleagues, clients, and stakeholders who have varying levels of proficiency in the common language, whether it is English or another lingua franca. This diversity in linguistic skills can affect the clarity and efficiency of communication, requiring engineers to adapt their communication styles, use simpler language when necessary, and employ effective strategies to ensure that technical information is accurately conveyed. In today's globalized work environment, successful collaboration and project outcomes depend on bridging the gap between individuals with different linguistic capabilities.

Traditionally, language education has followed a structured approach primarily centered around classroom instruction. Students engage in language classes where they are exposed to grammatical rules, vocabulary, and can practice listening comprehension and speaking only in a restricted manner. These classes typically involve a combination of lectures, textbooks, written exercises, and oral assessments. The emphasis is often placed on foundational elements such as pronunciation, grammar, and syntax. Additionally, traditional language teaching often incorporates cultural elements to provide students with a broader understanding of the language context, but intercultural communication is missing. While these methods have been the bedrock of language education for decades (Ur, 2013), there is a growing recognition of the need for more dynamic, authentic and practical approaches (Renau Renau, 2016; Spänkuch, Dittmann et al. 2019; Ur, 2013), particularly in professional fields like engineering, where precise communication skills and context-specific language use are crucial.

A major weakness of traditional language classes is the time allocated to each student for speaking exercises, a skill that is particularly important for future engineers (Salzinger, Schiffmann et al. 2022). To them, mastering the language to near perfection is less important than finding ways to express themselves successfully in a professional setting and adapting their language skills to the given situation. They need to be able to break down and express complex aspects in easy language, deploying the language skills they have, while adapting to their conversation partner. To cultivate a strong linguistic foundation, a combination of structured language classes with an additional focus on subject-specific discussions and problem-solving, and tandem language learning is considered ideal. Traditional language classes provide essential grammar, vocabulary, and foundational skills. However, tandem language learning, which involves pairing individuals with different native languages to practice conversational skills, offers a practical and immersive experience that cannot be replicated in a classroom setting alone. In addition, both partners will acquire much more intercultural competencies in direct interaction with a native speaker of their target language.

3. Revised approach

Although the university provides general foreign language courses in various languages, the Department of Civil and Environmental Engineering at the Ruhr-Universität Bochum, Germany offers two specialized courses in technical English for civil engineering to overcome the above-mentioned problems of traditional foreign language teaching. Each course consists of four hours of instruction, two of which are conducted asynchronously on Moodle. This allows for individualized grammar review, reading comprehension, writing exercises and practice at the student's own pace and to the necessary extent online. The time in class can be used to focus on relevant tasks that will occur in a professional setting, limiting grammar exercises to the most frequent problems. Technical English I (TE I) emphasizes reading subject-specific texts, extracting crucial information, and discussing the content. The required language level is

approximately B1. The texts serve as a basis for discussions in which students can apply their engineering knowledge to the foreign language. The primary objective is to help students feel confident discussing topics for which they may lack vocabulary. For further support, pro/con discussions are introduced, where students defend their own point of view and attempt to convince others of their position. Additionally, language games such as Taboo, which utilize engineering-related vocabulary, are played. Finally, towards the end of the semester, students participate in role plays where they embody different individuals working on a construction site. Students are presented with realistic problem scenarios that they must solve using the vocabulary they have acquired through the texts and language games, as well as the discussion skills gained from pro/con discussions. The class concludes with a written test covering grammar, translations, and a short, written discussion.

Technical English II (TE II) provides students with advanced and less guided discussions and role plays, along with an introduction to academic work in English. The required level at the beginning is B2. The course aims to equip students with the skills required to communicate effectively in academic and professional settings. The first half of the semester is dedicated to work-related discussions, including for example the evaluation of various materials, their strengths and weaknesses, and their suitability for constructing different structures with consideration for sustainability. Since the class is open to all engineering student regardless of their native tongue, this also allows them to interact with speakers from different cultural and linguistic backgrounds and different competencies in the language. The latter half of the course focuses on developing writing and presentation skills, which are demonstrated at the end by presenting group projects that the students have been working on throughout the semester. The project must be written in the form of a scientific paper afterward.

In addition to language classes, a STEM-specific tandem program is offered that pairs STEM students (Science, Technology, Engineering, and Mathematics) who want to improve their language skills. In a language tandem, two students are paired to help each other improve in their respective languages. They learn the language of their partner and provide assistance in return. Tandem.MINT is a unique program aimed only at STEM students because they often have different needs and interests when learning a language (Salzinger et al., 2022). STEM disciplines, which are often characterized by technical complexity and specialized terminology, benefit from a tandem system. In this setting, STEM students can leverage their shared expertise to delve into subject-specific language challenges and enhance their communication skills in a context directly relevant to their field. The tandem approach enables the examination of technical terminology, scientific discourse, and engineering communication techniques in a cooperative and pragmatic manner. This not only facilitates language acquisition but also promotes interdisciplinary and intercultural collaboration, preparing STEM students for effective communication in diverse and globalized professional settings. To receive credit points for the tandem program, students are required to compile a portfolio that served as a basis for

evaluating their grammar and writing skills. At the outset, the students need to put their overall tandem goal in writing and continuously reflect on their progress by writing detailed reflections of representative sessions throughout the semester.

4. Methodology

To observe and evaluate improvements, all writing assignments from the classes and the tandem, grammar tests and audio reflections were collected and reviewed. In addition, a self-assessment and an assessment of the tandem partner were conducted before and after the tandem program and analyzed.

The Technical English classes typically have around 30 participants, while the tandem program has been steadily growing and now has between 34 to 44 participants per semester. The tandem is open to all language combinations, but the main focus in this study has been on German-English pairs, with an emphasis on German speaking students who are eligible for the English classes. The English classes have only been offered within the last three terms, so only seven students have participated and completed all three components while three more have completed TE I and are participating in the tandem at the moment. However, the tandem program has been in place for five years already with increasing participation (Fig.1). Therefore, all written components and assessments have been considered since the winter term of 2020/21 for English, providing us with data from 64 German students who are learning English, seven of which could be evaluated in more detail based on their class assignments, test, and scientific paper.

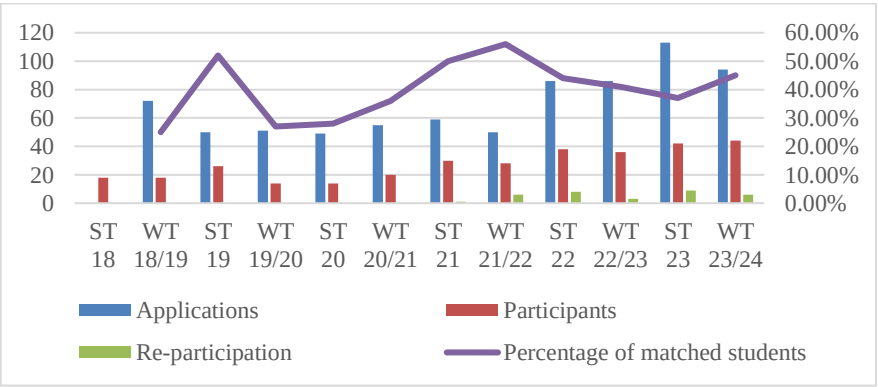


Figure 1: Tandem applications and participation

5. Findings and Discussion

According to the students' self-evaluation, they have improved in their desired area of written or spoken communication (fig. 3). Upon analysis of their written texts, work samples, reflections, and their written tests (fig. 2), this claim is supported by evidence: their texts contain

fewer errors, more complex sentences, and a wider range of vocabulary. The initial general paraphrasing of subject-specific aspects has been replaced with specific technical vocabulary, resulting in a more precise expression of scientific and technical contexts. Our American partner university requires oral presentations, which provide us with a good opportunity to observe oral competencies and improvements. The students' pronunciation, fluency, and accuracy showed significant improvement, which was corroborated by their German tandem partners (fig. 4). The students spoke more clearly, their accent became less pronounced, and they hesitated and corrected themselves less frequently than in the beginning.

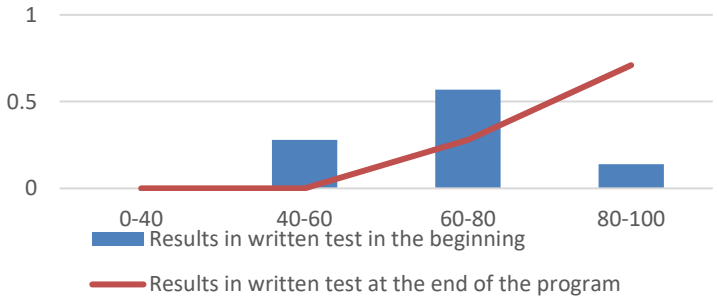


Figure 2: Improvement in written tests

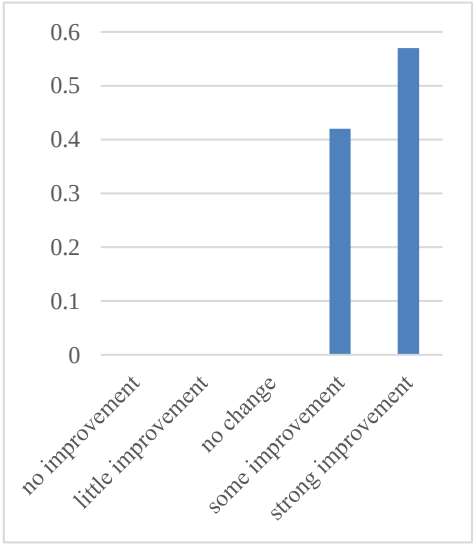


Figure 3: Self-assessment

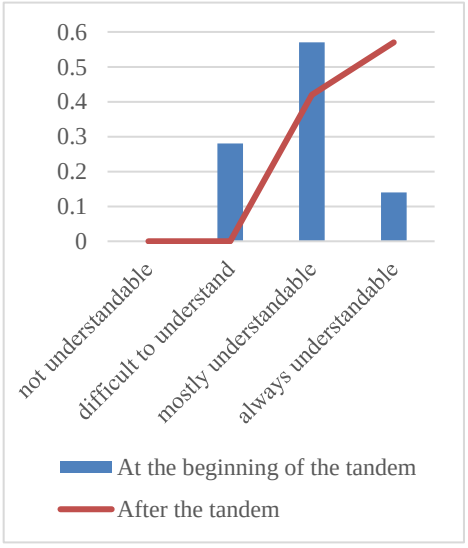


Figure 4: Assessment by the tandem partner

Students in class as well as in the tandem also confirmed that they feel more comfortable and confident speaking. But particularly in the tandem, students said that it helped immensely that they could practice speaking in such an intimate frame. Many of them expressed their fear of speaking beforehand, claiming that they were afraid of making mistakes and not being able to express technical concepts. Because both partners were in the same situation, having to use a foreign language to communicate, it becomes easier to overcome inhibitions. All students confirmed that even without always knowing and finding the exact terminology, they felt able to express what they wanted to communicate.

6. Conclusion

The imperative for engineers to speak foreign languages is undeniable in today's globalized engineering landscape. Recognizing this need, engineering education should encompass not only technical proficiency but also a commitment to linguistic diversity. The integration of language classes that follow a more hands-on method in combination with tandem language learning provides a comprehensive approach to language acquisition, preparing engineering students to navigate the complexities of international collaboration and contribute meaningfully to the global engineering community. The emphasis on discussions, role plays, and real-world problem-solving scenarios in both Technical English I and II not only enhances language skills but also builds the confidence of students to communicate effectively in engineering-related contexts. The mixture of the class with students from different language background like Arabic, Chinese, Vietnamese, Indian languages, and German prepares them for real life working situations where they are more likely to work with other non-native speakers using English as a lingua franca than actually speaking to English native speakers. The additional possibility of the tandem to practice in a one-on-one situation with a native speaker of English further contributes to their confidence in speaking, but also allows them to gain intercultural competences.

In conclusion, it can be said that in contrast to the more conventional classroom-based learning, these specialized programs offer a dynamic and hands-on approach that aligns more closely with the language needs and interests of STEM students, ultimately better preparing them for success in their future careers.

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Back to the Basics: Balancing Technology and Traditional Teaching Methods in Higher Education Classrooms

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Abstract

While much research has been dedicated to the opportunities and impacts of online learning since the COVID-19 pandemic, there is a lack of research about the learning and teaching preferences of students with regard to technology in the classroom post-pandemic. This exploratory study sought to fill this gap in research and better understand both the advantages and disadvantages of technological tools in the classroom, as well as the preferences of university students in teaching and learning methods. To fulfill the purposes of this study, researchers conducted a short, exploratory survey using a Likert scale among university students in the Western United States. Results indicated that while students have grown accustomed to digital learning elements in the classroom, they appreciate opportunities to interact with students and professors in meaningful face-to-face activities.

Keywords: *Digital learning, face-to-face learning, Likert-scale, COVID-19*

1. Introduction

The adaptation of technology in the classroom has changed and influenced education and learning throughout the world (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2023). Additionally, the COVID-19 pandemic changed the ways classrooms operate and how students are taught throughout all stages of education, presenting new opportunities, as well as challenges (Aguilera-Hermida, 2020; Leo et al., 2021; Rapanta et al., 2021). As the world is adjusting to a "new normal" in the years following the COVID-19 pandemic, institutes of higher education are finding new ways to include technology and improve online learning in classes (Crawford, 2023). However, with so much technology being implemented in classrooms, and online meetings replacing in-person classes, many students are missing opportunities to connect with and learn from professors and fellow students (UNESCO, 2023).

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While much research has been dedicated to the opportunities and impacts of online learning since the COVID-19 pandemic (Aguilera-Hermida, 2020; Leo et al., 2021; Rapanta et al., 2021), there is a lack of research on the learning and teaching preferences of students with regards to technology in the classroom. This study seeks to fill this gap in research and better understand both the advantages and disadvantages of technological tools in the classroom, as well as the preferences of university students in teaching and learning methods.

2. Literature Review

2.1 Technology and Higher Education

Universities throughout history have sought to implement the newest technologies in the classroom to enhance learning (Guan, 2020; Muñoz, 2022). The COVID-19 pandemic shifted many university students from an in-person, immersive learning experience to online, video-call-styled lectures almost overnight (Crawford, 2023), thus leading to a fully digital learning experience. In the years following the pandemic, universities are seeking ways to incorporate both technology and face-to-face experiences (Rapanta, 2021). Many college students use technology to take notes, use online search engines to clarify questions related to the course material, or even to study through online review games (Flanigan et al., 2023). With the introduction of more accessible artificial intelligence (AI) tools, universities are quickly trying to make adaptations to how digital learning is balanced within the classroom, all while the potential benefits and disadvantages of AI are still unclear in many ways (Holmes & Tuomi, 2022).

Despite the benefits that may come from using technology and personal mobile devices in the classroom, it can also become a serious distraction to students (Flanigan, 2023). Fasoli (2021) asserts that many individuals experience digital overuse, which affects digital well-being (Dennis, 2021). While technological tools can aid in the learning experience, there exists a "fundamental social and human dimension that lies at the heart of education" (UNESCO, 2023, p. vii). Previous research has shown that students who participate in online, distance learning are less effective at developing relationships of trust with both teachers and students (Wang, 2023).

2.2 Traditional Practices

While technological advances aided many university professors and students during the COVID-19 era, a study conducted by Gherhes et al (2021) showed that more than half of the students surveyed wanted to return to face-to-face learning by the end of the pandemic. Research on traditional pedagogical practices has shown that face-to-face interaction leads to more successful cooperative learning (Kristiansen, 2019) and is more motivating to students than

online learning situations (Aguilera-Hermida, 2020). Using mobile technology for non-class purposes has become common among college students, negatively impacting students' learning and performance (Flanigan et al., 2023). To foster stronger social, face-to-face connections within the classroom, researchers strongly encourage institutions of higher education to begin returning to more traditional teaching methods, while still incorporating the best of the online and technological learning practices that were established during the pandemic (Flanigan, 2023; Leo et al., 2021). However, little research has been conducted seeking to understand better what students' preferences are with regard to what specific technological tools are used to aid in the face-to-face learning environment.

With this gap in mind, the following research question is presented:

RQ 1: What are students' preferences when it comes to balancing technology and traditional learning methods in a university classroom?

3. Method

To fulfill the purposes of this study, researchers conducted a short, exploratory survey among students attending a university in the Western United States. Students who participated were from an Introduction to Communications class. In total 168 students participated in the survey. The survey consisted of a five-question Likert-type scale designed to differentiate between student feelings of online/digital vs. face-to-face class interactions. The survey included questions such as, "I feel easily bored when a professor uses videos or lectures with a PowerPoint presentation the whole class time", or "I prefer participating in digital activities (such as watching videos, Kahoot, PowerPoint presentations, etc.) in class." Students were asked to complete the survey, using a Likert scale to rate to what degree they agreed or disagreed with statements related to the research question. The Likert scale is a method of quantification commonly used in social sciences research to measure survey responses (Anjaria, 2022).

4. Results

There were two main results that emerged from the data. First, the results of this study indicated that the vast majority of university students enjoy face-to-face activities that are integrated into classroom settings. About 156, or 93%, of students reported agreement with the phrase "I prefer participating in face-to-face and group activities in class."

Second, in addition to enjoying face-to-face activities, many students also appreciated when digital elements were incorporated into lessons. 89% of students (about 151 individuals) agreed with the phrase "I prefer participating in digital activities (such as watching videos, playing Kahoot, PowerPoint presentations, etc.) in class." Even though students in this category did enjoy digital elements, it appears that there is a point at which it becomes too much for students.

About 63% of students (106) agreed that they felt easily bored when a professor used videos or lectured with a slideshow the whole time. This indicates that while students want digital elements incorporated into their lessons, they hope for a balanced mix of digital and more face-to-face to keep them engaged.

5. Discussion

The results of this study indicate that while students have come to accept both face-to-face activities and digital activities, students are willing and interested in participating in face-to-face and group activities, more so than what many university professors may realize. As was discussed in the literature review, many universities are returning to fully operating, in-person classes in the months and years following the pandemic and seeking to balance the technological skills gained during COVID, along with the traditional learning and teaching methods utilized pre-COVID (Rapanta, 2021). In addition to this shift, new technologies such as AI are widening the opportunities and possibilities available in the world of education (Holmes & Tuomi, 2022). While these technological advances are exciting and can elevate the educational experience, professors should recognize the needs and preferences of their students when seeking to find a balance between traditional and digital practices. As shown in the results of this study, students are accustomed to technology having a place in the classroom, however, they strongly desire to connect with fellow students and professors through group activities, partner work, and other face-to-face projects and mentoring.

6. Conclusion

The purpose of this study was to better understand students' preferences when it comes to balancing technology and traditional learning methods in a university classroom. While this study has the potential to inform educators about the types of in-class activities that university students prefer, some limitations exist. First, as this study was exploratory in nature, it only began to understand the preferences of students, and future research should increase the depth of these findings, especially through qualitative research methods. As all participants came from the same university and were generally in the same stage of higher education (as they were in introductory courses), different results may come through a wider age and experience range of participants. Future research may also consider studying students' preferences and beliefs about specific technological tools, such as artificial intelligence, as this study did not necessarily name specific digital tools or traditional learning practices.

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The impact of using formative assessment in introductory programming on teaching and learning

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Abstract

This study offers an efficient formative assessment strategy that may be used to encourage learning and improve students programming comprehension. In addition to traditional teaching sessions, the strategy offers a series of formative assessment quizzes on fundamental programming, utilising an adaptive model for program comprehension as a learning technique. A non-adaptive and an adaptive assessment, both based on multiple-choice questions, are provided to students enrolled in the 2023 introductory programming course. This study investigated how effectively these assessments assisted students in understanding, learning, and developing a sense of their proficiency in computer programming by introducing common programming errors. We gathered data from a survey that 218 students completed at the end of each quiz. Findings from student surveys and observational techniques show that employing adaptive technique was more likely to motivate students and increase their self-confidence. The results also show that formative assessment can be used to support learning programming in addition to classroom instruction to help students grasp key concepts.

Keywords: *Assessment and feedback; Computer programming; Formative assessment; Introductory programming; Learning method; Novice students.*

1. Introduction

A crucial component of learning is assessment, and a good assessment can make sure that students profit from and like taking tests. A programming assessment will, from the viewpoint of the instructor, promote the acquisition and implementation of all required programming skills. However, some students may view the same assignment as requiring them to write code that provides the "correct" response. Students must simultaneously learn more frequent errors and approaches to solve them. Formative assessment is a useful methodology for enhancing learning outcomes and providing learning motivation (Louhab et al., 2018). The student's program submissions are evaluated and delivered immediate feedback by an automated

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formative assessment system or manual assessor. Two characteristics were deemed crucial while intending to develop formative assessments. For error messages can be properly understood, feedback needs to be quick and detailed (Louhab et al., 2018) . Second, students must be given the chance to discover their mistakes after making several attempts on different questions. Due to the nature of these elements, it is necessary to create a quiz large enough so that students may repeat assessments without encountering the same questions twice. This study presents how effectively these assessments assisted students in understanding, learning, and developing a sense of their proficiency in computer programming.

This study investigates the formative assessment for introductory programming in higher education and proposes a framework for its customization and enhancement to fulfill this purpose. Our goal with this framework is to help novices who want to develop a variety of advanced applied programming skills by offering them helpful feedback and resources. While considering the limitations of automatic assessment, this framework emphasizes the importance of achieving comparable difficulty for questions and maximizes the potential for randomization for exercise tasks. This helps to create meaningful feedback for students and supports their learning process.

2. Development of formative assessment for introductory programming

A formative assessment tool might help students feel less anxious about giving incorrect answers by providing feedback on how to improve their work. An answer key and a few choices make up the two components of a multiple-choice question (MCQ) (Henriques Abreu et al., 2018). A query or a remark is typically made by the stem. A stem states the questions with a few potential solutions, including a key that provides the best response, and a few distractions that offer logical but incorrect responses. To proceed with the stem, the learner must choose the best or most accurate option. MCQs are insufficient for evaluating a student's coding proficiency in programming modules since they do not encourage learners to write their own code, even when they are at an advanced level. The ability to retain programming concepts and increase engagement, however, can be useful. This study has led us to create MCQ quizzes that are an excellent method to increase student engagement and help them remember the programming content (Ross et al., 2018). We have created formative assessment quizzes to introduce common programming errors. We have a list of questions with various answers in these quizzes. As they offer feedback for each selection, these quizzes assist in fostering their learning. While the wrong answer feedback helps them locate the appropriate response, the right answer feedback acknowledges their responses. Students can learn from their incorrect responses and determine the correct response. As a result, it is a system that progresses and aids in their ability to learn from mistakes. This study examines if the formative assessment increases participants' confidence in their capacity to understand the fundamental ideas behind

programming. They assist students in comprehending the common code errors they make as well as compiler error messages.

2.1. Quiz implementation

'Google Forms' is utilized to implement the quizzes as it can be an effective tool for formative assessment and for promoting active learning (Djenno et al., 2015). Each quiz aims to educate students about common code errors they made when studying the assigned topics (Ahadi et al., 2018). Feedback will be given to students for each potential response, which will help them better comprehend the errors and help them to understand easily. Feedback is customized messages that are like enhanced error messages (Becker et al., 2016). Every incorrect reaction offers advice on how to respond. Students can make the best alternative based on the feedback. These assessments are presently being examined in two distinct models: non-adaptive and adaptive.

2.1.1. Non-adaptive model

In a non-adaptive model, students receive feedback for each response regardless of whether it is correct or incorrect. This feedback allows students to learn from their mistakes and help them comprehend what the correct response is. However, they cannot return to correctly answering the same or similar questions.

2.1.2. Adaptive model

With adaptive model, the questions are redirected to match the student's present proficiency level and ongoing advancement (Ross et al., 2018). Repetition of questions until the answer is correct or the level of knowledge is reached is known as adaptive assessment. The knowledge level of the learners increased by varying the order of the assessment questions in adaptive approach (Heitmann et al., 2018). Difficulty levels have been added to learning objects in the next model. These things could be topics, questions, and a variety of errors. The goals relate to questions with varying degrees of difficulty. Difficulties in programming are classified as Bloom's taxonomy of programming (Thompson et al., 2008). In this model, we classified a list of questions in three cognitive levels based on the complexity (like easy, moderate, and difficult) (Louhab et al., 2018). Here easy questions assess the basic concepts, moderate questions assess comprehensive knowledge and difficult questions do the applications of the knowledge (Vie et al., 2017). If a student successfully responds to a moderate question on this assessment, the subsequent question is hard. If not, the easy questions will be. It goes on until the system forecasts the competency level of the students (Simon-Campbell & Phelan, 2018). A sample classification of a question is described as Table 1.

Table 1. Summary of 'print' statement question in adaptive model

Difficulty low	Difficulty moderate	Difficulty high	Summary
var = 'Amazon' print(var[4])	var = 'computer' print(var[5 :: 1])	var = 'Ireland' print(var[4 :: -1])	var = 'James Bond' print(var) print(var[3]) print(var[5 :: 1]) print(var[5 :: -1])

2.2. Research questions

Using the formative assessment quizzes, this study will particularly investigate the following research questions.

RQ-1: Does formative assessment help to build self-confidence in novice programmers in learning basic concepts of programming?

RQ-2: Does formative assessment support the ability of novices to understand and correct errors and encourage them to improve their programming skills?

RQ-3: Does formative assessment help novices effectively learn the modular parts of programming concepts?

3. Research method and data collection

3.1. Methodological paradigm

This research is using a mixed method approach (Mertens, 2019). An online survey was used in this study to gather data that was both quantitative and qualitative. This approach works well with a combination of qualitative and quantitative techniques. In this study, we use quantitative intervention to evaluate validity and reliability of formative assessment quizzes. A brief, optional, anonymous survey was employed to gain more insight into how students perceived and experienced formative self-assessment. It also includes qualitative elements and makes use of a range of data sources and data collection methods.

3.2. Research design

To answer the research questions, this research developed a set of quizzes for basic topics of introduction to programming. Due to its convenience and syntactical simplicity, Python is a popular programming language used in introductory programming classes (Johnson et al., 2020). Python is the language used for instruction, and topics covered include variables, operators, conditionals, loops, and a few concepts related to functions. We conducted these

quizzes periodically during teaching sessions to build novice's confidence as well as to capture their barriers in programming. At the end of each quiz, we conducted a survey about how it effectively helped them to learn programming. The respondents were questioned about how they felt about formative assessment quizzes of each programming topic. Open-ended questions for qualitative data and closed-ended 'Likert' scale questions for quantitative data were both used in the survey form.

3.3. Data collection strategies

Data collection is the methodical process of gathering information from relevant sources in order to address research questions, test hypotheses, and achieve the project's objectives (Kabir, 2016). Regular quizzes were offered during the study periods as an option. This facilitated students considering what they learned through taking the quizzes. The data includes 218 students' programming quiz attempts that they turned in at the end of each quiz session. In proportion to the number of quiz attempts, some students attempted numerous surveys. The data presented here is both quantitative and qualitative in traits, covering a two-semester span (2022–2023) (n=115, n=103) from each model. Student surveys provide quantitative data. The student questionnaires and their reflective writing assignments provide qualitative data. Every piece of qualitative data is anonymous.

4. Results

4.1. RQ1 – Increasing self-confidence.

This study asked, "Does this quiz increase your self-confidence in learning programming?", at the end of the quizzes to answer RQ-1. The responses ranged from 'Strongly disagree' to 'Strongly agree'. Figure 1 offers a thorough understanding of the students' feelings regarding their level of self-confidence in handling these quizzes. Responses for 'Strongly agree' and 'Agree' were higher than 'Disagree'. Consequently, this study discovered that these formative assessment quizzes helped them increase their self-confidence.

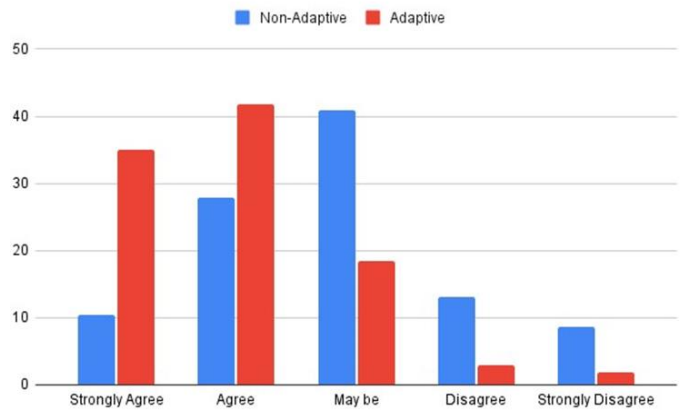


Figure 1. Students' feedback on self-confidence

4.2. RQ2 – Understand and correct the errors.

To answer the RQ-2, it included another 'Likert' question, "Do these quizzes help to understand and correct the errors?". The responses ranged from 'Strongly disagree' to 'Strongly agree'. Using a chart, the outcome is shown in Figure 2. High responses were submitted as 'Strongly agree' and 'Agree'. It highlights how these quizzes make it easier to learn common programming errors. These outcomes show that the self-assessment quizzes aided in their understanding of the frequent errors of programming.

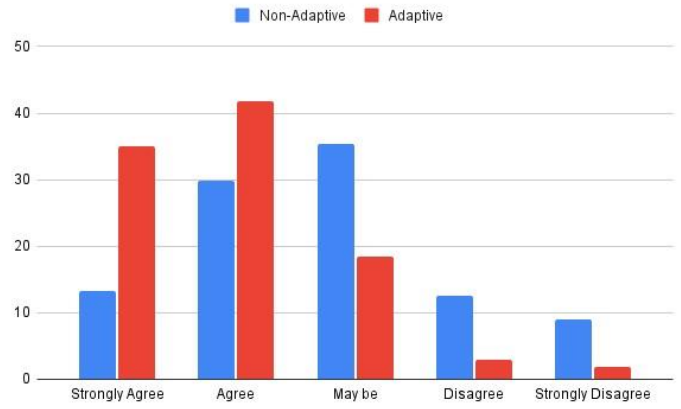


Figure 2. Students' feedback on understanding errors

4.3. RQ3 – Learning tool

To answer the RQ-3, it included another 'Likert' question, "Do these questions help to understand basic concepts of Python language?", at the end of the quizzes. The responses were 'Yes', 'May be' and 'No'. Figure 3 offers a thorough understanding of the students' feelings regarding these quizzes, help in understanding basic concepts. Overall, there were more responses for 'Yes' than 'No'. Quantitative data alone does not provide the full picture of the learning experience. Finding out what students think and feel about formative assessment as a computer programming learning activity is critical. They delighted in gaining knowledge by taking quizzes in various models. As stated in the comments below, they also valued these quizzes as a learning tool for various reasons.

> *...It helped to recall...introduced me to new elements of python...made me realize what I didn't know...was good to refresh my brain...very helpful exercises...I think they are much better than the way the lectures are being taught...Maybe do the quizzes in the lectures to fully understand what is being taught…*

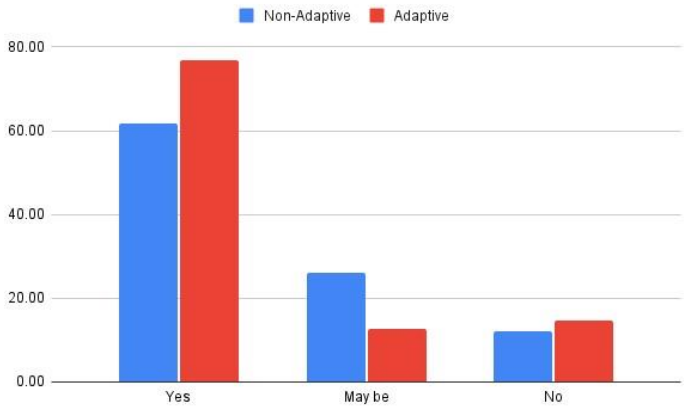


Figure 3. Students' responses on learning the Python basics.

5. Discussion

We plot the outcome charts in Figure 1, 2 & 3 that indicate the influence on self-confidence, comprehension of errors and supporting learning to analyze the impact of the adaptive technique. Based on the surveys' responses, it demonstrates that the students firmly believe the quizzes assisted in grasping fundamental programming principles. Figure 1 depicts a comparison of levels of self-confidence. Students' confidence in learning programming is reportedly much increased by the adaptive model quizzes. The adaptive model was far more helpful than the others as shown in Figure 2. It also demonstrates that adaptive assessments

helped them understand and correct errors better than non-adaptive ones. Additionally, students firmly felt that adaptive assessments increased their confidence relative to non-adaptive. Adaptive model maintains its lead in each quiz. In a conclusion, we argue that formative assessment quizzes motivate students to evaluate and learn from their mistakes, which in turn encourages them to learn computer programming. As they can effectively aid in the learning of programming, as a result, learning opportunities have expanded, increasing students' confidence, and understanding the frequent errors. This research demonstrates that adaptive quizzes help engage and motivate novice programming students, thus improving their programming comprehension. Future work involves a further iteration of adaptive model quiz to include closer alignment with the curriculum teaching. We will also concentrate efforts on deeper analysis of qualitative data.

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Where to go and why? Motivational factors in the choice of higher education institutions: the example of a university in Central Eastern Europe

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Abstract

The aim of our study is to examine the factors that influence the choice of higher education institutions (HEIs). To this end, we have explored the evolution and current challenges of marketing in higher education. By conducting an empirical survey of students (n=2330) admitted in 2023 at a Central-Eastern European university, we identified the factors that influenced students' decision to apply. The initial 19 variables, then 15 variables included in the factor analysis, eventually resulted in four factors, which are "education and reputation", "dormitory and services", "opinion of others" and "city". The factors and factor weights were used to identify the strategically important factors that can help HEIs to achieve a more effective market presence and, accordingly, more precise targeting.

Keywords: *HEI, factors, marketing in higher education, decision to apply*

1. Introduction

Nowadays, the term "enrolment marketing" or "higher education marketing" is increasingly used. The admission process itself is the result of a lengthy decision-making process, thanks to the diversity and variety of factors involved. The topicality of the subject is demonstrated by the fact that every year there is increasing competition to attract students, while at the same time there are many over-applications for the most popular courses. Accordingly, the aim of the present study is to examine higher education marketing in general, its challenges and to verify the motivational factors through a survey of students at a Western-Hungarian institution. First, the rationale for marketing in higher education is presented, followed by the challenges facing current institutions. Thereafter a discussion of the factors that influence the decision is presented. These factors are tested by the empirical research that is the focus of this paper. To highlight the novelty and importance of our research in terms of empirical evidence; by

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conducting a survey of 2330 students admitted in 2023, our study provides empirical evidence specific to the Central-Eastern European context. This localised data enriches the existing literature. In terms of methods the reduction from 19 initial variables to 4 key factors - namely "education and reputation", "dormitory and services", "opinion of others" and "city" - is novel. This streamlined approach allows universities to focus on the critical issues. In terms of strategic implications, our study goes beyond simply identifying factors. It strategically prioritises these factors, enabling institutions to allocate resources effectively. About the contextual relevance the study's focus on Central and Eastern Europe recognises the unique challenges and opportunities faced by HEIs in this region. It fills the gap in understanding localised decision-making dynamics. This research makes both methodological and practical contributions to assist HEIs in their pursuit of effective marketing strategies and competitive positioning.

2. The evolution of marketing in higher education

In the literature section, we highlight the main status of higher education, then the marketing orientation, followed by the evaluation criteria of the institutions. In today's environment, both businesses and higher education institutions face intense competition fueled by globalization. This competition transcends geographic boundaries and includes not only regional and national competitors, but also foreign institutions. As universities vie for prominence, understanding the fundamentals of competition becomes paramount. These foundations, which can influence student choice and market dynamics, often revolve around educational and research standards (de Haan, 2015). Identifying these critical factors is essential in the current competitive environment. Accreditation standards serve as a valuable lens through which to evaluate common focal points that warrant attention. By comparing these standards, institutions gain insight into areas that require improvement and alignment (Reddy et al., 2023). At the same time, the evolution of higher education institutions remains a pressing concern. Researchers such as Ayhan-Özdemir (2023), Cheng et al. (2023), and Olanya et al. (2023) examine the functions, operations, and efficiency of universities. Notably, the convergence of higher education and marketing theory has occurred in recent years, merging these two fields. To understand the metamorphosis of universities, we need to explore their unique characteristics. Four distinct university generations emerge from this exploration (Piskóti – Morva, 2022), like (1) first-generation, or mid-century, universities: Pioneers in education, these institutions laid the groundwork for subsequent generations. The second-generation universities (2): These institutions adapted to changing times by emphasizing research and specialization. Market-oriented universities (3): Focused on practical applications, they responded to the needs of industry. Society-oriented universities (4): Committed to societal impact, they address pressing global challenges. Currently, developed universities are gravitating toward the latter two models. However, their transformation remains a work in progress. The shift toward third-generation universities-most evident in Western European and North American contexts-

reflects efforts to modernize operations in the face of dwindling public funding and rising student enrollments. These phenomena are forcing universities to explore alternative funding sources and adapt strategically to thrive in a constantly evolving educational landscape. (Simai, 2018)

2.1. Challenges in higher education marketing

Universities must navigate a complex landscape of external and internal factors to maintain a competitive market position (Figure 1).

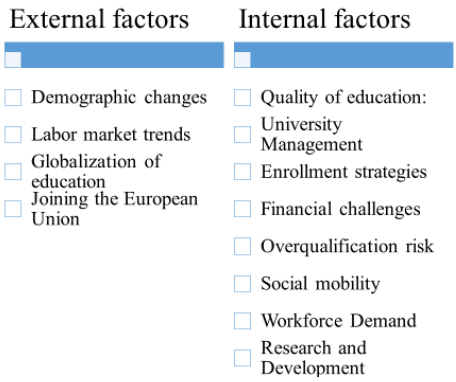


Figure 1. Challenges in higher education. Source: Own compilation.

In terms of external factors, demographic changes such as shifting population dynamics affect student enrolments. Institutions need to adapt to changing age groups, birth rates and migration patterns. In terms of labour market trends, aligning academic programmes with market needs ensures that graduates have relevant skills. Anticipating industry shifts is crucial. In the context of the globalisation of education, internationalisation drives student mobility. Universities compete globally for diverse student populations (Minor, 2023). In terms of joining the European Union, EU membership facilitates student exchange programmes but also increases competition between institutions. In terms of internal factors, the quality of education - maintaining high standards - attracts students. The quality of teaching, research and infrastructure is essential. In terms of university management, effective governance, resource allocation and strategic planning are essential. Effective management enhances competitiveness. In terms of enrolment strategies, targeted marketing, outreach and retention efforts are critical. Attracting the right audience ensures sustainable growth. In terms of financial challenges, universities are affected by reduced public funding due to economic crises. Budgetary constraints require innovative sources of income. The risk of over-qualification is a major concern; matching educational attainment to labour market needs prevents over-qualified graduates. Due to social mobility (Simai 2018), degrees as pathways to upward mobility drive enrolment. Financial accessibility expands opportunities. Through workforce demand, meeting

workforce needs drives programme development. Industry partnerships enhance employability. Research and development as a theme drives universities and contributes to innovation. R&D enhances reputation and relevance. The universities of the future must keep pace with critical trends - such as demographic, social, geopolitical or technological - that affect education. Individually and cumulatively, these will influence the future of higher education.

2.2. Criteria for choosing an institution

Students' choices of higher education institutions are influenced by a complex interplay of factors ranging from educational quality and financial accessibility to social mobility and occupational demand. These studies provide valuable insights into the field of higher education decision-making. According to Headcote et al (2020), a number of factors have been identified that influence student choice in the UK higher education system. These factors go beyond mere performance data and encompass a wide range of considerations that ultimately shape student preferences. In some cases, the reputation of the university and access to financial benefits are important factors in the students' decision-making process (Zuniga-Jara et al, 2019). Students' choice of university is influenced by factors such as geographical proximity, employment opportunities in the area and university reputation (Azzone & Soncin, 2020). Similarly, electronic word of mouth, peer influence and university reputation are important factors influencing students' choice of university (Wut et al, 2022), using different marketing tools like sources (Schimmel et. al, 2010). Like another motivator, course accreditation, location and parental influence are also confirmed as influential factors in students' choice of university (Bosah, 2020); and future career expectations, individual capacity and group references also play a role in influencing university choice (Ngan & Khoi, 2021).

2.3. The circumstances of the survey

The university is located in Western Hungary, it has nine faculties and approximately 15,000 students. The aim of the research is to assess the motivational factors of currently active, enrolled students, with the help and knowledge of which a more accurate positioning can be implemented using STP marketing. Some questions will assess students' sources of information, motivations and decision influences, but it will also look at students' enrolment by faculty, training, level and funding. The questionnaire was launched on 27 July 2023, after the publication of the 2023 admission thresholds by the Education Office. A total of 2,330 students were reached, with the last completion received on 7 September. The query was made through an online platform on the website of the Admissions Office, which was completed anonymously. The influencing factors were measured on a metric scale, while the other grouping variables were measured on a categorical scale.

2.3.1. Sample composition

The gender ratio in the sample is 48.7% female, 51.3% male; by generation, 6.4% are Generation X, 14.1% Generation Y, while the vast majority 79.5% are Generation Z. 97.5% of the respondents are resident in Hungary, the rest are foreigners. The majority, further broken down by place of residence, came from villages (64.6%), 30.3% from cities, 28.1% from cities with county status and 7% from the capital. 84.2% are publicly funded and 16.8% are self-funded students. The majority of respondents, 77.4%, were enrolled in bachelor's degree courses, 10.9% in master's degree courses, 6.1% in higher vocational education and 5.6% in postgraduate courses.

2.3.2. Examination of motives

The variables (see in Table 1.) are measured on a Likert scale with 5 points, the extreme points being 1 - not at all influenced, 5 - fully influenced. In order to maximize the Cronbach's alpha value run on the variables and in the light of the results of the initial factor analysis run (taking into account the correlation between factors and variables), four variables were excluded. Thus, the Cronbach's alpha value was 0.875 and the coefficients between factors and variables exceeded 0.5. The null hypothesis of the Bartlett's Test of Sphericity, an indicator of model fit and appropriateness, was rejected (Chi-Square 15107.337, Sig. 0.000), and the Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.860, also suggesting appropriateness. The method used is Principal Component Analysis, and the Rotation method is Varimax with Kaiser Normalization. Four factors were distinguished from the 15 motivators (based on the factor scores) explaining 64.2% of the total variance: education and reputation (37.85%); dormitory and services (10.12%); opinion of others (8.8%) and finally the city (7.43%).

2.3.3. Explaining the factors

The *first factor* includes practice-oriented courses, university-industry links, scholarships available, the reputation of the institution, free language learning opportunities and the level of reimbursement. On this basis, since in the majority of cases the values associated with the university itself were identified, the factor was named "education and reputation". The variance explained by this factor is the largest, 37.849%. The *second factor* includes the chances of being in a dormitory, the price of dormitory rooms and the sports facilities, i.e. the services that the university can offer based on its infrastructure. This factor has been labelled "dormitory and services" and explains a variance of 10.124%. The *third factor* includes the opinion of friends and family members, and also the fact that the friends are already students of the present institution, so the decision was based on their experience and their personalities. The factor is called opinion of others and the variance explained by it is 8.799%. The *fourth factor* includes the variables that consider the city itself, the distance from the place of residence and the

location; i.e. all geographical aspects that can be linked to the city as an entity. The factor is called City and the variance explained by it is 7.341%.

Table 1. Results of the factor analysis Source: Own compliation (2024).

Variable	education and reputation (37.85%)*	dormitory and services (10.12%)*	opinion of others (8.8%)*	city (7.43%)*
practical training	0.774			
university-industry link	0.765			
available scholarships	0.656			
reputation of the institution	0.637			
free language learning opportunities	0.621			
tuition fees	0.619			
better chance of getting into collage		0.925		
low college fees		0.918		
sport facilities		0.557		
opinions of friends			0.812	
friends			0.735	
opinions of family members			0.718	
city				0.736
distance from home				0.686
job opportunities				0.664

*Note: explained variance

3. Conclusions and proposals

The theory and empirical results in the provided search results both discuss the factors influencing students' choice of higher education institutions, but they differ in their focus and specificity.The theory, as presented by Headcote et al. (2020) and Zuniga-Jara et al. (2019), emphasizes a broad range of factors that influence students' choices, including educational quality, financial accessibility, social mobility, occupational demand, university reputation, geographical proximity, employment opportunities, electronic word of mouth, peer influence, course accreditation, location, parental influence, future career expectations, individual capacity, and group references. This theory highlights the complexity of students' decision-making processes and the interplay of various factors that shape their preferences.On the other hand, the empirical results, as presented in the study findings, focus on more specific factors that are categorized into distinct groups. The most influential factors are related to the educational structure, organization, and integration of the institution, including reputation, free language learning, and course costs. Secondary yet significant factors include college places, admission processes, costs, and sporting facilities, influenced by the institution's location and external environmental factors. Housing provision and quality of life services are also considered essential. The opinion of reference groups, while less influential than before, still plays a role in decision-making, particularly among friends and family. The city's characteristics, such as distance and location opportunities, represent a factor beyond the

institution's direct control.In summary, the theory provides a broader and more comprehensive view of the factors influencing students' choice of higher education institutions, while the empirical results focus on more specific and categorized factors. Both perspectives highlight the importance of factors such as reputation, location, and financial considerations, but the empirical results also emphasize the significance of educational structure, organization, and integration. The theory also includes factors such as social mobility, occupational demand, and individual capacity, which are not explicitly mentioned in the empirical results.

Overall, understanding students' motivational factors that help them make decisions is information that enables more precise targeting and more effective operations in strategy development. In this study, we have examined primarily the marketing tools and challenges facing higher education institutions and their related higher education marketing. Through empirical research targeting students at a Central - Eastern European institution, we have verified and identified the factors influencing the decision, distinguishing and grouping the factors that are related to the institution and can be influenced by it (hard and soft), as well as identifying the influence of reference groups and the less influential existence of the city as an entity. Knowing and using these factors will make the strategy for attracting students more precise and effective.

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Evaluation and Remediation Opportunities for High School Mathematics Knowledge Among Students Entering a Technical University

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Abstract

With the increasing interest in technical fields and the advent of the digital era, ensuring the effective preparation of students for technical universities becomes an utmost goal. Disciplines at these institutions necessitate strong mathematical knowledge, which, in turn, requires a solid foundation in high school mathematics. Insufficient skills in fundamental mathematics are a key challenge for a significant portion of students in technical universities. This paper focuses on comparing the subjective perception of mathematics knowledge among students entering our institution, VSB-Technical University of Ostrava (Czech Republic), with the objective state of their skills. As a possible solution to this unfavorable state, we introduce the potential use of a distance online course and targeted consultations as tools for bridging the gap in high school mathematics among students entering technical universities.

Keywords: *basics of mathematics; knowledge; survey; technical university.*

1. Introduction

Educational programs at technical universities always require a strong foundation in mathematics. During our teaching, we observed that students enter VSB-Technical University of Ostrava (Czech Republic) from various specialized high schools, resulting in the a significant disparity in their knowledge of mathematics (Dlouhá & Hamříková, 2018). There is a varying allocation of both time and content in teaching mathematics across different types of high schools. Despite the fact that students complete their high-school studies with the final state examination, the insufficient emphasis on mathematics in the curriculum of some high schools leads to a small number of students opting for the final comparative maturita examination upon completing their secondary education.

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It is essential to highlight that students can choose between final examination in mathematics and a foreign language (typically English). In 2022, when our survey was conducted, only 17% (11.9 thousand) of graduates registered for the mathematics examination, indicating objectively low motivation to focus on mathematics. As a consequence, students entering their first year of higher education have varying levels of preparedness for university-level mathematics due to differences in their prior knowledge. Long-term efforts have been made to assist students in quickly identifying their gaps in basic mathematics knowledge and providing them with opportunities for remediation. In Chapter 2, we introduce a group of our students who underwent a questionnaire survey upon arrival, focusing on their perception of their individual knowledge of basic mathematics and subsequent testing of these skills. The obtained data are compared, and the results are presented in Chapter 3. The presented survey and results identify gaps in knowledge and also shows how students overestimate their actual knowledge. In the following chapters, we present two different options to complement the knowledge and fill the gaps. Moving on to Chapter 4, we introduce a distance course in basic mathematics available to our students to help them acquire the necessary mathematical skills they should have possessed before entering university but may lack. Chapter 5 is dedicated to presenting the Math Support Centre at our university. This centre provides the opportunity for individual consultations. This paper builds upon our previous (Dlouhá et al., 2022), where we analysed the anonymous data. At the university, there is no longer space to substitute high school, but we can provide students with self-study materials or additional consultations. In this paper, we present data from students who have provided consent for the processing of the provided information.

2. Questionnaire Survey and Test

The research sample comprises students who enrolled in our technical university. Since the questionnaire survey and subsequent testing were not part of their curriculum, we sought their explicit consent for processing the information and results obtained from them. Our survey, conducted in the first week of the academic term, involved 128 students. However, we received the necessary data for analysis from 91 students who granted us permission. At the beginning, we queried students about the high school they attended (Figure 1a) and whether they graduated with a maturita examination in mathematics (Figure 1b). Furthermore, they were asked to rate, on a scale from 1 (best) to 5 (worst), their responses to the questions: "How much do I like mathematics?" (Figure 1c) and "What grade would I give to my mathematics knowledge?" (Figure 1d).

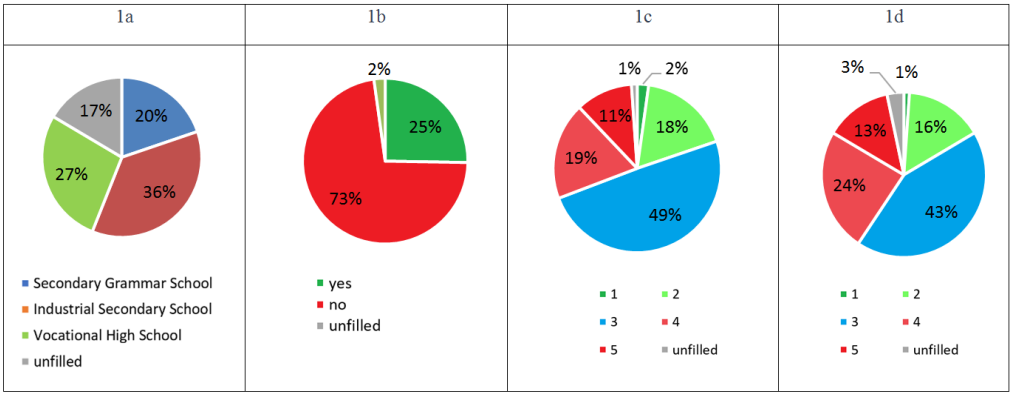


Figure 1. 1a) High School Type, 1b) Final High-school examination in Mathematics, 1c) "How much do I like mathematics?", 1d) "What grade would I give to my mathematics knowledge?". Source: Own (2024).

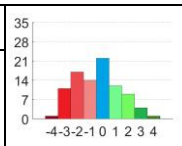
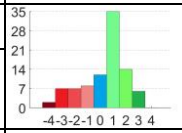
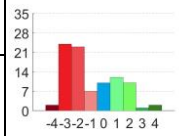
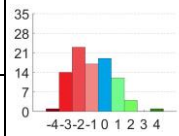
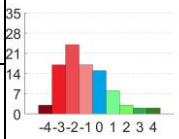
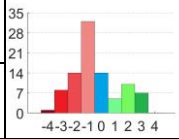
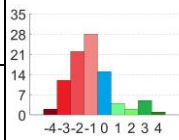
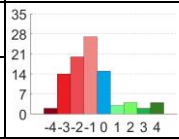
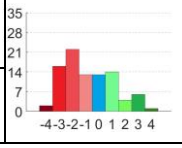
In the second part of the questionnaire, students responded to 20 questions related to specific thematic areas selected to cover the necessary knowledge of high school mathematics at our school. They were instructed to self-assess their knowledge of each topic by assigning a grade on a scale of 1 to 5, where 1 means the best and 5 means the worst. The evaluation was entirely subjective without defining any assessment criteria.

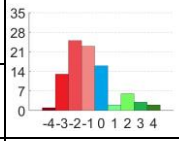
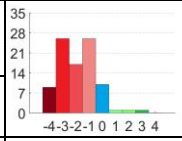
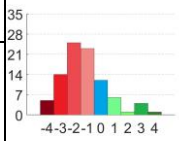
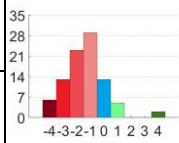
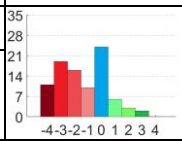
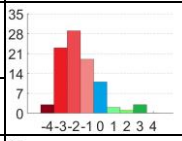
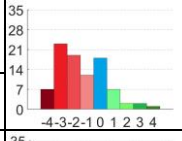
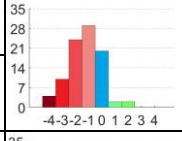
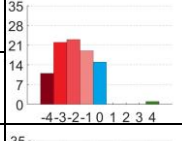
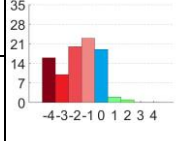
Additionally, to obtain objective information about the students' knowledge and compare it with the questionnaire survey, we designed a test consisting of 20 open-ended, straightforward tasks. The thematic content of the test corresponded to the questions in the questionnaire where students self-evaluated. Students took the test without any prior preparation, and they were not allowed to use calculators or mathematical tables for computations. Our aim was to assess their immediate knowledge. Considering the choice of very straightforward tasks in the test, it was assumed that a student who self-evaluated with a grade of 3 should be able to handle them. Similarly to self-evaluation, students were assessed on a scale of 1-5.

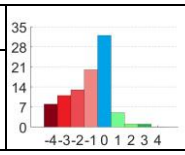
3. Results of the Comparison

We conducted a comparison between self-assessment and actual performance for each thematic area individually, considering each student separately. For each student, we subtracted the grade they assigned themselves from the grade they achieved in the test. If the result was a negative value, the student overestimated their abilities. If the result was a positive value, the student underestimated their abilities. A result of 0 indicates that the test performance corresponds to the self-assessment in the questionnaire. The comparison results are presented in Table 1 alongside the questionnaire question and the corresponding test task.

Table 1. Table of Self-assessment and Actual Knowledge Comparison. Source: Own (2024).

1	Grade your knowledge in the field of set operations. Sets **A**=(-∞;0⟩, **B**=(-2;3), **C**=⟨−3; −2⟩ are given. Determine the intersection of sets **A** and **B**, and the union of sets **A** and **C** both graphically and by expressing the results in interval notation.	
2	Grade your knowledge in the field of operations with numbers. Calculate and express the result in its simplest form as a fraction $\frac{2-1\frac{3}{10}}{\frac{5}{3}-0,5}$.	
3	Grade your knowledge in the field of powers and roots manipulation. Simplify the expression $\sqrt{4n^5 . 9n^5}$ for n∈**N**.	
4	Grade your knowledge in the field of algebraic expressions simplification. For a∈**R** - {-5;5}, simplify the expression $\frac{5a}{5-a} - \frac{10a^2}{25-a^2}$.	
5	Grade your knowledge in the field of equation solution with an unknown in the denominator. Solve the equation $\frac{x-2}{3x} = \frac{x+1}{6}$ in the domain of real numbers.	
6	Grade your knowledge in the field of logarithmic equations. Solve the equation $\log_5(3x+1) = 2$ in the domain of real numbers.	
7	Grade your knowledge in the field of logarithmic equations solvability. Determine the conditions for the solvability of the equation $\log_3 3x = 4$ in the domain of real numbers.	
8	Grade your knowledge in the field of exponential equations. Solve the equation $3 \cdot 9^x - 9^x = 6$ in the domain of real numbers.	
9	Grade your knowledge in the field of quadratic equations. Solve the equation $x^2 = -3x$ in the domain of real numbers.	

10	Grade your knowledge in the field of trigonometric equations. Solve the equation $\sin 2x = -1$ in the domain of real numbers.	
11	Grade your knowledge in the field of domains of functions. Specify the domain of the function $y = \frac{9-x^2}{x-3} + \sqrt{4-x}$.	
12	Grade your knowledge in the field of quadratic function graphs. The graph of the quadratic function f : $y = 9 - x^2$ for x∈R is a parabola. Determine the coordinates of its vertex.	
13	Grade your knowledge in the field of the range determination of function values from the graph? The graph of the quadratic function f : $y = 9 - x^2$ for x∈R is a parabola, determine its range of values.	
14	Grade your knowledge in the field of maps scales. The cyclist is traveling at a constant speed of 18 km/h. The route he covered in half an hour measures 18 cm on the map. What is the scale of the map?	
15	Grade your knowledge in the field of general equation of a linear function. Determine the general equation of the line p from Fig. 2a.	
16	Grade your knowledge in the field of a planar figure area calculation. Determine the area of the shaded region in Fig. 2a.	
17	Grade your knowledge in calculation of the deviation between two lines. Express the deviation of the line p from Fig. 2a in relation to the o_x.	
18	Grade your knowledge in calculation of the cylinder volume. The height of a rotational cylinder is 4 cm. The cross-sectional area of the cylinder is 24 cm^2. Determine the volume of the rotational cylinder.	
19	Grade your knowledge in the determination of the point coordinates. In the Cartesian coordinate system in Fig. 2b, the line p is depicted. Numerically determine the missing coordinate of the point A[6; a$_2$].	

20	Grade your knowledge in the field of trigonometry. The rectangular and triangular plots in Fig. 2c share a common boundary. The dimensions on the plan are given in meters. Determine the area of the rectangular plot with an accuracy of square meters.	

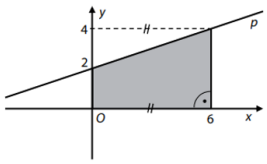
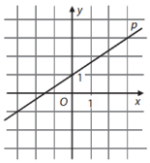
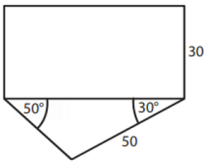
2a	2b	2c
		

Figure 2. 2a) Image for solving test problems 15, 16, and 17, 2b) Image for solving test problem 19, 2c) Image for solving test problem 20. Source: Own (2024).

Results indicate that the only area where students underestimated their knowledge is in the 2nd category, 'Basic numerical operations with numbers.' Conversely, the area where they overestimated themselves the most is in the 11th category, 'Domain of a function.' Unfortunately, in all other categories, students overestimated their abilities. Therefore, it is crucial to provide them the opportunity to quickly assess the actual state of their knowledge upon entering university and offer the possibility of rapid improvement.

4. Distance Course

To bridge the gap in required knowledge of high school mathematics among such a diverse group of students, there is not enough time during standard university mathematics courses. Therefore, we have decided that one suitable way of remediation is asynchronous learning through a distance online course. E-Learning environments may contribute to the teaching and learning process if the integration is done within the framework of proper pedagogy. Building customized E-learning programs places high demands on design, programming skills, and time (Kotzer & Elran, 2012). For the knowledge level equalization and facilitation of further studies for our students of university mathematics, we created a new e-learning course in LMS (Moodle-based university online platform), which is accessible for all students and employees of the university. This LMS-embedded online environment is interconnected with the school portal for students and employees (Dlouhá et al., 2021).

The course we have developed provides a flexible and individualized form of preparation, allowing motivated students to acquire the necessary mathematical skills at their own pace as soon as possible after entering university. ‘The Basics of Mathematics’ course includes videos and interactive elements such as graphs and exercises that help students visualize abstract

mathematical concepts and better understand them. End-of-chapter tests provide immediate feedback on tasks and exercises, allowing students to track their progress and identify areas where they need to improve their skills. Designed in this way, the online course gives students the opportunity for self-study and the development of self-learning skills, which are important for lifelong learning.

A key component of the course is videos of solved problems with teacher voice commentary, as videos have become a preferred form of information acquisition among students in recent years. The success of the video tutorial is ascribed to its design, which attended to and even incorporated key qualities of paper-based tutorials, while also capitalizing on the strengths of video (Meij & Meij, 2016).

Although the online course offers many advantages, it is also important to take into account individual learning styles and preferences of students. Combining online learning with traditional methods can provide a balanced and effective approach to mathematics education. In addition to regular consultations, our students can benefit from the services of the Math Support Center at our school.

5. Math Support Centre

Math Support Centres (MSC) are open to all students regardless of their skill level. They assist students in overcoming potential math anxiety and gaining confidence in their study of mathematics. The goal is to provide an environment where students can work on their mathematical development without stress. These centers are typically designed to help students develop their mathematical skills, improve understanding of mathematical concepts, and successfully handle math courses or assignments. They offer personal or group consultations with experienced math tutors, teachers, or peers who are capable and willing to work in the center. We are very happy that our gifted students work with us, who not only teach their classmates mathematics, but can also ensure them that they will need mathematics during their further studies (Dlouhá et al., 2019). This allows students to receive individual assistance with specific questions or topics. The centers provide access to textbooks, educational materials, online resources, and exercises that enable students to study independently and review. MSC at VSB-Technical University of Ostrava offers both in-person and online consultations and additional sessions covering the basics of mathematics, university-level mathematics, statistics, and descriptive geometry. In the year 2022, during which our survey was conducted, a total of 1748 individual consultations and 52 group consultations (tutorials) took place, both in-person and online.

6. Conclusion

Our goal is to promptly assess incoming students' high school mathematics proficiency and promptly address any deficiencies. This paper outlines a method to gauge students' mathematics understanding, pinpointing areas where they may lack insight. We propose two solutions for filling identified gaps. Survey results reveal a tendency for students to overestimate their knowledge. We advocate for employing online courses and individual consultations to enhance high school mathematics proficiency among technical university students, thereby bolstering their academic achievements.

Acknowledgments

This paper has been completed thanks to our department. We would like to express our gratitude to our students for their cooperation with the survey.

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Exploring the collocation database CCDB in the LSP classroom

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Abstract

This paper presents a proposal for the integration of the collocation database CCDB in German as Language for Specific Purposes (LSP) classes at the Master's level. The primary focus of this study is to outline a conceptual framework for its implementation in the classroom setting. The proposed approach emphasizes the importance of incorporating data-driven learning (DDL) methodologies to equip students with the necessary skills to extract insights from large language datasets. The use of corpora in language teaching and learning has been extensively researched and debated over the past few decades. The increasing integration of Information and Communication Technology (ICT) in LSP classes has significantly contributed to advocating for the adoption of corpora in language instruction. The German database CCDB (https://corpora.ids-mannheim.de/ccdb/), based on a 2.2 billion-word subset of the German Reference Corpus, is an invaluable resource for exploring a large-scale corpus through data-driven methods. It comprises rich collocation profiles that can be utilized in LSP classes to enhance students' linguistic competences. This study presents a teaching proposal integrated into the 'Languages and Business Relations' Master's course at the University of Aveiro.

Keywords: *Languages for Specific Purposes; corpus linguistics; data-driven learning; collocation database CCDB; German.*

1. Introduction

The demand for expertise in multiple languages across various fields has increased significantly. This has led to the need for language specialists with specialized knowledge in their respective domains (Gollin-Kies, Hall, Moore, 2016, p. 35). Multilingual communication has assumed a crucial role in industries that require language skills for specific purposes, facilitating information exchange in diverse linguistic environments. As the professional environment becomes increasingly complex and career paths continue to diversify, individuals are finding themselves in greater demand to adapt to changing requirements and specialize accordingly. Considering the diverse landscape of ICT today, attention will be directed toward the

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exploration of online corpora in Language for Specific Purposes (LSP) classes, due to their growing relevance in Natural Language Processing. By adopting a data-driven learning (DDL) approach, even novice students in corpus work may gain useful insights and become familiar with practices for exploring large amounts of language data. In this paper, we present a proposal for the integration of online corpora, specifically the collocation database (CCDB), into LSP classes. While the practical implementation of this proposal is yet to be conducted, we aim to outline a conceptual framework for its potential application in the classroom setting. Drawing on previous studies (Herget, 2018, 2020) that have explored project-based learning scenarios involving approaches to implementing the Translation Management System Phrase (form. Memsource) in LSP classes or conducting a localization project with a group of Master students in "Languages and Business Relations" at the University of Aveiro, our aim is to elucidate how the CCDB could be effectively utilized in the LSP classroom. Particularly in the context of LSP instruction, there exists a pressing need for continuously updated methods and strategies for the organization and management of knowledge due to the evolving complexity of professional profiles.

2. Languages for Specific Purposes – working definition and current challenges

LSP teaching focuses on developing language skills for specific professional contexts, such as business, law, medicine, and so on. In an era of immense technological potentialities for the educational field, LSP teaching offers personalized learning experiences that adapt to individual needs and accelerate language acquisition like never before. Firstly, we should clarify what LSP stands for and then discuss some major trends impacting the study of LSP. According to Basturkmen & Elder (2004, p. 672) "LSP is generally used to refer to the teaching and research of language in relation to the communicative needs of speakers of a second language in facing a particular workplace, academic, or professional context". In terms of a working definition, in the following, we perceive LSP from a broad perspective, as outlined by Koskela & Isohella, (2018, p. 101) rather than focusing on a specific language (e.g. GSP). According to the authors, a broad approach "can be applied to education offered on any language or to multilingual education". Following Brandt (2006, p. 14), *specialness*, or the adjective *special* or *specific* refers to different levels of the communicative process, involving:

- context (domain, subject-matter, setting)
- discourse partners (expertise and status)
- message (specific functions)
- channel and medium (discourse path and text type)
- code (syntactical, morphological and lexical features

Gollin-Kies et al. (2015) summarize key trends in learning, teaching and researching LSP, which include inter & cross-cultural communication, computer-based language research and

independent learning, among others. Each of these categories intersects with one another, reflecting the confluential dynamics within the domain of LSP.

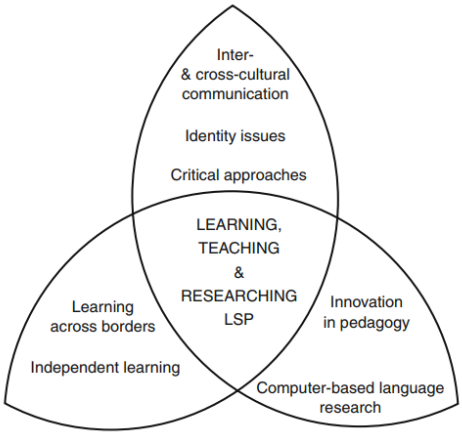


Figure 1: Key topics in LSP research, learning and teaching (Gollin-Kies et al., 2015, p. 51)

3. Self-directed Language Learning – a DDL approach

The integration of ICT in LSP classes has transformed language education, enhancing interactive learning and providing students with valuable digital skills for a specific domain. According to Arnó-Macià (2015, p. 5), "Developments in IT have influenced LSP, not only in facilitating access to specialized discourse and communication, but also as a result of the evolution of technology as a language learning tool (in turn influenced by evolving educational paradigms)". ICT broadly encompasses technologies used for the acquisition, processing, storage, and dissemination of information, as well as communication and collaboration through various electronic means. The integration of corpus analysis into LSP classes can be considered "potentially highly motivating as they allow exploration of individual questions and are thus learner-centered, fostering autonomy with potential for life-long learning" (Boulton & Tyne, 2014, p. 30X). It is a major condition to familiarize learners with strategies to discover grammatical patterns, word meanings or other aspects of language. Within the context of corpus application in LSP classes, data-driven learning (DDL) can be considered a major paradigm, being an "essentially constructivist, inductive approach" (Boulton, 2017, p. 182) by which learners explore large text collections according to their individual needs. According to DDL, teachers function as mediators supporting students' cognitive understanding and processing of L2 learning, which, consequently, "lead[s] to longer retention than simply 'being taught'" (Boulton, 2017, p. 182). Corino & Onesti (2019, p. 2) put it the following: "The DDL approach

in teaching vocabulary and grammar leads […] to a relevant consciousness-raising of the learners, drawing the student's attention to the formal properties of the target language." In our study, we propose the DDL approach to explore the collocation database CCDB in the LSP classroom, providing Master's students of German as an LSP with insights into a search word's co-occurrence profile. Hence, the DDL approach implies "the hands-on use of authentic corpus data (concordances) by advanced, sophisticated foreign or second language learners in higher education for inductive, self-directed language learning of advanced usage" (Boulton, 2011, p. 572).

4. The Case of CCDB: a brief contextualisation

The collocation database CCDB was created at the Institute for the German Language (IDS) in Mannheim in 2001, allowing for a variety of collocation analyses, based on empirical data that were established from a subset of the Mannheim German Reference Corpus (DeReKo) (Keibel & Belica, 2007). According to the Keibel & Belica (2009, p. 54), DeReKo "is to serve as an empirical basis for the scientific study of contemporary written German", comprising fictional, scientific and newspaper texts, among others. Co-occurrence analysis enables the identification of significant patterns in the usage of word combinations across large corpora. This is achieved through statistical analysis and clustering techniques, which assess the immediate context of a chosen search word within a particular corpus.

5. Exploring CCDB for classroom use

The CCDB can be explored in LSP classes in multiple way, presenting a promising tool for language learning and exploration. As a proposal, this study suggests leveraging the collocational database to provide direct access to DeRoKoVecs (Fankhauser & Kupietz 2017, 2019; Kupietz et al. 2018), a platform that offers insights into paradigmatic and syntagmatic relations between words based on large-scale corpora.

Syntagmatic | Info

#	w'	max(a)	⟨a⟩	Σa/Σw'	⊥(a/c)	Σa/Σw	Collocate (W2V)
1	·····×·····	0.996	0.100	2.411e-4	2.411e-4	5.946e-5	stillgelegter
2	·····×·····	0.985	0.098	2.384e-4	2.384e-4	4.909e-5	bestehender
3	·····×·····	0.982	0.098	2.377e-4	2.377e-4	3.783e-5	kerntechnischer
4	++···×·····	0.986	0.359	2.367e-4	5.829e-4	6.916e-5	oberirdischer
5	·····×·····	0.976	0.098	2.362e-4	2.362e-4	4.879e-5	vorhandener
6	·····×·····	0.971	0.097	2.350e-4	2.350e-4	3.533e-5	innerörtlicher
7	·····×·····	0.968	0.097	2.342e-4	2.342e-4	2.750e-5	gemeindeeigener
8	·····×·····	0.965	0.097	2.336e-4	2.336e-4	3.907e-5	veralteter
9	·····×·····	0.963	0.096	2.331e-4	2.331e-4	3.866e-5	ungenutzter
10	·····×·····	0.955	0.095	2.311e-4	2.311e-4	3.625e-5	maroder
11	·····×·····	0.950	0.095	2.300e-4	2.300e-4	2.659e-5	leerstehender
12	·····×·····	0.949	0.095	2.298e-4	2.298e-4	4.688e-5	denkmalgeschützter

Figure 2: Co-occurrences of Rückbau (DeReKoVecs)

Figures 2 and 3 represent the syntagmatic relations of the node word *Rückbau* and its collocates, illustrating the contextual associations and usage patterns surrounding the term. Analyzing these figures provides language learners with valuable insights into how *Rückbau* is commonly employed in various contexts, offering information on specific language patterns and proper usage. Exploring co-occurrences enables students to proficiently use vocabulary in specific authentic contexts.

WPD17/C93/67147	lagen sowie der **Rückbau stillgelegter** Industrieanlagen kommen als neue Kompetenzen hinzu. Seit 2010 entwickelt CSD den Bereich Energie. 2015 verstär
WPD17/D60/85976	tete das auf den **Rückbau stillgelegter** Kernkraftwerke spezialisierte Unternehmen Energiewerke Nord (EWN) bis Ende 2010. Werdegang Rittscher ist gelernt
WPD17/E10/64028	nehmen für den **Rückbau stillgelegter** Kernkraftwerke Einwahlrufnummer, eine Rufnummer zur Anwahl eines Modems über das Telefonnetz, siehe Rufnumm
WPD17/E02/42973	, ist ein auf den **Rückbau stillgelegter** Kernkraftwerke (KKW) spezialisiertes Unternehmen. Es ist auch als ein bundeseigenes Eisenbahninfrastrukturunterne
WPD17/K04/96909	e Kosten für den **Rückbau stillgelegter** Kernkraftwerke bei Insolvenz der Betreiber trägt, ist offen. Im Entwurf der Arbeitsgruppe Umwelt für den Koalitionsve
WPD11/L05/02057	öln-Nippes Gbf (**stillgelegter Rangierbahnhof, z. Zt. Rückbau** von stillgelegten Gleisanlagen außer der in eine Abstellanlage für ca. 20 S-Bahnfahrzeuge u
WPD11/D60/85976	itet das auf den **Rückbau stillgelegter** Kernkraftwerke spezialisierte Unternehmen Energiewerke Nord (EWN). Werdegang Rittscher ist gelernter Elektriker u
WPD11/E10/64028	nehmen für den **Rückbau stillgelegter** Kernkraftwerke {{Begriffsklärung}} {{DEFAULTSORT:Ewn}} EWN
WPD11/E02/42973	sind ein auf den **Rückbau stillgelegter** Kernkraftwerke (KKW) spezialisiertes Unternehmen. Sie sind auch als ein bundeseigenes Eisenbahninfrastrukturunter

Figure 3: Concordance search of node word Rückbau + 1R collocate stillgelegter (DeReKoVecs)

A very interesting feature is the possibility of creating self-organizing maps (SOM) that allow students to interpret co-occurring profiles of a specific search word. Figure 4 shows a two-dimensional self-organizing map (SOM) that "renders in a simplified way the complex multidimensional similarity relations within a set of collocation profiles" (Vachková & Belica, 2009). By compiling and examining a SOM, students get insights into the immediate lexical environment of a node word and its co-occurring items. The interpretation of the lexical feature map reveals that the lexical unit *Rückbau* is predominantly used in the context of physical deconstruction (*Abriss*, *Stilllegung*), redevelopment (*Neubau*, *Umbau*, *Renovierung*), environmental remediation (*Renaturierung*, *Rekultivierung*), infrastructure (*Gleisanlage*, *Straße*), and nuclear facilities (*Kernkraftwerk*, *Reaktor*). The lexeme *Demontage* is used both in

the context of physical disassembly and broader conceptual transformation. Lexical units such as *demontieren*, *Entsorgung*, *Zerlegung*, *Rückbau*, *Abriss*, and *Stilllegung* directly relate to physical disassembly of machinery or structures. In a figurative sense, lexemes like *Kollaps*, *Entmündigung*, *Verfall*, *Destabilisierung* represent the dismantling of systems, institutions, or social constructs.

Another feature for exploration in the classroom involves near-synonyms (Figure 5). The CCDB allows the modeling of semantic proximity by contrasting two near-synonyms, which can be visualized through a two-dimensional color-marked grid. According to Keibel & Belica (2007, p. 4), "[t]he distribution of colors generally provides a reliable idea of how similar the two near-synonyms really are with respect to their usage properties; moreover, it points to the particular usage aspects that the two words do not have in common." In the following figure, the yellow

Rückbau *Demontage*

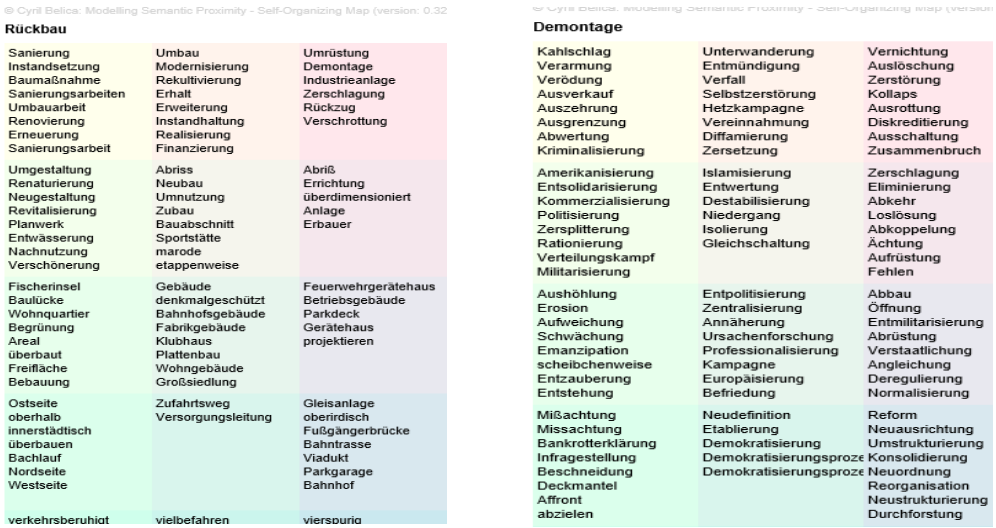


Figure 4: Section of topographic profile of Rückbau *and* Demontage *according to CCDB*

color refers to typical co-occurrences in combination with the lexical unit *Rückbau*, while the red color indicates typical collocates of *Demontage*. The mixed colors indicate co-occurrences where both lexical units are present. The grid shows a gradual transition from one color tone to another, revealing the existing continuum between both lexical units. The different shades are particularly important for the lexical-semantic understanding that students are expected to develop in LSP classes. Pure colors, such as pure yellow and pure red, indicate the most probable usage of both lexical units. For example, the lexical unit *Rückbau* is more commonly used in the context of traffic and infrastructure (e.g. *Verkehrsberuhigung*, *Durchgangsverkehr*,

Umgehungsstraße), as well as within the context of structures or facilities (*Wohnquartier*, *Kernkraftwerk*). The topographic profile of the lexeme *Demontage* reveals different usages, comprising the decay of social structures (*Niedergang*, *Verfall*), as well as the disregard of values (*Missachtung*, *Infragestellung*). The thematic field where the quasi-synonyms *Rückbau* and *Demontage* overlap relates to the context of transformation (*Umstrukturierung*, *Reorganisation*, *Umstellung*), discontinuation (*Schließung*, *Ablösung*, *Auflösung*), as well as political and economic changes (*Deregulierung*, *Abkopplung*, *Aufweichung*).



Figure 5: Topographic profile of near-synonyms Rückbau *and* Demontage

6. Conclusions

In conclusion, the proposal for integrating the collocational database CCDB into LSP classes presents numerous potential applications for linguistic exploration and learning. The examples discussed in this paper aim to broaden the lexical-semantic knowledge of students studying German as LSP, providing valuable insights into the utilization of self-organizing maps to

comprehend complex lexical relationships and usage patterns. By contrasting two near-synonyms, the proposal suggests a pathway for students to develop a deeper understanding of how words may co-occur in natural language contexts, allowing them to identify specific usage aspects of a lexical unit, as well as to enhance their linguistic proficiency in understanding subtle differences in meaning. With the help of the lexemes *Rückbau and Demontage*, various methods for potentially integrating the CCDB in LSP classes have been explored, employing a DDL approach that encourages learners' awareness of corpus usage but also equips them with valuable skills for independent language exploration and analysis.

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GLOBE Tabletop - Capability Development through Pre-Exercise Learning for Humanitarian Missions

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Abstract

Simulation exercises play a significant role in training for humanitarian missions and provide suitable space for appropriate preparation of humanitarian personnel. It was observed that participants in the GLOBE simulation, a humanitarian crisis simulation exercise, lacked fundamental knowledge concerning structure and process organization, situational awareness, and complex planning tasks. Thus, this paper explores the concept of capability development through pre-exercise learning, suggests improvements of the efficacy and effectiveness of learning for individuals engaged in humanitarian mission simulations, and provides implications for improving the overall effectiveness and outcomes of simulation exercises. The conceptualization of pre-exercise learning with gamification and tabletop exercise elements prior to participation in the simulation exercise is expected to lead to enhanced capability development during the simulation of humanitarian missions.

Keywords: *Pre-exercise learning; Tabletop; Simulation games; Gamification; Crisis management; Humanitarian mission*

1. Introduction

Due to the demanding nature of humanitarian missions, prior capability development and appropriate preparation for deployed personnel are crucial (Haverkamp et al., 2022). Simulation exercises and serious games provide a suitable space for such learning (Harteveld and Suarez, 2015). The primary objectives of this paper are to explore the concept of capability development through pre-exercise learning, suggest improvements of the efficacy and effectiveness of learning for individuals engaged in humanitarian mission simulations, and provide implications for improving the overall effectiveness and outcomes of simulation exercises. In order to limit the scope, the main focus will be put on capability development through pre-exercise learning

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on the example of an innovative tabletop exercise. This paper will be organized in six sections. Section 1 and Section 2 will be devoted to the introduction and theoretical background regarding simulation exercises, pre-exercise learning and gamification. Section 3 then presents the learning environment, including the presented exercises' learning objectives and how they were attained. Section 4 explains the applied method. The resultant findings and discussions will be presented in Section 5. Finally, Section 6 concludes the paper and identifies limitations and future research directions.

2. Theoretical Background

Sections 2.1. and 2.2. provide a background on the relevance of simulation exercises and gamification for effectively conveying skills and knowledge. Thus, they set a theoretical basis for the exercise formats described in Section 3.1. and Section 3.2., in which those concepts are applied.

2.1. Relevance and Potential of Simulation Exercises

A simulation exercise is a case study in which participants are confronted with the reality of functioning in an arranged environment (Thavikulwat, 2009). Simulations are very effective in achieving learning outcomes since they provide efficient means of comprehending the future (Day and Reibstein, 1997). The main advantages of simulation exercises include practice in a risk-free environment, reduced decision-making time, improved cross-functional understanding, and increased knowledge of subject content (Scherpereel, 2005).

2.2. Relevance and Potential of Gamification

Deterding et al. (2011) find that “Gamification is the use of game design elements in non-game contexts.”. Games are a powerful tool for humanitarian learning and dialogue, hence participants should be fully immersed in the topic and acquire skills and knowledge through application (Harteveld and Suarez, 2015). This is a valuable method to increase motivation and engagement in different learning contexts (Sailer et al., 2017). It is crucial to select game elements that are suitable for the concept to avoid ineffectiveness of the gamification (Voit et al., 2020; Sailer et al., 2017).

3. Learning Environment and Objectives

In the following, two different formats of GLOBE exercises will be described. Both exercises have the goal of capability development for humanitarian missions. One is a simulation exercise and the other one is a tabletop exercise, which is used as an example to explain the idea of pre-exercise learning (OTH Regensburg, 2024).

3.1. The GLOBE Exercise: Simulation of a Humanitarian Mission

The GLOBE exercise is a multi-day simulation exercise of humanitarian coordination, which is part of the study program *International Relations and Management* at the University of Applied Sciences (OTH) Regensburg (Bresinsky and Willner, 2019). After Bresinsky introduced the concept of GLOBE in 2013, students organized, planned and carried out the exercise under the supervision of the professor. Since its introduction, 21 runs of the GLOBE exercise have successfully been executed (OTH Regensburg, 2024). During the GLOBE Exercise the Training Audience (TA) is divided into groups, each representing entities of the United Nations Office for the Coordination of Humanitarian Affairs (UN OCHA), such as the UN OCHA Headquarters, an UN OCHA Country Office, and additional think tanks based on TA size. The TA is given a scenario, providing the framework of their work and posing tasks and challenges they have to tackle through collaborative problem-solving (OTH Regensburg, 2024).

3.2. The GLOBE Tabletop as an Innovative Learning Method

The GLOBE Tabletop was developed as an innovative and complementary format to increase the effectiveness of the GLOBE simulation exercise in the area of capability development for humanitarian missions (Bresinsky and Willner, 2019). By combining a pre-exercise learning approach with gamification and tabletop exercise elements, a sense of preparedness for the simulation of a humanitarian crisis is created (see Section 5). The format is innovative because many other simulations presuppose certain skill sets from their participants and do not offer them preparation beforehand. Skills that are not at hand, are supposed to be learned through failure (Palominos et al., 2021). GLOBE Tabletop, on the other hand, encourages participants to pose all emerging questions and creates an environment of collaborative learning to effectively prepare them for the GLOBE simulation exercise. Angafor et al. (2020) state that the concept of tabletop exercises, including feedback sessions, pre-briefings and debriefings in a non-threatening context improve collaboration and problem-solving skills. A research gap was identified on the topic of pre-exercise learning for simulation exercises, which is defined by the authors as follows in this paper: Pre-exercise learning refers to the intentional process of clarifying learning objectives prior to engaging in an exercise. It focuses on conveying the relevant concepts promptly before the exercise, with the intention of further exploration and reinforcement through feedback. This approach ensures alignment between the learning objectives and the subsequent exercise, fostering a more effective and purposeful learning experience.

The GLOBE Tabletop is a three-day exercise where the participants receive theoretical input which they then apply in tasks that have a gamification or tabletop character, such as analyses of Mali illustrated on table-sized maps. The participants are assigned a mentor for all tasks and the results are discussed together (OTH Regensburg, 2024). At the end of each exercise day, a debriefing is held in which the participants evaluate the tasks and teamwork of the day and

establish rules for the next day's collaboration. The game elements used for the GLOBE Tabletop are based on the Empirical Analysis of Motivating Game Elements (EMPAMOS) (Bröker et al., 2021). This research project analyzes game elements and the associated problems in terms of motivation, which they solve (Voit et al., 2020). The researchers developed a pattern language for game elements to create motivational framework conditions in educational projects (Bröker et al., 2021). Once the learning objectives and content of the GLOBE Tabletop had been defined, the EMPAMOS patterns were used to consider which game elements would motivate participants to learn the most from the exercise in order to be best prepared for the GLOBE simulation exercise.

3.3. Learning Objectives of GLOBE

The principal objective of GLOBE is to train students for real-world challenges and prepare them for the work environment of international organizations (Bresinsky and Willner, 2019). To do so, GLOBE focuses on three general, desired learning outcomes, which apply for the GLOBE simulation exercise and the GLOBE Tabletop. In past years, attempts have been made to achieve these objectives through the simulation exercise alone, but now they are to be accomplished through a combination of tabletop exercise and simulation (OTH Regensburg, 2024). The main learning objectives are defined as follows:

Structure organization focuses on the structure and the elements of an institution (Fischer et al., 2006). It reveals which organizational units exist and according to which aspects certain tasks are divided. Further, it indicates which capabilities are required and which responsibilities are assigned (Fischer et al., 2006). In the scenarios of GLOBE, participants are required to understand the structure organization of UN bodies such as UN OCHA (OTH Regensburg, 2024). Process organization demonstrates how tasks are organized and how work is divided within an institution (Fischer et al., 2006). It describes how individual elements work together to fulfill the requirements of the overall system (Fischer et al., 2006). Situational awareness contributes to a clear, accurate, common, and relevant picture of external circumstances (Nofi, 2000). Furthermore, shared situational awareness facilitates decision-making and therefore enables a fast response to challenges by reducing gaps in the common knowledge network (Nofi, 2000). During the GLOBE simulation exercise, emphasis is placed on fostering awareness of unfolding events and their resultant circumstances and understanding the perspectives and interests of various actors. This holistic understanding of the situation enables participants of the GLOBE simulation exercise to adapt their management accordingly. If structure organization, process organization, and situational awareness are understood, the TA will comprehend the complexity of carrying out a planning task within international organizations as well as the necessities for its success.

During several rounds of GLOBE, the organizing team identified deficits in skill acquisition during the simulation-related debriefings. In addition, an increasingly negative attitude towards

the simulation exercise was evident due to declining participant numbers. It was also recognized that the success and impact of the exercise could be increased if participants understood the above mentioned learning objectives before the exercise, as participants are expected to apply the learning outcomes, even though they may not have fully grasped them. Thus, the organizing team saw the need to introduce these concepts to potential future participants in a pre-exercise. Thus, the new concept of GLOBE Tabletop was introduced.

4. Method

The first run of the GLOBE Tabletop took place in November 2023 with a total number of 32 participants. At the end of the exercise, 28 of the participants took part in a survey from which the organizing team could draw conclusions about the effectiveness of the exercise. The sample forming the base for the explorative evaluation consists of 28 survey respondents. 25 of those are first-semester students and three are third-semester students from the bachelor's program *International Relations and Management* at OTH Regensburg. The procedure of completing the questionnaires took place from December 06, 2023, until December 31, 2023. In order to have a low entry barrier to the questionnaire, the first question was posed in the format of a simple yes/no question. A ranking and complementary free-text items were used to evaluate the exercise elements. Then participants were asked on a four-point Likert scale (Disagree: 1; Rather disagree: 2; Rather agree: 3; Agree: 4) how prepared they felt for the GLOBE simulation exercise in regard to various aspects. The measures included self-developed questions by the organizing team of GLOBE Tabletop related to several objectives: assessment of the effectiveness of each exercise element in terms of learning success, evaluating the exercise's contribution to the feeling of preparation for the simulation exercise, and finding potential improvements for future GLOBE Tabletop exercises. While data concerning these different thematic areas was collected, only the answers related to the feeling of preparedness for the GLOBE simulation exercise are included in this paper. The collected data is evaluated in a descriptive way.

5. Results and Discussion of the Pre-Exercise Learning Approach

To attain the previously mentioned learning objectives beforehand, the GLOBE organizing team applied the concept of pre-exercise learning for GLOBE. The aim is to achieve the greatest possible learning effect during subsequent participation in the GLOBE simulation exercise. To validate the idea behind the pre-exercise learning approach through a tabletop exercise, the GLOBE organizing team surveyed the GLOBE Tabletop. The following results were obtained:

- The question of whether they felt thematically well prepared was rated with an average factor of 3.25 and with a standard deviation of 0,56.

- Understanding of leadership processes in international organizations was rated with an average factor of 3.29 and with a standard deviation of 0,59.
- An understanding of the structure of the simulation exercise was rated with an average factor of 3.11 and with a standard deviation of 0,72.

To the yes/no question of whether they would recommend GLOBE Tabletop to others, 100% of participants responded affirmatively. This confirms that the exercise was perceived as a positive experience. From the mentioned points, the participants' self-efficacy in relation to the upcoming participation in the GLOBE simulation exercise cannot be derived. However, they show a tendency for participants to see themselves as capable of applying their skills during the simulation. Even though different opinions exist in literature (Brück and Toth, 2022; Franzen, 2014), the four-point Likert scale was rated by the authors as the most appropriate tool for measurement in this context as no critical questions were asked in order to drive participants into a tendency and ensure that do not express neutrality. Since the presented explorative study only addresses a self-evaluation by the participants, this paper's findings are limited to level 1 of the Kirkpatrick Model which deals with reaction and therefore the extent to which participants found the exercise valuable, engaging and relevant to their area of work. In further studies, the model's other levels, which include learning, behavior, and results, should be assessed (Kirkpatrick & Kayser Kirkpatrick, 2015). The next GLOBE simulation exercise will take place in May 2024 and will provide an opportunity to directly compare the performance of participants who took part in the GLOBE Tabletop with those who did not. Such a comparison will be more indicative of the effectiveness of the GLOBE Tabletop concept.

6. Conclusion, Limitations, and Future Research

Because participants lack fundamental knowledge like structure and process organization, situational awareness, and complex planning tasks, learning processes in the GLOBE simulation exercise were often based on mistakes that could not be categorized by the participants, often resulting in major frustration. By introducing the innovative pre-exercise learning approach, a learning experience based on motivation and preparation is created to train participants for the simulation exercise and maximize capability development. In conclusion, it can be asserted that the integration of pre-exercise learning, composed of gamification and tabletop elements, as a preparatory step for simulation exercises was positively received among participants in the GLOBE Tabletop which indicates increased capability development in the context of humanitarian missions. The full potential of the combined application of GLOBE Tabletop as a pre-exercise and subsequent GLOBE simulation exercise will be further assessed in May 2024. GLOBE Tabletop participants will then engage in the GLOBE simulation exercise. The effectiveness of this innovative approach will be underscored through a comparative analysis between participants who have undergone pre-exercise learning via the GLOBE Tabletop and those who have not. As the approach to capability development through pre-exercise learning

for humanitarian missions is currently in its early stages of development, providing a definitive assessment of its success remains open. The present paper is the first one evaluating this matter, thus it is to be seen as a first step towards a more profound analysis. A more conclusive understanding is expected to emerge through continued research and the practical implementation of this innovative concept. Moreover, exploring the adaptability of this approach to diverse contexts, such as in military or medical settings, holds the potential for valuable insights. This exploration expands the scope of potential applications for the concept, inviting further investigation and inquiry.

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Implementation of a teaching initiation project in public health and its relevance to medical training

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Abstract

The study in question reports on the experience of medical students in monitoring activities in the disciplines of Practices for Integrating Teaching and Community Service. The monitoring was able to increase learning efficiency, motivation and commitment to the syllabus. The process of building the autonomy and critical awareness of the subject and his group about the teaching-learning process was fundamental to these results. The monitoring activity is important for establishing, expanding and fostering knowledge, enabling the exchange of information and knowledge between teachers, student-monitors and students, contributing to improved teaching in curricular components. It is concluded that the monitoring effectively enabled the production of critical thinking, the joint construction of knowledge and the systematization of different points of view between the teacher in charge, the monitors and the students, showing that the monitoring proposal enables the construction of learning based on self-awareness of the teaching-learning process.

Keywords: *monitoring, learning, collective health, medical education.*

1. Introduction

The word monitoring has its origins in the educational system. Monitoring is a pedagogical support tool that provides selected monitors with the opportunity to improve their technical and teaching knowledge, as well as increasing the theoretical and practical knowledge of the students assisted by the project. It also aims to contribute to the development of the skills and abilities necessary for the training of medical professionals, especially when it comes to Brazilian public health, emphasizing the importance of integrative practices and teaching and service in primary health care.

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Furthermore, the incentive to start teaching provided by monitoring is extremely beneficial in the context of continuing health education, since this pedagogical project enables the monitor to exercise autonomy in the educational process, develop dialogue, identify demands and create teaching strategies. These resources are in line with the future work of the medical professional, who will have to act in democratizing access to knowledge, in order to help the population that uses health services to understand their rights and duties, as well as promoting the autonomy, emancipation and commitment of social agents in the Primary Care setting.

By including the student-monitor in the construction and development of the disciplines, monitoring can help learning in line with a dialogical educational perspective, in order to bring the actors of the educational process closer together and contribute to future professional performance in the Unified Health System. This concept of educational improvement is reinforced by the National Humanization Policy, from the perspective of developing concrete practices committed to producing health and human beings in their creative and unique capacity (BRASIL, 2013).

At our university, the monitoring activity is linked to a Teaching Initiation Project, in which monitors are assigned certain tasks, such as: guiding students by assisting teachers, carrying out activities in practical classes; participating in activities that provide in-depth study of the content covered by the monitoring subject and assisting students, under teacher supervision, in individual and/or group work, fieldwork and others compatible with their level of knowledge and experience.

This study was motivated by the possibility of contributing to strengthening the exercise of monitoring activities in medical education institutions in Brazil, in which insertion into fields of practice occurs from the beginning of the course, providing a broader view of the reality that people are inserted in (Silva et al, 2015). Thus, this study aims to report the experience of medical students in the performance of monitoring activities in the disciplines of Practices of Integration of Teaching Service Community.

This is a descriptive study with a qualitative approach, based on the experiences of two monitors and the University´s profesor responsible for the monitoring program.

2. Experience report

The graduate course in medicine at the State University of Santa Cruz (UESC) has now reached the milestone of more than two decades of existence. And although it represents an educational exponent in the state of Bahia and the northeastern region, this course still lacks the necessary advances to become an even more complete academic benchmark in its mission of competent and humane professional training, and in line with the experience of other prominent educational centers in the national territory.

It is worth noting that in order to fill the vacancies for monitors, a selection process had to be carried out, established by the project's teaching/coordination team and published in the form of a public notice for applications on the university's official website. This selection process consisted of a theoretical phase and an interview phase; the theoretical phase consisted of a test, which sought to ascertain the level of knowledge on the main subjects in public health; the interview phase sought to ascertain the suitability of the candidates in terms of aptitude and desire for teaching, availability of time and other subjective criteria; in the event of a tie after the two phases, it was established that the coefficient of performance would become the tiebreaker criterion.

Monitoring was initially established by agreeing a relationship of trust and availability with the students being monitored, who were free to contact the monitors via personal messages or online groups. This communication strategy aimed to make monitoring demands dynamic, prompt, accessible and resolvable. It was also agreed that meetings would be held between the coordinating teacher and the monitors in order to align the project's activities within a timetable.

Based on this, the monitors often provided multiple and reliable references from extensive bibliographic searches in order to solidify and expand the subject's syllabus, including relevant topics to be presented by groups of students in large seminars, in which the monitors could participate by making methodological considerations about the presentations, as well as asking questions about the topics discussed. In addition, other teaching resources were provided to the students being monitored, such as thematic summaries, a list of residency questions and flashcards.

As for face-to-face activities, face-to-face meetings were held continuously in university spaces, in order to solve doubts or to build health intervention projects in the local community; the Google Meet resource was also used for some activities in epidemiologically unfavorable situations related to COVID-19. Also, the monitors conducted activities to theorize curricular subjects in classrooms, as well as proposing practical activities in meetings at basic health units.

On the other hand, the work of the coordinating teacher and team was also very important to the success of the project, and a work plan was proposed for the coordinator, who should: guide the monitor in the development of their routine activities within their attributions; promote the necessary training of the monitor regarding the use of different teaching and learning methodologies; promote, together with the monitor, a theoretical deepening regarding the contents covered in the discipline referred to for monitoring; hold periodic meetings; evaluate, based on pre-established criteria, on an ongoing basis, the performance of the monitors; monitor the student's performance within the subjects of their course, being sensitive to the possible interference of monitoring activities on curricular performance; provide guidance on the construction of project reports; encourage scholarship holders to participate in scientific events,

presenting products arising from the project; encourage the publication of results in scientific journals, medical congresses and periodicals, enriching training.

Additionally, an effort was made to develop a way to monitor the impact of the mentoring program on the mentored students. A questionnaire was devised to be filled out by the students at the end of the program, to assess the didactic trajectory and gains in the teaching-learning process fostered by the mentoring. Table 1 comprises the questionnaire questions that will serve as a basis for evaluating the program's impact, as well as continuous monitoring of its progress and improvements. In this sense, the evaluation questionnaire considers the protagonism of the student body in the teaching-learning process, taking into account students' opinions on the topics discussed in the course, the assessment methods used, and how the practical activities were conducted. This type of questionnaire reinforces the empowering role of the student in their own education, devising strategies for improvement based on a critical evaluation, comparing the objectives of the course with its didactic delivery.

Table 1. Questionnaire questions. Source: elaborated by the authors..

Elaborated questions	Type of response
How do you evaluate the theoretical exams conduted?	Quantitative response (0 to 5)
Do you believe the theoretical exams can be improved in any aspect?	Descriptive/qualitative response
How do you evaluate the conducted seminars?	Quantitative response (0 to 5)
Do you believe the seminars can be improved in any aspect?	Descriptive/qualitative response
How do you evalute the completion of practical activity reports?	Quantitative response (0 to 5)
Do you believe the practical activity reports can be improved in any aspect?	Descriptive/qualitative response
Do you believe there is homogeneity among students in learning the course syllabus? If there are discrepancies, what do you atribute them to?	Descriptive/qualitative response
How do you evaluate teamwork and relationships within your practice group?	Quantitative response (0 to 5)
How do you evaluate the practical activities proposed/perfomed in the course?	Quantitative response (0 to 5)
What do you believe could be improved in the practical activities of the course?	Descriptive/qualitative response
How do you evaluate your professor/tutor?	Quantitative response (0 to 5)
How do you evaluate other profesors/tutors, in activities where they were together with you?	Quantitative response (0 to 5)
What do you believe could be improved in the performance of profesors/tutors?	Descriptive/qualitative response
How do you evaluate the course´s syllabus in the contexto of Brazilian Public Health and its guidelines?	Quantitative response (0 to 5)
Was there any topic that could have been better addressed or that have not been addressed that you would like to discuss, in the context of Brazilian Public Health and its guidelines?	Descriptive/qualitative response

It is important to emphasize that throughout the year, the monitors' performance has been adequate in view of the balance of achievements and possible improvements that have been listed in reports that are developed halfway through and at the end of the project's term. These evaluations revealed a very positive balance for the first year of monitoring through the academic development of both the monitor and the monitored. Some of these achievements are: 1) improvement in the students' oratory, communication and critical thinking in the correlation between the subjects studied and the experiences encountered in practice; 2) greater understanding and consolidation of knowledge about SUS norms and policies, as well as other collective and preventive health issues; 3) optimization of study time; 4) greater support for students who find it more difficult to speak publicly during classes and also to express doubts directly to teachers; greater suitability of presentations in relation to the rules recommended by ABNT in Seminars and Intervention Projects in the local community; and 5) in-depth learning for monitors about teaching practices.

Despite such a positive impact of monitoring on the academic experience of monitors and mentees, it is important to note that there were challenges to overcome in this process. The first challenge consisted of the need to better operationalize the new technologies and active teaching-learning methodologies, such as roleplay/dramatization, the creation of concept maps and the use of Team Based Learning (TBL), which had been advocated in the project, but which were little explored when compared to the more conventional teaching methodologies. The second challenge consisted of the possible lack of physical spaces at the university to carry out some face-to-face activities, so virtual platforms became important tools for maintaining these activities. The third challenge was the conflicting schedules between the planned activities and the curriculum of the monitors, who, as a result, were unable to attend them; in addition, because the PIESC discipline proposes dividing students into smaller groups that must be inserted into an ESF or UBS, the monitors' monitoring of these groups in situ proved to be unfeasible. Finally, as this is an unprecedented project in the medical course at UESC, there was gradual and progressive adherence to the project by the students being monitored, who initially did not have the culture of seeking academic reinforcement offered by monitors.

3. Discussion

The core motivation behind the monitoring project lies in the intention to improve the treatment and participation of students in the educational process in Collective Health, both in the teaching-learning activities themselves and throughout the construction of academic life, thus also mitigating problems of academic evasion, learning gaps in the syllabus, as well as making it possible to research new teaching methodologies that suit the disciplinary proposals, integrating human and material resources to build sophisticated, complete and satisfactory didactics, by strengthening an autonomous attitude towards knowledge, a view shared by Frison (2016).

In the meantime, the monitoring project aimed to deepen the knowledge of Collective Health for the second year students of the Medicine course at the State University of Santa Cruz, so that they understood the main health problems and needs of the collective, as well as being able to develop realistic interventions to solve social problems, based on the compression of the services offered in Primary Health Care in the Brazilian Unified Health System. While this project is also characterized as an intervention in the teaching-learning process, contributing to critical and creative training in the future professional performance of the students contemplated by the program. As a result, the tutoring work has been able to contribute to learning, especially for those who have more difficulty understanding the teacher's explanation, those who need more time to work on the proposed activities and to understand the content (Anastasiou & Alves, 2006).

On the other hand, the development of the monitoring project aimed to develop teaching skills for the student-monitors, seeking to improve their academic training, thus enabling them to act in a responsible and competent professional manner in the future. In this sense, the program also establishes conditions for theoretical improvement, strengthening the interface between practical knowledge and theory, supported by student involvement in the teaching-learning process..

From this situation, it can be inferred that tutoring was able to increase learning efficiency, motivation and commitment to the syllabus, above all through a process of building autonomy, control and critical awareness of the subject and their group about the teaching-learning process (Anastasiou & Alves, 2006).

4. Conclusions

Considering that the project in question aimed to promote the adoption of strategies to contextualize content, approaching it in an interdisciplinary way, the introduction of monitoring provided an opportunity to develop planning skills and teaching responsibility, giving students greater autonomy in their process of constructing knowledge, which was reflected in a deeper understanding of the content taught.

Thus, it can be inferred that the monitoring activity is an important space for establishing, expanding and fostering knowledge, enabling the exchange of information and knowledge between teachers, student-monitors and students, contributing to improved teaching in curricular components.

In addition, one might inadvertently think that monitoring is an easy form of teaching, but on the contrary, it is a demanding practice that requires constant monitoring, commitment and care in the training and qualification of the monitors. Not only was the teacher in charge the producer of critical thinking, but students and monitors also built knowledge together, systematizing

different points of view, showing that the monitoring teaching proposal makes it possible to build learning based on self-awareness of the teaching-learning process (Frison, 2016).

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Envisioning AI-powered Learning Stemming from Piloted Personalized Education

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Abstract

Learning systems can potentially transform education and training by allowing educators to encourage behavioural changes and internalization of concepts in learners. This paper introduces such an AI-powered model for a personalized learning system, building on our success of hand-curated learning paths to support individualized education.

We utilize a network science approach as a construct to create an environment that is supportive of an individualized learning process, presenting an AI-powered framework. This framework is informed by student and faculty interactions with two custom created learning systems, experiences that shaped goals and expectations of the proposed AI-powered method since 2018.

This paper contributes to advancing the conversation around AI-powered learning systems and personalizing educational experiences. Our AI-powered model engages learners in their educational journey through individualized and adaptive learning paths, while meeting each learners' specific learning outcomes. We conclude with open research problems that surfaced from this vision.

Keywords: *Innovating teaching and learning experiences; AI-powered learning; personalized learning; individualized learning; AI-infused education model.*

1. Introduction

Traditional forms of education involve uniform instruction presented at the same pace and schedule for all learners. This approach may result in a lack of effective student engagement and often includes some learners being over and under challenged. Moreover, these educational

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models have the high potential to produce graduates with similar skill levels, rather than providing a platform for enhancing learners' existing skills and talents. Recent methods have explored the use of AI in classrooms through hands on projects to improve the learning environment, yet at scale success is still needed (Kumar et al., 2006, Zhang & Aslan, 2021).

A responsive way of engaging learners with educational content would be to map out personalized and adaptable learning modules, catering to each learner's existing knowledge levels and specific interests. In this environment, learning is driven by individualized learning outcomes by filling in the identified gaps. This facilitates the cultivation of a learning culture where individuals, while balancing personal and professional responsibilities, can engage in lifelong learning that complements formal education (Gera et al., 2019, Raj & Renumol, 2022, Reinhardt & Elwood, 2019).

In this paper, we introduce an AI-powered model for a Learning and Development System (LDS) that uses a non-traditional educational approach guiding students through a repository of networked micro-learning modules supporting personalized learning. LDS's micro-learning modules facilitate targeted and adaptive learning opportunities, to complement students' knowledge, skills, and abilities when ideally suited. We envision a world where personalized AI-powered learning technologies build upon students' unique knowledge backgrounds while challenging them to realize their full potential. Our AI-powered learning model for personalized learning is an approach that differs significantly from the traditional ones, aiming to improve students' focused engagement, support their unique circumstances, and lead to meeting tailored learning outcomes.

2. The Model: Creating the AI-powered Personalized Learning Experience

To ensure an effective personalized learning experience, it is imperative to capture relevant learner information automatically. This can be achieved by creating a dynamic learner profile that collects the necessary information stored as tags, such as the learner's employment, existing education, interests, personality, preferences, and accessibility of resources. Additionally, this information can be dynamically updated based on assessments and individualized learning experiences, allowing for continually personalized learning. This data is then used to personalize the experience and motivate the learner through a combination of intrinsic and extrinsic factors. Some examples of learner profile components could be learner's goals (such as "learner needs basic concepts of AI"), learning outcomes (such as "learner wants to use AI to help improve writing skills"), inferred competencies (such as "learner validated Unsupervised Learning as he previously used clustering and association rules in data analysis"), environment constraints (such as the "learner rides the bus for 30 min daily during the light study session and is available only 1 hour a week for deeper sessions") and so on.

2.1. The Learning Environment

Based on each learner's assessment and learning outcomes, content from a repository could be pulled to create a path, a sequence of individualized content, for each learner individually, where the personalization is guided by the learner profile content. We proposed to overlay a network of knowledge framework over a semi-structured learning material repository to guide learning path creation. Figure 1 introduces a visual of the correspondence between the information saved in the learner profile on the left, and the learning paths highlighted in yellow through a network of knowledge on the right. This style of creating learning paths has been successfully used by the authors since 2018 in graduate level courses (citations added once authors are added, post double-blind review).

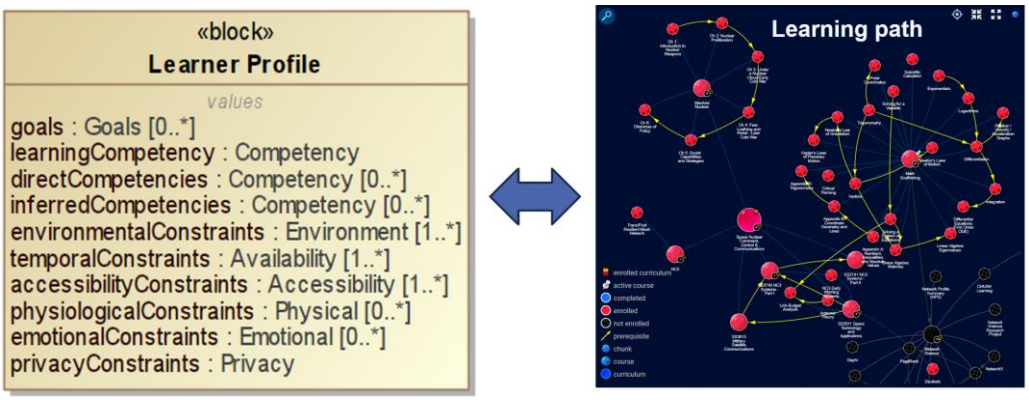


Figure 1: Individual learner profile information influence learning paths, while dynamically updating based on the individual learner's progress of the learning path

While this strategy of creating learning paths was a successful model, it did not scale as the authors had to find content, tag it appropriately, connect in the network, and create each individualized learning path based on each learner's profile. We propose a scalable model for personalized learning based on the functionality of AI that can overcome the limitations of relying heavily on human intervention.

We thus propose the idea of an automated approach of curating data and creating a personalized learning path for each individual, ensuring relevant and engaging content while supporting the curator as well. The real-time, continuous adaptation of learning paths makes education engaging, enhancing the quality and diversity of learning experiences. The implications of this model on educational practices could be significant, advancing our practices of personalized learning in the digital age.

Our four-step methodology for the AI-powered personalized education model is illustrated in Figure 2. Based on the above-mentioned non-AI model that we have piloted, our proposed

approach utilizes a networked environment of micro-learning materials to create AI-powered tailored educational experience as we describe next.

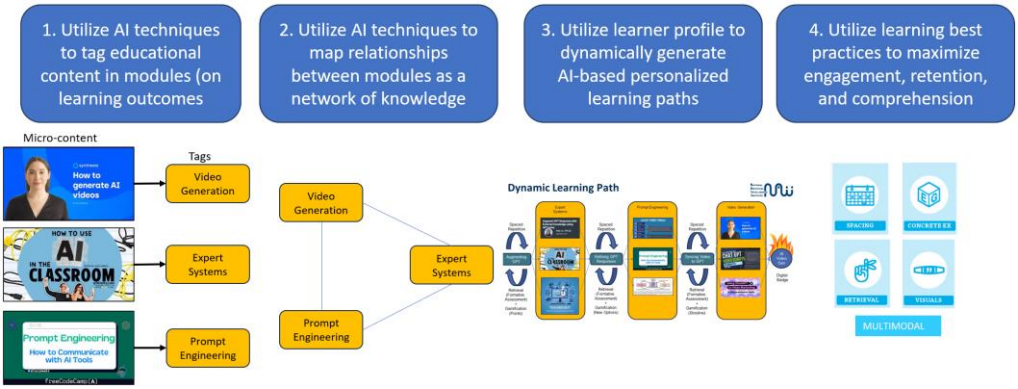


Figure 2: Our 4-step AI-powered model of tagging content, creating a networked framework, and identifying tailored learning paths through the network of knowledge to personalize the learning for each student based on each learner's profile (for readability Step 3 is enlarged in Figure 3)

The first step is AI-powered tagging of flexible micro-modules to support the creation of a tagged-rich environment. Our approach assumes that an abundance of content is available for a given topic to be learned. This data could be tagged (categorized) through multiple strategies including pattern recognition, machine learning, or term frequency/structure analysis. Tagging is important because AI is imperfect and human intervention may be necessary. Proper micro-module tagging is vital for a well-organized learning environment, and AI can help achieve this effectively. Moreover, based on the tags, AI can assist in addressing content gaps required for effective new content creation.

In the second step of our methodology depicted in Figure 2, we introduce the concept of creating a framework that automatically produces a network of knowledge as a collection of educational modules to support 21st-century learners. This network of knowledge is constructed by inspecting the structure and relationships between terms within content and existing courses. For example, the table of contents from a textbook or syllabus, or the keywords that a video is tagged with, provide the universe of related generalizations that are then linked by the content within the chapters and curriculum. The advantage of visualizing these relationships within a graph involves the ability of a human instructor to make adjustments. This is similar to prior work as illustrated in Figure 1 as yellow learning paths. Unlike a traditional textbook whose content is strategically sequenced and static once published, our micro-lectures repository of knowledge is dynamic in time as authors add added content or older content becomes obsolete. Thus, we propose that a model is needed to curate a network of knowledge that incorporates network evolution to support dynamic growth and retirement of micro-content (such as PDFs, videos, code, PPT, simulations, examples, exercises, etc.). This network's function is to allow

the creation of personalized and adaptive learning paths to enhance learner's education by filling in the exact missing gaps while building on each learner's knowledge and experiences.

In the third step of our methodology depicted in Figure 2, we create dynamic personalized learning paths. Much like a GPS dynamically adjusts a driving path from a source to a destination while roads are being built or closed, the structure of the network of knowledge's content allows a recommender system to assist the learner in moving through the educational materials even while the network evolves. Based on each learner's background, the system would provide different choices in how to engage the learning content, while ensuring the learner reached the desired destination meeting the individualized learning goals. Each student benefits differently from the available content as the suggested learning materials also build on learners' pre-existing knowledge.

Lastly, in the fourth step of our methodology depicted in Figure 2, we augment the recommendation of the learning paths based on best learning science practices, such as using multimodal content to engage multiple senses, space-repetition, relevant to each user application, and so on (Anderson, 2016, Jarvis, 2004, Kang, 2016, Kress et al. 2006, Merriam & Bierema, 2013, Seibert Hanson & Brown, 2020). This is accomplished in a variety of ways. Spaced repetition will likely be determined by parameters determined from past learning engagements. Similarly, gamification techniques could be determined by how well prior techniques were received by the learner. Additionally, we adjust the content and the interaction with the content based on learner feedback by updated parameters within the learner's profile.

2.2. An Example of Personalizing the AI-powered Learning Paths

Our AI-powered personalized education model creates learner-focused learning paths using interchangeable micro-learning content from the network of knowledge. The AI-identified content tags help in organizing the content into coherent and cross-referenced learning paths towards meeting the chosen learning outcomes. Figure 3 depicts this process by showing a portion of a learning path as the learner engages with "Expert Systems" content, followed by "Prompt Engineering" and later by "Video Generation" content.

We emphasize that the model should be content agnostic, we rather use particular topics as an example. Also, the content is multimodal for each of the three topics of this example, to support multiple sensory engagement. That is, the learners can engage with several types of content, such as videos, podcasts, images, PDF, and interactive activities to capture learners' interests and provide a more engaging experience. Additionally, we sprinkle space repetition between contents to solidify learning and facilitate retention.

The tags created by AI help identify what content can be swapped for what other content to meet the multimodal experience. This recommendation is achieved based on the learner's profile information, content preference, and performance on formative assessments and other learning

activities. To optimize the learning journey, we use gamification elements to support motivation and engagement supporting lifelong learners. This highly personalized approach makes learning adaptive, responsive, effective, and engaging for learners of all levels and backgrounds (Anastopoulou et al., 2003, Jewitt, 2008).

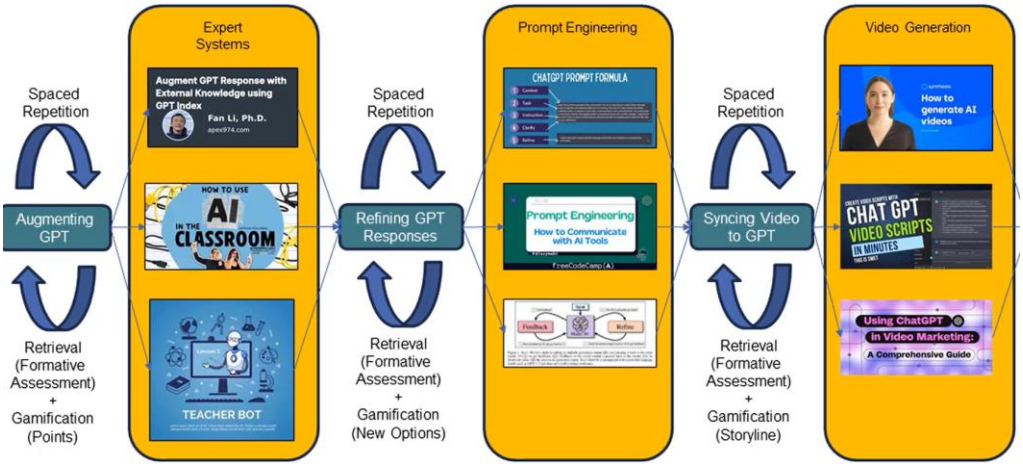


Figure 3. An AI-powered dynamic learning path

Overall, our methodology enables a scalable AI-supported personalized learning environment. By leveraging content tagging, networked content, multimodal presentation, and AI-assisted learning path creation, learners can benefit from a tailored educational experience that enhances engagement, knowledge retention, and performance.

3. Future Work and Conclusions

Learning methods that promise novel approaches to education and training still face the challenges of transitioning from merely sharing information to educating and developing learners. Generally, learning platforms tend to reflect an evolution of the physical classroom into a virtual experience. In this work, we present an alternative to that learning process by creating AI-powered learning paths based on a previously used novel learning model that utilized hand tagged content, networked content, and curated learning paths.

Our work addresses these challenges by proposing an AI-powered learning framework that leverages AI technology to meet the educational outcomes and provide flexibility by personalizing journey of the learner. We propose that a learning and developing system that personalizes the learning experience is needed to present learning content by scaffolding knowledge based on 1) the learner's goals, constraints, and behavior, 2) knowledge structure of

materials, and 3) assessment mechanisms and achievement records. Our proposed AI-powered framework consists of a four-step novel construct to automatize each aspect of the individualized learning journey and to advance personalized educational experiences represented by learning paths.

Our theoretical framework is informed by student and faculty interactions with two operational learning platforms. We built these learning platforms and they have now endured the scrutiny of students and faculty since 2018, whose feedback has shaped our goals and expectations for this work. Our framework creates an individualized learning experience supported by micro-learning content, building on assessments guided by learning outcomes. While these ideas can create a personalized environment, research is needed in identifying how to meet this vision. We thus conclude with open research questions to take this work towards implementation:

1. What is a good framework for a dynamic network of knowledge to incorporate network's evolution, as the curated repository of micro-learning allows updated content to be added, existing content to be updated, and old non-relevant content to be retired? This structure needs to ensure content discoverability by learners and curators, otherwise we end up with gaps as content retires, or we end up with content that nobody is presented as alternatives.
2. How can AI assist in addressing content gaps required for effective content creation to fill in the gaps that learning paths might have?
3. How can automatically personalized and adaptable learning paths be created, addressing tailored gaps in knowledge, while providing a cohesive learning experience for each user (as each learning path is generated while the learner progresses)?

Adult learning theory supports that learning takes place best when learners are actively engaged with relevant content, in a self-directed modality (heutagogy), through multimodal methods, uses space-repetition, and supported by peers. Relevant content is critical to adult learners' motivation and engagement, as learners should have opportunities to make content connections with their subjective experiences and skills development that support their professional education. Therefore, adult learners need an attention-grabbing, contextualized, interactive, and collaborative environment that facilitates their learning and meets their specific learning needs. We addressed the first four components in this research, and we further recommend that social learning be considered in future research, to have a comprehensive learning and development system. Future work also includes implementation and quantitative measures.

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"YouareImportant" Project: One Experiential Learning in Mindfulness in the Educational Context

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Abstract

Using Experiential Learning in Mindfulness, students from the Polytechnic Institute of Leiria's higher vocational technical courses in Clinical Secretarial and Social and Community Intervention were able to experience Mindfulness content and exercises in the second semester of the 2022/2023 academic year, as part of the Internship course. This active learning project took place in ten online training sessions over three months, involving four teachers and twenty students. At each session, all the students anonymously evaluated their experience and progress, giving feedback. To summarise, the students gradually became aware of the aims and potential of Mindfulness in their teaching and learning process in Higher Education, with a preference for mindful breathing practices and daily gratitude. The results suggest that the project could be replicated with undergraduate and postgraduate students.

Keywords: *Higher Education; Innovation; Mindfulness;Pedagogical Practices.*

1. Introduction

The concept of Mindfulness was translated from the words "sati" and "empali" and is understood as a particular and intentional mental state that centres attention on the present and facilitates awareness and self-perception (Leahy et al, 2013). It originated in Buddhist psychology and was introduced in different contexts by Jon Kabat-Zinn, who described Mindfulness as a psychological procedure that enables a relational quality of attention to experience. The person must observe every situation with interest, acceptance, without judgement, with genuine awareness of the present moment: 'here and now' (Kabat-Zinn, 2005). From the perspective of

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Meikeljohng (2017), interventions based on Mindfulness significantly improve working memory, attention, academic abilities, social skills, emotional regulation and self-esteem, as well as facilitate the stabilisation of adverse emotional states. According to Meikeljohngin and Robinson (2015), other benefits of Mindfulness can be considered, particularly in the educational context, in terms of behavior, focus on tasks and self-regulation, which consequently reduces emotional distress and brings progresses in academic performance.

According to Pereira (2019), research identifies the need to use these practices in educational contexts, from preschool to university. Learning to manage stress and emotions is one of the main objectives of Mindfulness-based programs in education (Da Silva & De Lima, 2023). From Ergas' (2015) perspective, this makes it urgent to restructure the education available based on greater attention and focus on the student's inner world and not just on learning. Based on the literature, it is understood that Mindfulness, from a cognitive/emotional point of view, has a positive impact on the training process of students at Higher Education Institutions (HEIs), the future professionals of the labor market in the 21st century.

In terms of innovation and creativity, it allows processes to become truly student-centered, facilitating applicability and flexibility in learning in practical contexts. It favors maintaining focus/attention and reducing stress (Schonert-Reichl & Roeser, 2016; Sobreiro, 2016; Serrão, Rodrigues & Ferreira, 2022). Integrating the practice of Mindfulness into the educational context of a HEI can strengthen students' knowledge, attitudes and behaviors (Schonert-Reichl & Roeser, 2016).

In this sense, an online educational program called TuésImportante (*YouareImportant)*, was created, to reduce stress based on mindfulness, applied to students of two Higher Professional Technical Courses (CTeSP's): Clinical Secretarial (School of Health Sciences of the Polytechnic of Leiria) and Social and Community Intervention (School of Education and Social Sciences), in order to reinforce their emotional and stress management skills. Regarding the professional profile of each course, it is known that: a) The CTeSP in Clinical Secretarial Studies aims to train professionals to plan, manage and carry out secretarial activities in health and/or rehabilitation institutions (Decreto Lei nº 11670/2019); b) The CTeSP in Social and Community Intervention aims to train professionals who can intervene in the most diverse areas of Social Work, contribute to community development, act and work with different audiences, in the most varied contexts.

The projet took place in the academic year 2022/2023, at the Torres Vedras Training Centre due to: (1) the proximity of two courses from different Organic Units of the same IHE´s; (2) the feasibility of this at level 5, where the last semester takes place only in a real context, with a closer relationship to the labor market (equivalent to one academic semester); (3) the applicability of the practice to students whose professional profile prepares them for working

contexts. Those are real-life experiential contexts that require students to deal with different people, borderline situations that require emotionally appropriate responses.

This experimental Problem Base Project was base on Experiential Learning in Mindfulness, according to Kolb´s Model, supported by the second edition of the Pedagogical Innovation Projects (Kolb, 2015). In experience-based learning, experience is central to the learning process and develops in cycles, one of each cycle consists of four stages: concrete experience (doing), reflective observation (reflecting), abstract conceptualization (thinking), and active experimentation (re-doing). Through repetition of this cycle, individuals can constantly improve skills and knowledge (Kolb, 2015).

1.1. Aim

This study qualitatively investigated the meanings of an educational experience based on a Experiential Based Learning Methodology (Kolb, 2015).

The projet includes different Mindfulness-based stress reduction techniques, used by the students on a regular ten-week basis in the second year Internship course of two Higher Professional Technical Courses at the Polytechnic Institute of Leiria: Clinical Secretarial Course and the Social and Community Intervention Course (Kolb, 2015).

2. Method

2.1. Study Design

The YouareImportant project followed the project methodology - Experiential Learning - 'learning by doing, collaborating', in order to capture students' attention, involving them in reflecting on real-world problems, making them acquire and apply new knowledge, as well as developing or systematising problem-solving skills (David, 2008 cited by Efstratia, 2014, p. 1257). In this methodology, the teacher appears as one "facilitator" of "knowledge" and "socio-emotional competences", and should know what students have learnt from experience" (Ibidem). This methodology allows for collaborative and experiential learning in a group of students who "work together to solve a problem, complete a task or create a product" (Laal & Ghodsi, 2012, p. 486). It is considered that the development of a Mindfulness-based stress reduction training project will provide this joint creation.

The participants took part in a project that included a regular training process in informal and formal Mindfulness techniques. It should be noted that there were two distinct moments: a first moment centred on the group of teachers and the acquisition of training in this area; a second moment of interaction and joint work between teachers and students.

2.2. Participants

The students eligibility criteria were cumulatively: (1) active enrolment in the 2nd year Internship course of the two CTesP courses; (2) signing an informed consent to participate voluntarily in the project. Purposive sampling was used in this case in order to select cases rich in information and different narratives in terms of contact with the world of work and dealing with the public, while still in the context of the Internship. The sample consisted in one group of twenty students from two CTesP courses at the Organic Units of the IES Politécnico de Leiria, making a total of 24 participants. The majority of participants were women, and the average age of participants was 23.5 years. There were 2 male and 18 female students with an average age of 23.2 years old.

The group of teachers (four teachers) were all teacher´s bellonging Polytechnic Institute of Leiria: two belong to the Department of Health Sciences and Technologies and one to the Department of Nursing Sciences of the School of Health and one to the Department of Social Sciences of School of Education and Social Sciences.

2.3. Procedures

The project - YouareImportant - took place over a 10-week period (between 20 February and 1 June 2023), using the Zoom videoconference application. This period includes the Mindfulness training carried out by the teachers (totalling 30 hours of each teacher) and the 10 sessions with the students.

The fact that it was carried out online made it possible for students and teachers to be in different geographical contexts, as the internships took place in different parts of the country.

With regard to the timing of the sessions with students, the consensus was that they should take place in the morning, before lunch, during the internship period, making it possible to collaborate with internship sites. All 10 planned sessions were held and evaluated anonymously, using one online survey, which was answered voluntarily. Between sessions, autonomous work (practising the techniques learnt) was the responsibility of each student. All the information about the projet was shared in WhatsApp group and Moodle platform of the 'Internship' course.

2.3.1. Structure of the planned training and sessions

Through their training and experience, the teachers selected a range of informal and formal practices to apply to the students. The first and the last sessions were dedicated to presentation and conclusion. The progress sessions followed the agenda: briefing on the previous session; feedback; presentation of the day's practice; homework proposal; evaluation of the session. In Chart 1 it´s summarized the total of the training.

Chart 1. Structure of the Planned Mindfulness Training

Sessions	Organisation of sessions
1	Project presentation; Team Presentation; Signatures Consents and Introduction of First Formal Body Scan; Assessment
2	Sharing Experiences; Practical Review; Body Scan Attention to the Body and Breathing; Final Sharing and Evaluation
3	Sharing Experiences; Practical Review; Introduction to Body Scan Practice paying attention to Thoughts, Emotions and Physical Sensations; Assessment
4	Sharing Experiences; Practical Review; Emotions and Physical Sensations; IThree-Dimensional Breathing Practice; Assessment
5	Sharing Experiences; Practical Review; Introduction to Mountain Practice; Assessement
6	Sharing Experiences; Practical Mountain Meditation; Introduction to Gratitude and Blessings Meditation; Assessment
7	Sharing Experiences; Practical Review; Tree Meditation Practice; Assessment
8	Sharing Experiences; Practical Review; Lake Meditation Practice; Assessment
9	Sharing Experiences; Practical Review Lake; Repetition Practices Selected by the group: Three-Dimensional Breathing and Blessing Practice; Sharing and Assessment
10	Project Closing; Final Assessment and Gratitude Practice; Gratitude to the group

Source: Own elaboration

3. Findings

The average attendance at the sessions was 9,5 students and always 2 teachers. The session time (50 minutes) was adequate, the sequence and resources available on online platforms were also appropriate. The practices recorded in audio by the teachers, allowing portability, was differentiating. Sharing thoughts and feelings during the sessions, it´s difficulf for the majority of the students, who preferred writtin in Zoom and WhatsApp chats.

From what we were able to find out, regarding prior knowledge about Mindfulness, the teachers had no prior contact with the practice. About the students, three indicated that they had already contact with the practice by saying: "*I had already practiced and left* (...) *was good to get back to it*" (P 12). The rest of the group, indicated that they had never contacted with this Practices ou topic: "*I have never tried Mindfulness*" (P1).

In session 1, it was possible to identify that students attributed to the project the characteristics/words: "*interesting, introspective, informative, knowledge, reflexive* (...)" (P 1, 5, 10).

In the last session, participants expressed themselves by saying: "*it helped to improve their daily lives, personal and professional*" (P3); "*the practices are inspiring, motivating*" (P4).

We can summarized the Informal and Formal Practices that Impact the group, with strong potencial to be used in Educational Contexts.

Mindfulness Informal Practices

To summarise, among the informal practices proposed, those with positive feedback in the reality of the workplaces, with potential for replication in Educational Contexts were the daily practice of Mindfulness and the daily practice of gratitude. We heard: "*thanking someone or ourselves is special*" (P9). Another participant said: "*Mindfulness is freedom from "autopilot". It helped me deal with problems in the health unit where I'm doing my internship*" (P2). The group understood mindfulness can be integrated into almost daily life routine, personal and professional daily routines. We can listen: "*My meals take now much longer than 15 minutes,…I take care of my meals with presence and attention*" (P 16).

Mindfulness Formal Practices

Among the formal practices proposed, the one that gained impetus and seems to have been integrated into the students' professional and personal reality, especially among those who at first were not so open to the project were: the practice of three-dimensional breathing and the practice of a brief body scan, namely: "*The fact that I realised I could breathe better was differentiating (...) the body scan is also incredible, and can be replicated anywhere or in any context. It's excellent*" (P 1). Another participant said: "*Tree meditation was amazing, ….it will be my new daily exercise when i finished the course…it´s great* " (P2).

In fact Lake Meditation was the less interesting formal practice for our students. They reflected about the meditation and said: "*it´s difficult to be focused on this meditation…maybe with some more training! But it´s the must difficult. If I can delete one practice from the projete, maybe this, was the one to deleat*" (P 14).

4. Conclusion

Both from the teachers' and students' perspective, there were positive results, in a short space of time. Everyone gave very positive feedback at the end, regarding the practices and the project itself. The group of participants positively evaluated the YouareImportant project, they considered the project, a great opportunity to "stop" in an organized way, for at least one hour/week, dedicating time to integrating the regulatory practice of Mindfulness during curricular unit Internship. Therefore, and due to the nature of the training, it will be important to replicate it in future editions in a face-to-face format. Addressing face-to-face it will facilitated the opportunity to focus on the participants inner world and experience.

The regular basis given to the process, the consistent use of practices, at each person's pace and time, were aspects valued by the students and dictated the keys to success/completion. The fact

that participation was not included in formal learning, but rather in non-formal learning, was considered a great added value. It was possible to learn about the range of formal practices and informal practices preferred by the group, highlighting the mindful attitude, the practice of gratitude and/or blessings, the use of three-dimensional breathing and rapid bodyscan. From the initial structure projected, it is considered that the practice of meditation with visualization should not be part of sessions in this context/format, specifically the Lake Meditation.

It is urgent to develop more exploratory research in Mindfulness, specially in Higher Education contexts, where projects like the one we present, can support future researches. This type of Pedagogical projet and experience can support experimental design in Mindfulness topic.

Therefore, it seems decisive to mantain this practice in level 5 training degrees, it´s also needed in undergraduate, postgraduate or master's degrees (Javadzade et al., 2024; Vuijk & Buil , 2004).

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A Roadbook for the Professionalization of Project-based Learning Courses

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Abstract

Project-based learning (PBL) is a teaching method that encourages active, experimental learning and transforms students from passive recipients to active participants. This method shifts the educational process from a teaching-centered to a learning-centered environment, thereby promoting effective and sustainable learning outcomes. Although a large number of research articles deal with learning outcomes from the students' perspective and the adjustments made by teachers, the transition from traditional to PBL-based teaching methods can be a challenge for all involved. The roadbook method provides an in several university courses tried-and-tested, development concept with defined result types and creation processes for project-based teaching. It also works for several cooperation partners, topics and student teams at the same time and allows sufficient flexibility in execution. In addition to the advantages of a project-based course for students, it also simplifies the necessary activities for lecturers and cooperation partners.

Keywords: *Project-based learning; Development Concept; Data-centric process.*

1. Introduction

Project-based learning (PBL) is a teaching method that promotes active, experience-based studying and turns learners from passive recipients into active participants (Thomas, 2000). This method, based on constructivism (Reinmann-Rothmeier, 2001), shifts the educational process from a teaching-centered to a learning-centered environment, thereby promoting effective and sustainable learning outcomes (Helle, Tynjälä, & Olkinuora, 2006). At Munich University of Applied Sciences, business administration students from Munich (Germany) and IT students from Tampere (Finland) were to work in several teams to solve different digitalization topics from several cooperation partners in a joint course in one semester.

According to Thomas (2000), PBL involves the completion of complex tasks that usually result in a real product, service or even just a presentation to an audience. But, the support for lecturers

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(Condliffe, 2017) often remains at a very basic level. A more or less free-form project-based course can become a risk. Especially, projects in the field of digitalization of business processes are accompanied by the creation of a business concept with subsequent IT design, development and testing. Due to the complex, company-related context with changing cooperation partners from industry, go along with current challenges and authentic customer behavior such as unclear tasks and change requests.

Since industrial practice also follows fixed procedures such as design thinking (Jia, 2023) or optimization of business processes in order to minimize risk and maximize success, it makes sense to use these structures as the basis for detailing the weekly course sequence for project-based courses as well. The roadbook concept provides lectures and students with a structure of procedures that they are often already discussed in theory, allowing them to concentrate on the content and interaction with cooperation partners and fellow students. Lecturers benefit from the fixed framework from faster planning and initiation of a course, structured implementation of projects, even with several cooperation partners and topics. For the cooperation partners, the clear, previously agreed structure facilitates participation in project-based courses through fixed tasks, time frames and interaction points.

The following section outlines the current state of research and provides an overview of the roadbook concept and its theoretical derivation. The following section reports on the practical application at the university.

2. Related Work

Although a large number of research articles deal with learning outcomes from the students' perspective, the transition from traditional to PBL-based teaching methods can be a challenge for teachers. Among others, Zhang and Ma (2023) show in their meta-study that PBL has positive effects on learning outcomes with a focus on academic achievement, thinking skills, and affective attitudes. Furthermore, it was found that the effects are influenced by various conditions such as subject area, course type, academic period, group size, class size, and experiment period. Many aspects such as group size, the need for a real-life task, and interdisciplinarity increase the burden on teachers. Also, Almulla (2020) explores the effectiveness of the PBL approach as a means of engaging students in the learning process. The results show that the PBL method improves student engagement by facilitating knowledge and information sharing and discussion. Therefore, a framework for PBL for lecturers is requested, consisting of guidelines for teachers to incorporate the PBL approach in different areas of learning and learning processes. Helle et al. (2006) also point out that the majority of scientific articles are exclusively course descriptions of individual courses. In addition to the technical aspects, it is analyzed that the organization and administration of project-based courses is time-consuming. According to Condcliffe (2017), there are several levels of use for PBL. The

teacher-initiated PBL is most flexible but lecturers start these courses "from scratch" or gather input for the course themselves, which means a great deal of individual effort. For the effective use of PBL, Barron & Darling-Hammond (2008) call for support for the role of the lecturer. According to Blumenfeld et al (1991), the lecturer should also be supported with a "project support environment" that provides knowledge about implementation, help for self-help and for planning and management. Groschel and Roth-Dietrich (2018) reports on the implementation of a project-based course with external cooperation partners with an organizational and process structure, which describes a general technical and rough time schedule within the framework of a practical project in a course. Bernstein et al. (2005) take the approach of using a virtual software development company and a standardized procedure from software development. Although the need for lecturers is partially addressed, there is no discussion of operational support to get that framework.

3. Roadbook Concept

With the help of a universal roadbook concept, a project-based course is to be professionalized by providing a clear and accepted course structure in the form of procedures and results, but also offering freedom of scope and feedback opportunities for students.

3.1. General concept

A roadbook is intended to make it easier for lecturers to plan and implement a PBL-course with known objectives and result types, but also for students to master the challenges that arise with unfamiliar project topics. A roadbook is a detailed guide that offers participants through orientation, efficiency in planning and implementation and safety, but also freedom in terms of content. A project-based roadbook usually consists of the following components:

- Project starting point in the form of defined assignment descriptions and project end point in the form of expected result types, i.e. deliverables for the client and lecturer like software and business concepts
- Overview of the overall process
- The content-related tasks between the individual course slots (and the overall course) as sub-results types
- Detailed descriptions of the procedure to be used (process for creating the sub-result types)
- The roadbook uses templates to standardize the creation of the sub-result types
- The roadbook contains a detailed schedule in a specific time frame (i.e. semester)
- Notes: Helpful notes and explanations increase success.

3.2. Data-based processes for building the roadbook

The key elements of a roadmap are the standardized partial deliverables (i.e. sub-results like a `Persona` in design thinking, an `IT Architecture` in software development or a `Retrospective` in scrum) and procedures (i.e. the process to develop the sub-results) that offer participants orientation, efficiency and security in planning and implementation. The approach of Müller (2007) for the development of a data-driven process structure serves as a basis for the design of project-based courses. The aim is to reduce effort by increasing model reusability, i.e. not "reinventing the wheel" in each semester and maintainability and a parallelization of several projects and cooperation partners in a group of students.

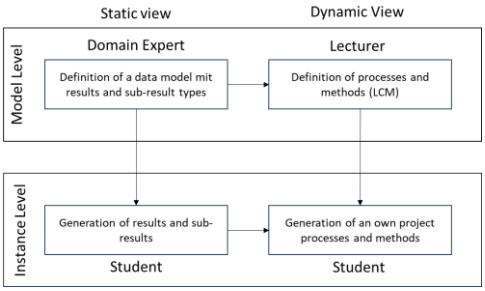


Figure 1. Data-based process – derived from source: Müller et al 2007.

In general, this requires (Fig. 1) the definition of the (sub-)result types and their relationships as a static view and the definition of the processes as a dynamic view for generating a course schedule. Furthermore, the two levels, i.e. model level in planning by the domain experts and lecturers and instance level in the implementation by students are required.

Static view

The domain specific data model consists of object and relation types and is specified by domain experts. This data model will be instantiated by the students in creating the specific project results during the project time. The object type represents a (sub-)result type of a procedure for solving a task. A relation type reflects the relationship between two object types. For a design thinking project, a domain expert will request sub-result types such as a `Persona`, a `Storyboard` or a `Vision` (Fig. 2). In addition to instructions for implementation and tips, templates are also provided.

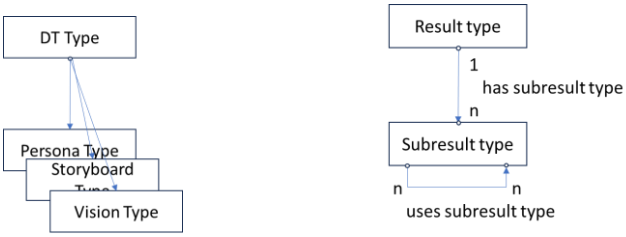


Figure 2. Result Types and Design Thinking Example on Model Level

The instance level is established during the implementation of the student projects. Instances are the specific `Persona` for the respective case: these are created in the implementation of the project and are vertically related to the specification of the model level. The materials provided in the model level support and standardize the student's results.

Dynamic View

Dynamic aspects of the creation of the object types are described by the lecturer in the processes at model level in order to derive the course sequence. The lecturers describe the dynamic aspects of each object type by modeling the "life cycle" of the objects/ sub-results through processes and their sub-processes. The LCM (Life Cycle Coordination Model), named by Müller et al (2007), structures the states and creation of the result types and their dependencies. Each result and sub-result type is described in the LCM with its dynamic aspects. For this purpose, the activities for changing the result and sub-result types and their status are modeled (fig. 3).

The actual creation of the results by the students is shown at the instance level and is derived from their results under the specified process structure. The difficulties lie in the process, but also in the dependencies of the different results.

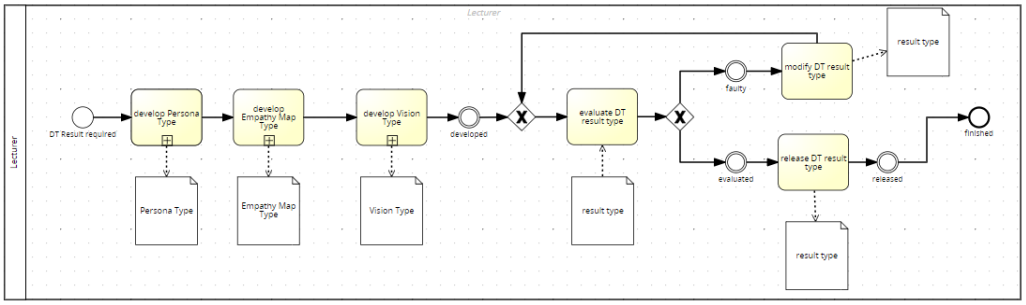


Figure 3. Example Design Thinking of LCM on model level modelled in BPMN

3.3. Procedure for creating and improving roadbooks

Roadbooks are set up initially by domain experts and lecturers, but are subject to a continuous improvement process, as each implementation provides new insights and potential. Based on

the data model and process model at model level, the roadmap of a course can be derived by adding specific course content, times and other restrictions to the course.

1. Design initial data model from existing procedures at model level by domain experts: Collect of all necessary result and sub-result types and their dependencies and derive specific templates, descriptions and work instructions
2. Derive initial processes and sub-processes from data models by lecturers with their corresponding states at model level through process modeling with dependencies, interfaces, roles and result types and mapping to the respective time slot of the class
3. Implementation of a class with multiple instantiations in parallel projects through students. Of course, the weekly time slots of the course are fixed for lecturers and students.
4. Optimization of data models and processes after each implementation such as adding new data types, smoothing interfaces, new interactions or improved quality assurance.

4. Sample Case

A typical setup can be found at the Munich University of Applied Sciences in the Co-Innovation Lab (www.co-inno-lab.org), where each semester approx. 50 business administration and computer science students with several cooperation partners from industry, associations or authorities are to solve real challenges in teams of approx. 10 students, in which a business concept and an IT prototype are to be implemented on a cloud platform. The duration comprises three months (one semester) with approx. 150 hours of working time, of which approx. 50 hours in attendance. The examination is a project paper. The course comprises the three phases of preparation, implementation and follow-up.

- In the preparation phase, domain experts optimize and fix the general (sub-)results at model level. On the IT side, this includes an IT architecture; on the business side, it includes a process model. A lecturer from business and a lecturer from IT are usually used for this. From a dynamic perspective, the rough schedule is laid out in terms of semesters and vacation periods in order to finalize the roadbook. Before the start of the projects, the students receive an information package about the requirements of the project paper with result and sub-result types, the general procedure and the PBL process.
- During implementation, the projects are carried out by the respective teams - usually five to six projects in parallel with the help of the existing structure. Analogous to Bernstein (Bernstein, 2005), the module begins with the description of the "consulting firm" by the lecturers as the management team. On this basis, the challenges and cooperation partners are then introduced, teams formed and topics assigned. The actual processing takes place on the basis of the roadbook, in which students work on the result types independently,

customize the process for their own team and topic. Several sub-results are discussed each week in class. The cooperation partners are invited at predefined times to review the results and provide input.

- In the follow-up, the results are finally submitted to the cooperation partners and the supervising lecturers and blog posts are published. In a joint discussion between lecturers and domain experts, adjustments are made for the next semester.

5. Critical Discussion

Nevertheless, there are issues that can only be dealt with to a limited extent, even through professionalization, but rather require individual treatment. Despite the professionalization of the process, human problems such as intercultural or interdisciplinary conflicts can arise among the students, different time availabilities outside the course, but also development problems due to a different understanding of result types. Dealing with cooperation partners and understanding the current situation is particularly unfamiliar. Lecturers are often faced with the question of when and how to intervene in teamwork in terms of organization or content, or which controlling function should lie more with the cooperation partner. The cooperation partner should be informed in advance about the expectations regarding the scope of the results and, if there is too little project experience, about the tasks such as content-related feedback on results during the project. Important here are the additions for quality assurance on sub-results by the participants through group discussions, performance assessments, solution reviews or self-assessments (Barron et al 2008). It should also be noted that this type of synchronization of several parallel projects using the roadbook only works if the project types and result types are the same.

6. Conclusion and Outlook

The roadbook has proven to be a suitable tool for planning, but also for the implementation of project-based courses. Also in international cooperation projects, it makes it easier for everyone involved to organize courses that are based on process-driven challenges. The students are placed in a highly complex and challenging situation due to the project topics, the cooperation partners and the interdisciplinary approach. However, the roadbook helps all those involved to obtain certainty and planning in advance and still retain the freedom to shape the content. A side effect of this realistic lecture is the opportunity for application-oriented research for academic staff and for theses, which arises from a variety of challenges faced by the participants.

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Impact of an Undergraduate Level Course on Student Perception of Ageism: Evidence From the Analyses of Student Post-Course Reflections

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Abstract

Ageism is a growing issue that affects all nations, though it receives limited attention in higher education curricula. The purpose of this qualitative study was to utilize post-course student reflections to examine the benefits of participating in a 1-credit course focused on ageism. The course pedagogy provided education on normal aging and intergenerational contact, elements shown to reduce negative aging stereotypes and reduce ageist perspectives in college students. Participants included 20 undergraduate students from various disciplines. Analysis of narrative data revealed students had a greater awareness of discrimination, prejudice, and implicit bias associated with aging resulting from the course. Proposed methods for reducing or eliminating ageism were reported within four different categories including education, greater intergenerational contact, personal actions, and legislation. This study provides evidence related to the benefits of combining accurate information about aging and exposing students to quality intergenerational experiences with older adults as ways to address ageism.

Keywords: *Aging; ageism; implicit bias; higher education; post-course reflections; qualitative analysis.*

1. Introduction

According to the National Poll on Healthy Aging (2020), ageism is a serious concern as 82% of older adults reported experiencing one or more forms of everyday ageism, and 40% experienced three or more forms such as in their interpersonal interactions, or hearing, seeing or reading suggestions that aging is undesirable. Negative stereotypes on age not only have a negative

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effect upon quality of life, but are recognized as a public health issue (World Health Organization, 2015). Prejudice against older people is also one of the most common types of prejudice, likely because it is often overlooked or publicly accepted. It is important to recognize that ageism can affect individuals of any age, but older adults are most negatively impacted, affecting cognition (Lamont et al., 2015), mental health (Wurm & Benyamini, 2014), increased diseased state (Allen, 2015), and length of recovery (Levy et al., 2012). Also, ageism can cause older adults to feel excluded or isolated from society (Wethington et al., 2016).

According to Iversen et al (2009), ageism includes three dimensions: stereotypes, the cognitive dimension (e.g. *I think older adults are a burden to society*); prejudice, the emotional dimension (e.g. *I do not enjoy conversations with older adults*); and discrimination, the behavioral dimension (e.g. *I try not to interact with older adults*). Additionally, stereotypes on aging can be either positive (e.g. Older adults are beneficial to society) or negative (e.g. Older adults are irrelevant) and can be either explicit or implicit (Levy & Banaji, 2002). Levy and Banaji (2002) assert that implicit ageism is unique in that there is not an explicit hatred against people of a different age, however a common acceptance of negative attitudes and beliefs towards older adults emphasize the importance of improving knowledge on aging and improving attitudes towards aging.

While controversial topics including discussion around stereotypes is not uncommon in higher education, ageism, the discrimination, prejudice, and stereotyping of people based upon age (Ayalon et al., 2019), is rarely adequately addressed and often neglected leaving many students unaware of its harmful effects and how to address it. While anyone can express ageist attitudes, young adults, specifically traditionally-aged college students, may be more likely to express negative attitudes toward older adults (Guest, et. al., 2021; Wurtele & Maryuma, 2013) compared to other age groups (Berger, 2017; Gutiérrez & Mayordomo, 2019).

Recently, a study was conducted on the benefits of an elective course focused on ageism (Beach et al., 2024). The findings of this study demonstrated the feasibility of improving undergraduate student perspectives on aging in a low stakes 1-credit honors course by teaching accurate information about aging and providing quality experiences to interact with older adults inside and outside of the classroom. The overall purpose of the present study was to examine these students' implicit biases through their qualitative reflections following this 1 credit seminar course on ageism.

2. Materials and Methods

2.1. Study context and design

This study focuses on the analyses of qualitative reflections submitted by undergraduate students following a 1 credit seminar course on ageism at a medium-sized public liberal arts

university in New York State. Following the completion of the course at the end of the spring 2022 semester, students were asked to reflect on the impact of the course on their perception of older adults and whether or not the course changed their views on ageism. In addition, students reflected on ways to reduce or eliminate ageism both in their academic institution and in society at large. Separately, demographic information including student age, gender, and year in college were collected to provide context for the data obtained.

2.2. Research questions

The research questions examined in the student post-course reflections can be summarized as follows:

1. What is the impact of the course on your perception of ageism – including perspectives on aging, age discrimination, and attitudes toward older adults?
2. What are some ways to reduce or eliminate ageism?

2.3. Study participants

A broader description of the overall methods used in the study as well as the full demographic information of the participants have been published elsewhere (Beach et al., 2024). Briefly, a total of 22 students (21 undergraduate students and one older adult auditor) self-selected for the course. Nearly all students (n=20) submitted a post-reflection at the end of the course. The student participants represented different academic disciplines and majors on campus. This study was approved by the university's Institutional Review Board (IRB).

2.4. Data analysis

Transcripts from student post-reflections were analyzed by two authors using qualitative description methodology (Sandelowski, 2010). The authors read the transcripts independently and then summarized the information into categories that represent similar meanings in relation to the research questions. Following their independent analysis of the post-cost reflection transcripts, the authors met to compare their analysis results. Areas of disagreement were discussed by the authors until final consensus was reached on the final themes or major findings from the study. Specifically, this methodological approach enabled the generation of themes relating to the impact of the course on student perception of ageism, as well as ideas on ways to reduce ageism at academic institutions and society at large.

2.5 Study rigor

To ensure the rigor of the study, the researchers noted and discussed their biases as part of the data analyses process. Hence, the emergent themes and their descriptions were close to how the students described them in their post-course reflections. In addition, the setting of the study in

a liberal arts university in New York State helps to improve the applicability of the findings to similar educational institutions in the United States, thereby increasing transferability of the findings. Further, an audit trail of all decisions related to student participation in the course, post-course reflections, researchers' meetings, analyses, and writing was kept and are available for auditing. Finally, confirmability was achieved since the study's findings are traceable to the perspectives of the undergraduate students as described in their post-course reflections at the conclusion of the course (Lietz & Zayas, 2010; Lincoln & Guba, 1985; Lincoln & Guba, 1986).

3. Results

A brief demographic profile of the students who enrolled in the course is presented in Table 1. A more detailed profile has been previously published (Beach et al., 2024). Of the 22 students who enrolled in the course, 20 students submitted the post-course reflection. Table 2 summarizes the major themes derived from the analysis of the post-course reflections submitted by these students.

Table 1. Participant demographic profile

Variable	**Number (n)**	**Percent (%)**
Gender		
Female	14	63.6
Male	8	36.4
Nonbinary	0	0.0
Class (year in university)		
Seniors	4	18.2
Juniors	2	9.1
Sophomores	10	45.4
First Years	6	27.3
Ethnicity		
White	17	77.3
Hispanic	0	0.0
Asian	1	4.5
Black	0	0.0
American Indian	0	0.0
Not identified	4	18.2

Table 2. Themes from student post reflections

Research Question (RQ)	Themes	Supporting quotes
RQ1: ***Impact of the course***	Greater awareness of age-based discrimination	"I would say that my key takeaway is a greater awareness of age-based discrimination in all contexts and settings. With each class, I was introduced to more and more forms that ageism may take that I had not noticed before. Whether it is through birthday cards, advertising, or blatant neglect, I've learned that older adults are mistreated all around us." I started this semester having no idea what ageism was. I had never heard of discrimination based on age, and had never even thought of it as a possibility. Now that I've taken this course, however, I see ageism all around me; in the things my friends and family say, the things I used to do, the workplace, public spaces, educational settings, everywhere."
	Implicit bias awareness and better preparation to combat all types of discrimination	"Sometimes I would ask or offer someone help with moving something or completing a task, even though they were perfectly capable of doing it. At the time I thought I was just being nice, but now I see that I only did it toward older adults, and they may have seen it as me thinking that they were incapable of doing it themselves. This class has allowed me to self-reflect on my attitudes towards those around me and hopefully help me become a better person" I went to buy a birthday card for my boyfriend, and I was reading some of the cards. I started reading some of retirement and 60s and 70s birthdays

		because I remembered talking about those in class. I was reading them with a whole new perspective and didn't find them funny like I may have in the past.
	Change in personal attitude towards aging and ageism	"*The biggest takeaway I can think of from this class is my perception of age changing. As previously said, I thought that "old" was anyone over 65. However, after seeing more and more cases (both outside and inside the class) people in their 60s and 70s were fit and intelligent, sometimes way more than me!*"
		"I used to be afraid of getting old and becoming lonely or sad because my quality of life would decrease. Now, I'm more excited to grow into a more complete and wise version of myself."
RQ2:		
Ways to reduce/eliminate ageism	Education and/or training	"*Education and training are important not only for those working with the older generation, but also the older adults themselves so they can recognize if they are victims of ageist behavior and defend themselves and/or report it*"
	More intergenerational contact	"*I think mixing generations is such an important aspect of fighting ageism. Once people see that older adults do have their own interests and personalities, rather than lumping them into a category, empathy can be gained, and even friendships across generations*."

	Personal actions	*It is important to be able to recognize ageism when it is happening and call it out as one would with any other kind of discrimination.* "This can be done by addressing older populations with the right language. Use older, or older adult instead of weak and frail."
	Legislation	*"Perhaps the greatest change could be brought through stronger legislation concerning age-based discrimination. While some laws do exist that forbid this kind of judgement during the hiring process, they are easily avoided and hardly enforced*."

4. Discussion

Qualitative analysis of post-course reflections revealed that students had a greater awareness of discrimination and prejudice associated with aging. Importantly, students described ageism being present in many aspects of society including the workplace, healthcare, marketing, and more. Many described being unaware of this serious issue until enrolling in this course. Results also indicate the course impacted students' attitudes and subsequent behavior toward older adults due to a greater awareness of their implicit biases (Levy and Banaji, 2002). Several students described a classroom lecture identifying examples of birthday cards that perpetuate negative aging stereotypes and how this awareness resulted in being more selective in purchasing these types of cards for aging family members. Other students described applying their knowledge about ageism to point out and correct ageist remarks made by family and friends. Students also reported having improved personal attitudes toward aging. Specifically, that aging is not a time of loss, nor decreased functional ability that is universal. This provides further evidence that course design which incorporates accurate information about the aging process (Allan & Johnson, 2009; Levy, 2016) and the promotion of positive intergenerational learning opportunities (Lytle & Levy, 2019), can contribute to improved knowledge and attitudes related to aging.

Identification of ways to reduce or eliminate ageism were reported within four different categories including education, greater intergenerational contact, personal actions, and legislation. Suggestions related to education ranged from workshops and course content infused into high school and undergraduate curricula, to more generalized public education to the larger population, especially older adults who may not realize the ageism they experience. Greater intergenerational contact, achieved through course assignments and an older adult participating in the course, was recommended by many students as they described being able to dispel myths of aging by developing positive relationships. Several participants described the importance of developing mentoring programs and engaging older adults who are active and positive role models for aging. A large number of students described the importance of taking personal actions for combatting ageism. This was often described as speaking up when someone makes an ageist comment, and taking personal responsibility to educate others about how their language negatively affects others and promotes ageist behavior. Language is indeed a major contributing factor toward ageism and large-scale campaigns are working to address this (National Center to Reframe Aging, 2024; World Health Organization, 2021). For the final category, some students described using legislation to enforce violations of age-based discrimination. Others described legislation within the context of education to mandate training about ageism in schools and universities.

One limitation to consider when interpreting these results is the students who participated in this study self-selected by registering for a course titled, "Ageism". Students interested in working in an aging-related field, or having had previous positive experiences with older adults may have been more likely to register for this class. While this self-selection may have impacted attitudes toward older populations prior to the course, the insightful post-course reflection responses highlight a new awareness of their perspectives and attitudes toward older adults. Another factor to consider was the presence of one older adult auditor enrolled in this course, a female in her late 80s. This older adult registered for the course as part of the university's lifelong learning initiative (Dauenhauer, Heffernan, & Cesnales, 2018; Hazzan, Dauenhauer, & Heffernan, 2021; Heffernan, Hazzan, & Dauenhauer, 2022). Her outgoing nature and engagement with many students in the class may have contributed to students' growth by providing a consistent opportunity for intergenerational contact with a healthy, engaged, community-dwelling older adult. It should also be noted that the sample of students is disproportionately white and this may pose a limitation to generalizability. Lastly, it is important to note that while most student reflections demonstrated improvement in knowledge and attitudes toward aging and the issue of ageism, there was one student who dismissed much of the information and interactions within the course, especially the topic of implicit bias and the seriousness of ageism. This underscores the reality that ageism education, similar to other forms of bias and discrimination (e.g., racism, sexism, etc.), presents challenges to try to educate those who are not yet able to consider, or

believe, that these issues exist, or think that collective action is needed to address these systemic issues.

In conclusion, the post-reflections from this this course, in addition to the information provided from the larger study by Beach, et. al., (2024) provides further evidence related to the benefits of combining accurate information about aging and exposing students to quality intergenerational experiences with older adults. It also provides educators an example of how a 1-credit course offering can have a positive impact on ageism in a higher education setting.

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Mentors' identity approaches of pre-service teachers

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Abstract

The impact of the student-teacher mentor's identity is crucial for the development of pre-service teachers during their practicum, influencing skill acquisition, knowledge assimilation, and the nurturing of self-esteem. This research delves into the area of mentoring approaches for early childhood and primary student-teachers in Spain. Using a qualitative approach, data from 35 mentors was analyzed to understand their approaches in guiding pre-service teachers. The study identified three distinct mentor identities approaches: those focused on developing students' design skills, fostering socialization, and facilitating professional growth. To enhance the quality of mentorship, universities and school-university partnerships should prioritize the training of mentors in these approaches, ensuring they can provide optimal guidance for the future educators they support.

Keywords: *mentoring; pre-service teachers; approaches, identity.*

1. Introduction

During internships, student-teachers highly value their mentors (Lindgren, 2005; Marable & Raimondi, 2007), seeing them as a crucial source of practical advice for their future profession. Positive internship experiences yield numerous benefits for future teachers, including increased confidence, self-esteem, professional growth, enhanced problem-solving abilities, development of classroom management skills (Malderez et al., 2007), and adaptation to teaching norms in schools (Wang & Odell, 2002).

Since the Bologna Process, which established the European Higher Education Area, mentors for student-teachers in Spain have gained importance. The law outlines mentors' functions, including welcoming, advising, evaluating pre-service teachers, and introducing them to teaching practice. However, mentors often lack training and guidance for these responsibilities. Universities typically only request mentors to provide evaluation reports on specific tasks

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performed by their mentees during the practicum period, without offering additional support or training.

Despite the absence of specific institutional training in Spain, extensive research has been conducted on the general functions of student-teachers' mentors (Martínez & Raposo, 2011), mentor competencies (Cuelliga, 2015), and student-teachers' opinions on mentoring (Mendoza-Lira & Covarrubias-Apablaza, 2014; Vallejo et al., 2019). Traditional studies often categorize mentors from the students' perspectives (Colomo & Gabarda, 2019). However, no studies in Spain specifically analyze the identity of early childhood or primary teachers as mentors of pre-service teachers based on their interactions with mentees.

Our goal is to outline the identities mentors associate with when guiding future teachers in schools, aligning with legal requirements and the attributes of a quality mentor (Ellis at al,, 2020). Established mentors tend to resist change, posing potential issues in the midterm. Identifying these identities enables universities to initiate development projects for current and future student-teachers' mentors. Recognizing the pivotal role of practicum in teacher education programs, there's a clear need for a more proactive and responsible approach to teacher education as a whole (Hoffman et al., 2015).

2. Pre-service teachers mentoring

A mentor's identity becomes apparent through the functions and actions mentors perform in their professional role. A mentor's identity is reflected in their actions, emphasizing certain functions over others. The various responsibilities and functions arising from research on pre-service teacher mentoring illustrate the connections between specific actions and a mentor's purpose in a given context.

Mentoring involves various activities such as supervision, evaluation, orientation, advisory, and organizational tasks. Wildmand et al. (1992) identified eight key mentoring activities based on analysis of reports from 150 pre-service teacher mentors, including encouraging reflection, directing actions, providing support, offering information and resources, maintaining motivation, receiving feedback, and acting as mediators. Mentoring advice covers professional issues, cultural context, academic literature, classroom matters (e.g., management, lesson planning, special needs), and instilling confidence in student-teachers (Achinstein, 2006; Rajuan et al., 2007). Teachers, as noted by Sanders et al. (2005), play a crucial role as models and planners in mentoring, with 40% of interactions focusing on content decisions. Douglas (2011) found an emphasis on lesson planning rather than reflective work with student-teachers.

Mentoring processes prioritize psychological support, aiming to create a sense of acceptance and inclusion for student-teachers (Rippon & Martin, 2006). Psychological support helps students contextualize challenging experiences (Marable & Raimondi, 2007). Effective mentors

can offer support through methods such as hands-off facilitation, progressively collaborative approaches, integrating student-teachers into the school community, and acting as professional friends by sharing experiences and offering guidance only when necessary.

Mentors convey essential information about school rules, routines, and norms (Bartell, 2005) and handle evaluations and forms for the higher education institution. Some mentors adopt an advisory and directive role, providing instructions and suggestions on lesson planning and teaching methods (Douglas, 2011), rather than facilitating personal reflections on classroom strategies and innovations (Feiman-Nemser, 2000; van Ginkel et al., 2016). This approach may not motivate mentees to develop their independent thinking (Hoffman et al., 2015).

Effective mentors often serve as coaches and models for best instructional practices, attending to educational issues that student teachers may overlook. They offer constructive feedback on pedagogical aspects, including classroom management, curriculum planning, and providing resources for files and materials, addressing a variety of student teachers' needs. Richter et al. (2013) propose two mentoring constructs: constructivist-oriented mentoring, emphasizing reflection and autonomous decision-making, and transmission-oriented mentoring, involving the transmission of necessary conceptions and behaviors for effective teaching tasks.

Based on the literature review and the need to investigate the identities of mentors for student-teachers in Spain, our research question focuses on the identity approaches that mentors consider with in their role as mentors in schools.

3. Methodology

Initially, we gathered data through a survey featuring open-ended questions, followed by the interpretation of meaning derived from the textual content. Subsequently, we employ a qualitative research technique, utilizing a direct content analysis approach to pinpoint the mentors' core sets of approaches.

3.1. Context

In Spain, primary school teacher studies are regulated by Order ECI/3857/2007, which outlines the requirements for official university degrees necessary for practicing as a primary education teacher. According to the law, mentors in this context are responsible for: a) endorsing the student's commitment to tutoring, b) welcoming trainees during specified periods throughout the school year, c) facilitating students' initiation into teaching practice, d) providing guidance on pedagogical and didactic matters, and e) evaluating students' practicum development based on criteria and guidelines from the corresponding School or University Faculty's practicum plan.Primary teachers from various public and private schools across Spain were invited to participate in the study. These teachers collaborate with multiple universities to facilitate

internships for Education bachelor's degree students. During 2 to 3-month practice stays in schools, student teachers observe real teaching activities and engage in various supportive teaching tasks as deemed essential by their respective universities for the learning process. The mentors of these teachers are required to submit a final report assessing the students' activities during the practice period, and this evaluation contributes to the students' final grade in their practicum subject.

3.2. Participants

Initially, 41 mentors of student teachers in early childhood (ages 3-5) and primary education (ages 6-12) schools in Spain, each with a minimum of two years of mentoring experience, were invited to participate via email. Ultimately, 35 mentors (85% of the potential sample) positively responded. The majority were female (77.1%), over 40 years old, and held a bachelor's degree (91.4%). Specializations included 48.6% in primary education and 44.8% in both early childhood and/or primary education. Additionally, 74.3% had over five years of mentoring experience, with 88.6% having mentored at least one student-teacher in the last academic year.

3.3. Data collection

The structured survey comprised two sections. The first gathered personal, academic, and professional details from participants. The second focused on mentors' functions, requiring detailed information on each function, including the label (a), the purpose (b), and a prototypical task (c). Respondents were instructed to use a minimum of 50 words for each aspect.

3.4. Data analysis

We employed MAXQDA2018 for direct qualitative content analysis (Hsieh & Shannon, 2005) by creating 35 participant documents, each containing relevant data. Thematic units within the "mentor's function" were considered, with a categorization process involving initial coding and assigning two labels: one for mentoring position and another for identity approach. Redundant thematic units were merged, resulting in 175 identity approaches, averaging five per participant. A subset was reviewed for interrater agreement, yielding an excellent Cohen's kappa value of 0.80.

Descriptive statistical analysis, presented in Table 2, illustrates frequencies and percentages of categorized thematic units and identity aporoaches mentioned by mentors. Besides, a hierarchical cluster analysis (HCA) classified cases based on the total number of identity approaches within each mentor's six positions.

Table 2. Distribution of mentors assuming at least one approach within each approach (n=35).

Mentoring position / Identity approaches	n (%)
1. To supervise and evaluate students	**9 (25.7)**
1.1 By evaluating students' activities and completing forms	9 (25.7)
2. To foster students' development towards professional issues	**5 (14.3)**
2.1 By exchanging information on the context of education	5 (14.3)
3. To develop students' planning and design skills	**32 (91.4)**
3.1 By providing instructions and resources to design lessons plans	11 (31.4)
3.2 By revising and evaluating lesson plans made by students	27 (77.1)
3.3 By providing advice to adjust a lesson plan to classroom characteristics	19 (54.3)
3.4 By providing new perspectives to elaborate a lesson plan	7 (20.0)
3.5 By discussing and reflecting collaboratively on lesson plans made by STs	13 (37.1)
4. To develop students' teaching skills in the classroom	**32 (91.4)**
4.1 By evaluating and giving feedback on students' teaching activities	8 (22.9)
4.2 By advising the adaptation of teaching practices to classroom conditions	12 (34.3)
4.3 By serving as a model, showing how to teach	10 (28.6)
4.4 By reflecting collaboratively about students' teaching activities	8 (22.9)
4.5 By supporting students' enquiry processes of their teaching performance	8 (22.9)
4.6 By giving instructions on teaching practice	12 (34.3)
5. To ensure personal well-being, engagement, and satisfaction	**8 (22.9)**
5.1 By nurturing the students' self-esteem, confidence, and trust	8 (22.9)
6. To facilitate socialisation at the school level	**29 (82.9)**
6.1 By introducing students in activities of the whole school community	20 (57.1)
6.2 By introducing students in new educational practices of other schoolteachers	8 (22.9)
6.3 By relating students to pupils' families	9 (25.7)
TOTAL Mentor I-positions / Mentors positions	**175/35 (100%)**

4. Results

We found three clusters of mentor's identity approaches following the HCA analysis. In Cluster 1, identified as "Mentoring oriented to student's design-skills development," mentors perceive their role as planning and designing skills of future teachers through instructions, assessment, and guidance for effective lesson planning. While they maintain an operational mentoring approach, they do not actively encourage the professional or personal development of the students nor position themselves as role models to be emulated. Cluster 2, designated as "Mentoring oriented to student's socialisation," emphasizes mentors' commitment to integrating pre-service teachers into the educational community. Their focus includes ensuring students feel at ease, confident, and engaged, encouraging participation and sharing experiences with other schoolteachers. While they provide instructions on lessons, they do not prioritize professional development beyond the classroom or engage in collaborative reflection with students on their

overall performance. Cluster 3, identified as "Mentoring oriented to student's professional growth," places a strong emphasis on fostering the professional development of students in the broader context of education. Mentors in this cluster engage in collaborative reflection, offer feedback, and encourage discussions to support students' growth. However, they infrequently provide detailed instructions for planning and design skills in the classroom, and they show less concern about the social inclusion of students within the school environment.

This study aimed to investigate and characterize the various identities assumed by Spanish early childhood and primary teachers in their roles as mentors to prospective educators. Over 80% of mentors identified themselves as facilitators of the socialization process for student-teachers, aligning with the second function outlined in the law (welcoming trainees). However, only 23% of mentors prioritize ensuring the well-being, commitment, and satisfaction of student-teachers. It is evident that mentors grasp the expected functions outlined by the law, despite receiving limited information and training from universities. While mentors acknowledged a diverse range of mentoring identity approaches (refer to Table 2), over 77% of teacher-student mentors specifically engage in revising and evaluating lesson plans created by students (Douglas, 2011), with more than 50% offering advice for classroom adjustments (Rajuan et al., 2007). Similarly, emphasizing social support (Koç, 2012) and fostering a sense of acceptance and inclusion for pre-service teachers by involving them in school community activities emerged as prevalent identity appraches, highlighted by over 50% of the study participants.

5. Conclusions

These three identities approaches are thoroughly examined based on mentors' disclosed actions with student-teachers. Mentoring has a significant impact on how future teachers understand and approach their profession. Therefore, knowing the conceptions and approaches that mentors convey to their pre-service teachers is of vital importance for educational institutions. Notably, certain functions considered relevant in other studies, like quality control and self-learning with student feedback, are not explicitly mentioned by mentors, including a lack of emphasis on self-reflection. Given anticipated resistance to change, universities or school-university partnerships should take trainingresponsibilities for developing comprehensive identities, modeling best practices. Training in specific models can facilitate changes in mentoring practices (Hoffman et al., 2015). As main limitation we point to the sample size, warranting future research with larger samples, potentially including secondary education. Exploring how student-teachers' mentor identity integrates with broader teacher identities and their mutual influence presents also an interesting research direction.

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Enhancing Higher Education Recruitment and Retention through Considering the Employee Voice

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Abstract

Astute recruitment in any industry is a source of significant competitive advantage because hiring high quality performers can have a significant impact on teaching and learning quality, research output and brand recognition alongside reputation enhancement. The challenge that many Higher Education (HE) providers face is how to attract high quality and reliable staff, and subsequently retain them. This is a challenge leadership and managers continually face in what are often administrative heavy days, where personal recommendations can carry a lot of weight given the issues involved if poor hiring decisions are made, even with probationary periods providing a degree of protection in this respect. To better appreciate the forces that motivate employees and then subsequently either satisfy or dissatisfy them this paper considers the case of two of the largest and most well-known Transnational Higher Education (TNHE) providers in Asia and listens to the insights that their staff share. The implications are important for HE institutions and those who run them and are responsible for staffing them, as all too often time demands mean that recruiters get lost in statistics and data and overlook the human dynamic.

Keywords: *Recruitment, Retention, Motivation, Satisfaction, Dissatisfaction, Leadership*

1. Introduction

Leadership is an area of HE that encompasses every area of working life and at every hierarchical level. It is also something that is influenced by temporal, contextual and situational circumstances and influences as Morris (2021) attests. Importantly, a lot of the skills, qualities and traits that successful and effective leaders and managers demonstrate can be acquired with systematic deliberate learning as Ericsson and Pool (2016) draw attention to. In the world of Transnational Higher Education (TNHE) providers, in which provision can and does transcend national boarders, leadership and management need to continually evolve in light of changing parameters. Two notable influential forces have been the Covid pandemic's legacy and the

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emergence of generative AI. There is also the business mindset to HE which Collini (2012) cautions against. With management practice impacting on staff recruitment and retention, and ultimately institutional performance, this paper considers the experiences of four mid-level career employees and their perceptions of TNHE leadership. It also highlights what they believe is important in enhancing the employee experience.

2. Background

This research stems from two of the leading and most acclaimed TNHE providers in Asia. Both have institutional populations in the tens of thousands and both have been in operation for close to two decades. Where the two institutions differ is in terms of their set up and growth models. Institution 1 opened a couple of years prior to Institution 2, but is part of an international tri-campus set up with student numbers seemingly capped. Institution 2 in contrast is an autonomous entity which only relies on its parent institutions for quality assurance purposes. It has grown rapidly in the past decade, opening a new site in a satellite city and now has broader national expansion plans. It also operates an online learning space giving it a potentially prominent virtual presence going forward.

3. Literature

Employees are motivated to join a HE institution for a diverse range of reasons. In reductionist models of employment motivation that seek to cluster drives under broad umbrella themes these might include employment related features, personal considerations and the ease of making a move (Morris, 2021). Once a move has been realised, and the new reality emerges, staff in HE are likely to be either satisfied or dissatisfied by features such as their work and how interesting this is (Wilkins and Neri, 2019), their personal interactions (Aldridge and Fraser, 2016), the employment package (Munyengabe et al., 2017), and the recognition and progression (Morris and Mo, 2023), that they experience over time. Of course, the role of expectations, as Robson (2022), notes, are pivotally influential here as satisfaction or dissatisfaction is often determined by the extent to which reality aligns with what employees expect and value. Where leadership is important is in ensuring that initial motives are realistic, and that the conditions exist so that, once in employment, staff are more likely to feel content with their working reality than discontent. Managers also have a huge influence in the all spheres likely to impact upon satisfaction. The only area in which they cannot really have much of an impact is in regard to the nonprofessional, personal area, which dovetails and influences working lives (Morris, 2021).

4. Methodology

This study is an exploratory case study based one. It adopts a pragmatic approach to the research project. Consequently, the design is determined by the intended aims, and this has led to the uptake of a relativist ontological and epistemological position as Grix (2010) considers. The research questions are:

[01] What motivates TNHE employees to join their institutions?

[02] To what extent are TNHE staff satisfied or dissatisfied with their jobs?

The four participants, hereafter referred to as RP1, RP2, RP3 and RP4 all currently work or have worked at Institution 1 or Institution 2. They have been selected on a purposive premise, but also a convenience one as Table 1 below highlights:

Participant	Gender	Career	Nationality	Focus	Qualification	Dependents	Institution
RP1	Male	Mid	Expatriate	Teaching	Masters	Yes	01
RP2	Male	Mid	Expatriate	Teaching	Doctorate	Yes	01, 02
RP3	Male	Mid	Expatriate	Research	Doctorate	Yes	02
RP4	Female	Early	Home	Admin	Masters	No	02

Table 1: Participant Demographics

To collect the insights from the participants a semi structured interview guide was utilised. This was a modified version of the one that Morris (2021) designed. The interviews were conducted in January of 2024. After a period of data familiarisation, as Caulfield (2019) recommends, a dual inductive and deductive approach to data analysis was adopted. The work also followed the ethical guidelines of the British Educational Research Association's (2018) guidelines, alongside the Data Protection Act (2018). In this respect, key features such as informed consent, the right to withdraw, anonymity, confidentiality, alongside safeguarding, were all considered and ensured.

5. Results

5.1. Employment Motivation

The four research participants were motivated by a diverse range of factors which were a combination of push and pull ones. RP1 noted:

> ***I think I was motivated by a desire to find a stable position. I had previously been working part-time while also studying, this was in the UK, and when I finished my studies, I wanted something a little bit more secure. I also***

> ***wanted something that paid quite well since I didn't have much money at that point.***

RP2 also stressed the importance of stability, and added that familiarity and brand reputation were important, the latter point also being stressed by RP1.

> ***It also had a good brand name and paid much better than other similar jobs. It was basically a step up with minimal risks.***

For RP3 he liked the EDI features noting:

> ***I was motivated to join my current institution because of its diverse environment. The inclusivity and diversity within the institution were appealing.***

Finally, for RP4 who had worked overseas in Europe for a number of years and was now returning home she felt that good brand reputation, remuneration, the location and a role-competency fit were important in her decision making. The latter point she stated:

> ***I identified a strong alignment between my skills and the potential contributions I could make to the workplace.***

5.2. Job Satisfaction

Having joined their workplaces, three of the four were now largely satisfied, but there were also some interesting findings. RP1 was generally content and it was having a purpose and helping others that left the greatest sense of satisfaction:

> ***These are the moments when I feel that I am actually making a difference to the students' lives. I also enjoy the subject area that I'm working in at the moment since this is something that I personally am interested in.***

He went on to add that autonomy, working conditions, remuneration and health provision were also key features, and the fact that these compared favourably to elsewhere. RP2 echoed a number of these sentiments. He felt his workload, autonomy and interest were all favourable, and the campus facilities excellent. He also stressed how important the personal side of life was to professional satisfaction:

> ***The other big consideration is that the schooling is sorted out here. This had been a headache for years.***

For RP3 having a clear role remit and being offered autonomy were appealing. He also noted the work-life balance:

> ***The balance between work and personal life is well-maintained, contributing to a positive work environment. Additionally, the proximity of***

> ***my apartment to the office and the presence of recreational and sport centres contribute to my job satisfaction.***

RP4 also stressed the importance of an interest in her work, and being able to work on projects that had a positive meaningful impact on others. She would go on to summarise:

> ***This combination of interesting, challenging tasks, the sense of achievement, and the prospect of continuous learning creates a dynamic and fulfilling professional experience for me.***

5.3. Job Dissatisfaction

As far as dissatisfaction went, it was future facing concerns that gave RP1 the most concern. Reduced opportunities at work, in terms of roles, and having a limited voice which necessitated him having to fight at times to be heard caused some discontent. He mentioned:

> ***I can't see many clear career pathways ahead of me. Within my institution the only pathways seem to involve increased administrative work, which is not something at this moment, and under the current leadership, I am enthusiastic about.***

For RP2 who was largely content in his new job, he did draw on a short two-year stint in K12 to allude to his current perspective:

> ***My last workplace completely imploded. Rapid cost cutting, heavy and frequent staff cuts, a revolving door of students and colleagues, a lack of continuity and transparency in many areas, constant role additions and work overload, changing contractual terms, very long draining commutes. The list is pretty much endless in terms of challenges. Being in a job now that is stable, well within my comfort zone, and has no surprises feels like a godsend in comparison.***

RP3 in comparison felt that more could be done to enhance collaboration and support expatriates with dependents.

> ***On a personal level, the institution could enhance activities and events for families, particularly for professors who relocate with their families. Additionally, there could be more job opportunities for spouses, addressing a potential source of dissatisfaction.***

Finally, RP4 found that the biggest challenge that she encountered was a result of heavy workloads in administrative teams, long hours, limited support and a fear of making mistakes. A lot of this stemmed from the management approach she felt.:

> ***The intensity and volume of work often contribute to a tense atmosphere, making the process more demanding. One notable aspect is the managerial approach within the team. Unfortunately, my manager's leadership style tends to be more condescending and assertive, which has resulted in an overall stressful office environment.***

6. Discussion

6.1. Employment Motivation

Aligning with the employment motivation framework of Morris (2021), the respondents highlighted a diverse range of features that attracted them to apply. RP1 and RP2 both mentioned job stability and security based on prior experiences, and also drew attention to the importance of HE brand reputation, a point also iterated by RP4. Indeed, branding is affected by both successful and unsuccessful candidates based on their experiences and subsequent reactions, as Miles and McCamey (2018) note. Many prospective staff will even forgo better salaries at institutions in exchange for working at a more prestigious and trusted employer (Cable and Turban, 2006). Many others have stressed the important of work life balance, and the environment post pandemic, as Parker (2023) notes. This is something RP4 noted, while RP2 noted the work environment and the importance of inclusivity. Inclusivity is something which can be highly influential in the trajectories that lives take, as Smith (2021) alludes to. RP4 also highlighted the importance of the person-job fit, and this can be telling on behaviour, involvement and commitment (Huang, Yuan and Li, 2019). Offering professional development opportunities is also an attractive pull factor as Hunter and Nicol (2002) note and RP4 stated.

6.2 Job Satisfaction

All four respondents mentioned how positive relationships were an essential feature of contentedness for them. Indeed, Morris and Berhanu Tesema (2024) stress the important role that community plays and why HE providers need to facilitate these. RP1, RP2 and RP3 also mentioned just how important autonomy was, in contrast to the experiences of RP4. Instead, RP4 noted how a sense of achievement was a source of satisfaction. The employment package also was mentioned by RP1 and RP2, the latter of whom, along with RP3, also stressed the importance of the natural environment to them in this post pandemic working era. This is a point that Parker (2023) found to be particularly important to many now. The fact that good facilities also helped enhance satisfaction aligns with findings such as those of Dallmeyer, Wicker and Breuer (2023). A sense of purpose was also important to long term satisfaction and outlook, and aligns with the suppositions of Lewis (2023).

6.3 Job Dissatisfaction

As far as job dissatisfaction was concerned, the broad themes identified by Morris (2021) also featured, and some areas more than others. RP2, who was considering his previous employment, felt no dissatisfaction, but considering the volatility of working in mainstream schooling as Mo and Morris (2024) draw attention to, this is understandable. For RP1 future orientated concerns and a lack of voice in the present were the greatest concerns and may reflect his career and life stage. RP3, in contrast, drew on Morris's (2021) fifth dimension and found the lack of support in the personal sphere challenging as an expatriate. RP4 faced very different challenges, and found that the professional encroached into the personal as did too much management oversight. Domestic generational expectations may have been influential in this instance, as Zhao (2017) demonstrates. A lack of voice was also a concern for RP1 and RP4, and echoes the findings of Morris (2021) in TNHE just prior to the pandemic occurring. Guarding against work life imbalances is also essential.

7. Summary

This study has examined the employment motivation and satisfaction of higher education employees in a transnational setting in Asia. It has considered the insights of staff at two of the largest and most prestigious institutions. The findings suggest that a number of pull factors attract staff and, also, a few push ones. Once in employment, the implications for leadership and management are clear. Staff from all areas and of all demographic backgrounds value autonomy, good working relationships, opportunities to develop, and stable work with employment packages that support both them and their dependents. When work encroaches too far into the personal sphere or leaders start to micro manage discontent results even in contexts where this might have been the norm previously. Staff also like to feel a sense of security when looking to the future and acknowledgement that their views and voices matter.

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Employment Motivation and Job Satisfaction in Transnational Higher Education: A School Level Case Study

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Abstract

This paper is an executive style summary of a collection of studies that were carried out at a case study institution over a turbulent five-year period which began with a school level management overhaul, followed by the onset of a global pandemic. The academic school in question boasts the largest language centre in Asia, and employs over two hundred staff. The leadership insights presented in this paper should be of interest to educators, managers and policy makers alike.

Keywords: *Employment Motivation, Job Satisfaction, Higher Education*

1. Introduction

There are a number of acclaimed transnational higher education providers in the east of China. Some of the most notable include the University of Nottingham Ningbo (UNNC), Xi'an Jiao Tong-Liverpool University (XJTLU), Duke Kunshan University, NYU Shanghai and Wenzhou-Kean University. This paper considers a series of three studies that examined the experiences and perceptions of language teachers at one of these Sino-Foreign institutions over a five-year period between 2019 to 2023. The rationale for the studies stemmed from a desire to lessen the issues which were apparent and, hopefully, lead to improved and enhanced working experiences going forward.

2. Background

Leadership is a complex phenomenon which can be viewed from a wide range of perspectives. It can be considered in terms of competencies, traits, skills and behaviours, and/or in terms of what the individual in question offers or delivers, such as transactional and transformational designs. Notions of greatness also gain traction in many fields and historically as opposed to seeing leading as something which is situational, temporal and, often, culturally grounded (Meyer, 2014). In fact, notions of leadership being a natural born gift can be easily purported

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simply because of the power that charisma can have in influencing perceptions, but this in itself can be acquired with practice (Fox Cabane, 2013). Leadership, and management, are also skills which can be learned more generally with training and deliberate practice (Ericsson and Pool 2017), as well as hard work (Duckworth, 2018). In addition, these facets can be evolved (Ferguson, 2016). Indeed, even within these spheres, leadership is evaluated differently depending upon who and what is asked, and accepting for bias and opinion influences (Kahneman, Sibony and Sunstein, 2022), as well as the ability of values and perceptions to evolve as Stephens-Davidowitz (2018) alludes to.

3. Case Study Methodologies and Results

Study 1: The first of three studies considered what motivated expatriate staff to join the institution initially. This first piece of research was an exploratory qualitative study which utilised in-depth interviews that were administered to twenty EAP teachers in the summer of 2019. The intention was to provide a window into the educator's world, as Silverman (2011) suggests, and drew inspiration from the insights provided by Kahn (2011) when investigating staff perceptions in Oman. Morris (2021) subsequently suggested that the three primary factors which motivated a career move in this instance included employment ambitions, personal considerations, and the convenience of the move. Please see Figure 1.

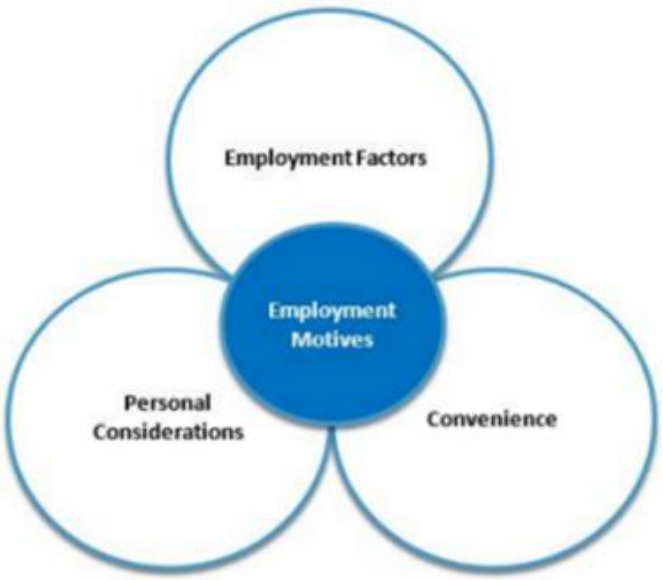


Figure 1 – Expatriate Employment Motivation Framework (Morris, 2021)

The second area that Morris (2021) investigated in his doctorate research were the factors that satisfied and dissatisfied staff at the same educational provider when they were in post. Drawing initial inspiration from the seminal works of Maslow (1954) and Herzberg (1959), alongside a wide range of studies over a seventy-year period from a wide range of management disciplines, the data suggested that there were four broad areas which were influential to these staff. These areas included personal interactions, teaching and learning aspects, recognition and progression, alongside the employment package. The importance of the immediate, and nonprofessional, environment was also highly influential, and Figure 2 illustrates this.



Figure 2 – Expatriate Job Satisfaction Framework (Morris, 2021)

Study 2: Following on from the insights gleaned from this initial study, Li and Morris (2021) conducted a quantitative questionnaire-based piece of research which involved inviting all 215 staff in the School of Languages to participate and which considered the perceived professional development needs of the then staff. From 88 responses, and more specifically 72 EAP teacher sets of data, it was found that during a period in which student numbers were increasing yearly, the pandemic had necessitated learning to move online, and management restructuring was taking place, there were four areas in which greater support and training were felt to be required.

These were with respect to the use of technology, the associated administration of assessments, research (a core part of annual PDR/PDRP reviews and now more inaccessible) and leadership.

Study 3: A year later Morris, Xu and Li (2022) revisited seven of the participants from the previous study to explore through a semi structured interview approach how these staff now felt about their professional development needs and what teaching challenges they now faced. Technology enhanced learning was still a growing source of concern with additional training desired. Increased student numbers presented another challenging area which, along with staff departures, was leading to greater pressures as experience was lost and more work was now required.

4. Discussion

Employment Motivation: There are many factors that can motivate people to engage with a course of action, or influence decision making. In reality, numerous motives play a telling role at any given point in time to varying, often fluctuating, degrees. In this instance the most influential feature was ultimately how easy it was to make the move, which at the time happened to be relatively straightforward. It was also apparent that for many, moving to this provider represented a step up in their careers, meaning that they expected, or had initially expected, to be able to develop in this new workplace. However, as numerous personal career testimonies highlight, expectation and reality can be quite different as Winkler (2023) notes. This is irrespective of how well one may have done professionally previously. Expectation as the saying suggests can lead to disappointment. In this respect, it is important to temper initial expectations, which takes emotional appreciation and control which we may not always possess as Burnett (2023) notes. That said, this regulation is incredibly important given the power of emotions (Haidt, 2021). In addition, it is also understandable that personal considerations will influence any move, and these may fall under either push or pull factors, with the latter likely the more aspirational and forward thinking. Initial motivation can also have a noticeable impact upon satisfaction or contentment, and/or dissatisfaction or discontentment in due course.

Job Satisfaction: As far as the participants in the first study were concerned, most were content with their personal interactions, believing that colleagues and students generally brightened up their days, or at the very least did not make them worse which is not always the case as Mo and Morris (2024) found in smaller transnational educational providers. For management, difficult encounters however tended to increase discontentment and generate unease. In a similar manner teaching and learning related features were also generally perceived as reasonable, despite a sense of the provision lessening in terms opportunities which has remained the case today as Morris et al. (2024) draw attention to. The employment package was also regarded as competitive in the field and profession, and more so given the experiences of the recent past in which many professions and professionals suffered during the pandemic as Morris and Mo

(2023) noted when seeking educators perceptions within the same regional context. The only other broad area under consideration according to the conceptual framework in this instance was recognition and progression, and this will be discussed momentarily as it was an area of dissatisfaction. The inevitable personal professional divide, although incredibly important and acknowledged, was not covered as it fell outside of the professional sphere.

Job Dissatisfaction: Although in study one the results suggested that within Morris's (2021) framework that recognition and progression was a source of discontentment for many staff at that moment in time, what was also apparent was that at the same institution this had not always been the case. In fact, half a decade earlier promotion opportunities had been abundant. This was because pedagogic provision was being expanded and new roles with promotion laden responsibilities created. The reality was that at the point in time at which the data was collected in 2019 leadership overhauls were being enacted, institution level packages reviewed, school and department structures revisited and a watershed moment reached. In many respects perhaps one of the most apparent additional issues that had arisen was that expectations, which are powerful forces as Robson (2022) highlights, and reality were now clearly and rapidly diverging. Old habits were having to change, and this is also difficult to navigate as Duhigg (2014) suggests. Indeed, it would have been difficult to navigate at the best of times with an experienced leadership team in place who held their communities trust.

Professional Development: Professional development can obviously be delivered through either formal or informal learning opportunities, as well as internal institutional and external provider training. Mandatory training is important because it enables staff to perform their work more efficiently, effectively, and successfully, but overload or inefficiencies can lead to problems. Ideally professional development should also motivate those enrolled, and align with career-based needs and goals if it is more bespoke in nature. Given how demanding teaching can be and, indeed, the increased pressure educators have faced in recent years due to the pandemic, a drive towards greater technology enhanced learning, alongside the evolving nature of educational landscapes, as Morris and Xu (2024) have noted, the importance of having an employee wellbeing element incorporated within teacher development initiatives where possible may also be valuable. The reason for this suggestion is simple. Good teachers, and staff more widely, provide businesses and organisations with a source of competitive advantage, but disgruntlement, anxiety, stress and burnout are commonly encountered challenges, and have featured in this case study institution previously.

Leadership and Management Implications: Given the importance of motivation, satisfaction (and dissatisfaction), alongside professional development to teachers, educators and employees more generally, Morris, Morris and Li (2023) also considered the implications of these three studies findings as they potentially applied to EAP leadership and management. Drawing on experience with the UNNC administered Cambridge Assessment PDQ they suggested that there were at least twelve key takeaways. These included the importance of self-awareness and

personalised leadership. The need to have good communication skills, create an identity, build teams and then lead these successfully and effectively, as well as supporting staff with their employment journey were also mooted. It was also deemed essential to protect leaders, promote professional development, network, embrace and lead change and ensure leadership sustainability.

5. Summary

There are many benefits to be derived from evaluating the changes that take place over time. There are equally many benefits that can be derived from reflective practice, and in the areas of employment motivation, job satisfaction and professional development the implications are obvious as far as staff recruitment and retention is concerned. Like most experiences, the greater the ability that these real-life accounts and insights have in terms of resonating with people the greater the potential they hold for personal and professional growth. Likewise, a degree of practice based and personal self-evaluation from time to time is equally no bad thing. In these studies, it was clear that there was a lot of relatable practice taking place, and equally areas in which contextual and temporal influences led to challenges, and arguably opportunities, many of which appear to have been resolved and others which have since evolved. This has been demonstrated in the emergence and results from future studies and the opportunities which now exist for possible future research directions including, but not limited to, additional longitudinal, quantitative and theoretical framework based ones, as well as follow up personalised accounts.

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Classroom Goes Future: Promoting Essential Skills of Teacher Training Students

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Abstract

Some of the current challenges, such as preserving democracies and managing the risks of advancing digitalisation, are expected to persist in the future. To prepare pupils for these challenges, qualified teachers are needed to implement both civic and media education. Enabling prospective teachers in these areas is an important task of universities. A special seminar was developed to specifically prepare future teachers by promoting their competencies related to digitalisation, democracy, and future orientation. Its effectiveness was evaluated in an initial round through triangulation of recurring online surveys, a group discussion, and external evaluation. These methods were used to obtain findings with an empirical basis on the suitability of the seminar for promoting skills and at the same time to identify opportunities for improvement. The objective of the seminar in the university phase of teacher training is to ensure optimal training and to prepare future generations for an increasingly complex world.

Keywords: *innovative experiences, technologies, competency orientation, exploratory learning*

1. Challenges and potential solutions

1.1. Challenges

In Germany, the EU, and globally, current and future social and professional challenges include maintaining democratic coexistence (Boese, 2021) and addressing the risks of digitalisation (Zierer, 2019). It is essential that the next generations are adequately prepared to meet these challenges. Schools provide an ideal platform for imparting skills across the spectrum and they have a corresponding educational mission. In this context, teachers have the task of preparing next generations to deal with the named challenges through education and upbringing. But what skills do teachers need to adequately fulfil this key task? Educational science and policy papers provide valuable information on the competencies to be promoted in teacher training.

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Frameworks, models and concepts offer points of reference. They emphasize the significance of digital competencies, democratic culture, and future-oriented skills for teachers as well as they suggest potential solutions. It is essential to prepare teachers specifically for these aspects, so that they are able to provide students not only with subject-specific knowledge, but also with the necessary skills for active and responsible participation in society that they could pass on to their future pupils.

1.2. Potential solutions

The models and frameworks presented below demonstrate the theoretical foundation of the seminar and offer potential solutions on how to deal with the challenges pointed out in 1.1. Details on how the frameworks are transferred in teaching student teachers are displayed in section 2. In *DigCompEdu,* Punie & Redecker (2017, 8) explain "that educators need a set of digital competencies specific to their profession in order to be able to seize the potential of digital technologies for enhancing and innovating education." This framework describes digital competencies that teachers need and organizes them in six areas: professional engagement, digital resources, teaching and learning, assessment, empowering learners and facilitating learner's digital competence. Democratic principles have long been core values in European societies. Boese (2021, 30 f.) explains that contemporary democracy is facing a threat due to global symptoms of autocratisation such as the erosion of democratic norms, the increasing power of the executive, and declining media freedom. In times of multiple crises, continuous efforts are required to uphold democracies by active citizenship. The dynamic process of promoting competencies is never complete and requires individuals to adapt and develop new skills in response to changes in their living environment. *The Reference Framework of Competences for Democratic Culture* summarises twenty competencies for promoting and protecting democracy. These competencies are divided into values, attitudes, skills, and knowledge and critical understanding.

> "The model proposes that, within the context of democratic culture and intercultural dialogue, an individual is deemed to be acting competently when he or she meets the demands, challenges and opportunities that are presented by democratic and intercultural situations appropriately and effectively by mobilising and deploying some or all of these 20 competences",

says The Council of Europe (2018). To enhance the democratic skills of future generations during their school years, it is crucial to understand the required competencies and implement appropriate measures to empower future teachers during their studies. In the *Future Skills Triple Helix-Model,* Ehlers (2020, 40) defines future skills as competencies that individuals need to perform successfully "in highly emergent contexts". These skills are anchored in three interlinked areas of competence: individual development-related skills, object-related skills, and organisation-related skills. As described in 1.1, future skills are crucial for next generations. When analysing frameworks and models, it becomes apparent that necessary competencies can overlap and appear in different places. For instance, digital literacy in the *Future Skills Triple*

Helix-Model is considered part of the subject related skills, while at the same time it has a central role in the *DigCompEdu* framework. However, in the conceptualised training course, it is not feasible to promote all the competencies of these models in their entirety due to the structural circumstances. Therefore, section 2.2 explicitly addresses the skills that are focused.

2. Improving skills in seminar Classroom Goes Future

2.1. Classroom Goes Future as a part of the module Civic and Media Education

In view of the challenges, the interdisciplinary compulsory module *Civic and Media Education* has been recently introduced for teacher training students of all types of school and subjects at Leipzig University. The module is completed by attending the eponymous lecture and a seminar of choice. The seminars are based on the lecture and cover topics such as digital media in schools, digital game-based learning in civic education, journalism skills for schools, civic education in dealing with disinformation and conspiracy theories, democratisation of schools and media didactic applications in schools. Furthermore, the *Centre for Teacher Education and School Research* established a *Digital Classroom* which subsequently is utilized in some of the courses mentioned. This classroom is equipped with digital media, some of which are already available in schools (e.g. interactive whiteboards, iPads in classrooms) or are expected to be used in the future (e.g. virtual reality). Various teaching and learning formats are available for users of this specific place of learning to enhance their skills in handling media, as well as in media education and in media didactics. One format offered is the seminar *Classroom Goes Future - Using the Digital Classroom at the Centre for Teacher Education and School Research* which is assigned to the above-mentioned module and is designed for goal- and competence-oriented learning.

2.2. Contents

The content of the seminar is divided into a theoretical and a practical part. First of all, it has to be made clear that the students already have a wealth of prior knowledge and experience, which must be taken into account when wanting to promote skills. The theoretical part aims to bring the students up to the same level in terms of the necessary didactic and pedagogical knowledge. As already mentioned, they come from different teacher training programmes and study different subjects in different semesters. It is therefore a very heterogeneous group of learners that can be considered a major challenge. Accordingly, the course covers general didactic content related to competency-oriented teaching, including articulating teaching and learning objectives, lesson phasing, detailed planning, and key characteristics of effective teaching. The theoretical part of the course also includes content on civic education and media education. In addition to the civic education principles discussed in the lecture, such as the principle of controversy and the prohibition of overwhelming, the seminar teaches political didactic

principles such as problem orientation and exemplarity. The content on media education is approached in a similar manner. Finally, in the practical part of the seminar, the students experiment with digital media. Working on application-oriented tasks that encourage the use of digital media and methods of democratic cooperation enables students to plan their own subject-specific teaching projects that fulfil important characteristics of civic and media education. The results of the work are reflected and discussed. The first competency that is improved in the seminar is digital literacy (Ehlers, 2020; Punie & Redecker, 2017) because it is essential to use digital devices for communication and collaboration, as well as to select, create, modify, manage, protect and share digital resources. Digital devices and resources have to be used in an objective-oriented manner. This already indicates that communication and collaboration are the next two essential skills (Ehlers, 2020; Punie & Redecker, 2017; The Council of Europe, 2018). These skills are essential for effective communication and collaboration, particularly in relation to educators' professional and pedagogical competencies. In addition to organisational arrangements with fellow teachers, school administration, parents and other partners, this also includes teaching, guidance, support for collaborative and self-regulated learning, and empowering learners. Thus, prospective teachers must possess the ability to communicate and collaborate while respecting democratic values and attitudes. When pupils cooperate, e.g. in group work or in the context of discussions, attention should be paid to the implementation of these values and attitudes. They also have to be proficient in using digital devices to facilitate this process. Reflective competence, also referred to as reflective practice or critical thinking skills, is another crucial dimension of competence (Ehlers, 2020; Punie & Redecker, 2017; The Council of Europe, 2018) that prospective teachers need to promote. Pupils need to be empowered to critically examine their own attitudes and actions and those of their fellow human beings (e.g. those posted on social media). The following section describes the seminar concept and how it strengthens competencies of prospective teachers to enable their future pupils' competencies.

2.3 Concept

The course content is too complex to be covered in 90-minute weekly seminars. Instead, it is organized as a block seminar, which means that it takes place on four separate days during the semester, each consisting of four 90-minute units. Based on the work of Helmke & Schrader (2009), the key features of the approach aimed at increasing the likelihood of taking up learning opportunities and thereby increasing the chances of promoting skills are: clear and logical structure, technical correctness, and comprehensibility. A conducive teaching environment is achieved through friendliness, respect, and a positive error culture. Encouraging cooperation and cognitive activation of learners achieve diverse motivation and activation. To ensure learner orientation and accommodate heterogeneous learning requirements, learners are involved in decision-making, receive individualized feedback on their progress, and have access to learning opportunities that are adapted to their changing needs. Another important feature of the seminar

is the students' self-determination. As part of the examination, students have to give a presentation on a key topic that they choose from various proposals. Prior to the first course block, students are asked to complete an online survey in which they select their preferred digital devices. The central design element of the seminar is the concept of exploratory learning with minor guidance due to approaches that combine traditional and constructivist methods often result in better learning outcomes (Newman & DeCaro, 2019). According to Waever et al. (2018), students benefit from support during their exploration only when requested and limited thereafter. This concept is encouraging because it supports cognitive load and helps students recognize the deeper structure of the problem, promoting their understanding of the concept (Newman & DeCaro, 2019). If required, learners receive guidance from the lecturer who behaves empathetically, patiently and helpfully (Helmke & Schrader, 2009). If desired during exploration, learners can also benefit from direct peer support due to each student being expert in a particular field of interest. This can take place thanks to the presentations, as each learner has different expertise. The portfolio, which is used to examine the outcome of the seminar, combines features of both a process-centered and product-centered approach. The product-centered approach facilitates practical implementation by creating a comprehensive portfolio, which includes not only a collection of ideas but also a detailed lesson plan for the student's own subject lessons. In order to self-assess their competency development, teachers use the process-oriented component.

3. Empirical investigation of the seminar

An exploratory study analysed how suitable the seminar for imparting skills to prospective teachers in the field of civic education and media education is. Self and external assessment are considered.

3.1. Self-evaluation

3.1.1. Recurring online survey

After each block seminar, the thirteen students were surveyed four times in total about their knowledge, skills, and values. The topics covered previous experience in planning and performing lessons, as well as using digital media as both students and teachers. The discussions that took place following the exploratory phases also covered attitudes towards the use of digital media in the classroom. The results show: While most students were already familiar with digital media from their school days and internships, and used them for communication, cooperation, media production and presentation, they reported having poor average skills in operating digital devices. The standard deviation (0.90) was rather high. The final survey shows that, on average, skills in using digital media were rated highly. In comparison to the initial survey, the standard deviation significantly decreased (0.78), indicating that previously diverse skills have been

standardised. All students are now more proficient in using digital media for communication, collaboration, media production, and presentation. The students considered their lecturer to be highly competent in dealing with digital resources and designing learning processes. They have acknowledged that technologies are an essential part of modern teaching and developed an awareness of the opportunities and challenges of using them in a classroom setting. Similarly, they report being able to reflect on their personal use of digital media and their future use with pupils. The students are prepared to work with pupils on equal terms when using digital media in lessons.

3.1.2. Group discussion

During the group discussion, attended by eight out of thirteen seminar participants, impressions, attitudes, and opinions on skill development in the digital classroom were recorded. The successful implementation of the concept of explorative learning was highly rated by the students. One student commented, "it was great that we were able to try out everything right from the beginning and that the lecturer gave us enough time without interfering too much." It also became evident that the space *Digital Classroom* is significant in university education, as "there is no time during internships or seminars to familiarise yourself with digital devices extensively," said another student. In addition to the general opportunity of trying things and the low level of intervention, the students also appreciated the positive error culture. Another student commented: "I think it was very important that we always had the approach to stick to the idea that it's not a bad thing to fail. I really enjoyed trying things out, making mistakes, and learning how to deal with them." The students also appreciated implementing pupil-orientation and dealing with heterogeneous learning requirements. One student said: "The mixed group offered a wide range of opportunities. We were able to benefit from each other a lot and gained interesting insights in how we might see things in advanced semesters or what we could implement at other types of schools." This oral survey makes it clear that the students have collected interesting ideas for the design of their future lessons with cooperative forms of learning to promote democratic education and with digital media for media education. One student described how she would like to have her students create explanatory videos in groups in the future in order to implement the principle of learning by teaching.

3.2. External evaluation

External evaluation by the lecturer was used in addition to self-assessment to evaluate competency development.

3.2.1. Observation

During the initial phase of exploratory learning, the participants were hesitant. However, this shyness quickly dissipated, and they got more unreserved in seeking support from their peers.

They adapted various social forms to overcome challenges together and were willing to share their expert knowledge. The need for advice from the lecturer varied among the participants, with few seeking advice while others felt confident in their independence. Despite these differences, the group consistently and positively participated in the assigned tasks. The exchange was characterised by intense discussions. The common learning journey was enriched by a variety of perspectives and experiences from both lecturer's and students' sides.

3.2.2. Results of the examination

Earlier, it became clear that interesting ideas were developed for the use of digital devices in specialised lessons to intensify civic and media education. The lesson plans developed are characterised by stringent planning that takes into account the didactic principles of political and media education. This allows the focused development of democratic and digital skills in future teachers. For instance, virtual reality applications can be used in history lessons, while iPads can be used to analyse and enhance movement sequences in physical education classes. Both approaches involve methods and tasks that encourage cooperation, communication, and the teaching of democratic values. These innovative uses of digital media promote various aspects of media literacy. Based on the written drafts can be inferred that the students have improved their competencies in line with *DigCompEdu*. The examination results are supported by reflections on the learning process, which demonstrate that the students have enhanced their skills in digital and democratic education, as well as future skills.

3.3. Summary of the results

The overall balance between self-evaluation and external evaluation is positive all in all. The group discussion and reflection on the learning process, which are integral parts of the examination, provide valuable insights into the suitability of the concept. These aspects also offer clear indications of areas for improvement. The decision in favour of exploratory learning proves to be successful, as the exploratory phase appears to be extremely valuable. The chance to interact with digital devices and experiment with them in a secure environment is highly beneficial. Unlike in a school setting, the fear of failure is diminished, resulting in an effective learning environment. However, the design and the lack of tasks to measure competencies make it impossible to draw reliable conclusions about the actual development of competencies. This emphasizes the importance of further research in this area.

4. Discussion and outlook

The seminar is well received by students who examine this learning programme valuable for developing their competencies. It became noticeably clear that all challenges (e.g. heterogeneity, problems with digital media) in the course of the seminar must be seen as learning opportunities, which is transferable to learning at school. The seminar is suitable for students wanting to

improve their competencies by exploring technologies. It provides an opportunity to practice skills, which is often not available in other seminars or during internships at school. Skill development occurs almost automatically and is supported by the conceptual framework of the learning programme. In order to increase flexibility, it is desirable to make the structural boundaries of the university more permeable when organising this seminar. Real added value can be gained by implementing the lesson plan with a school class and reflecting on it afterwards. Due to time constraints of the seminar, it is only possible to make suggestions for strengthening the necessary skills. Additional courses should be considered to promote the competencies mentioned and establish them as part of teacher training, reaching a larger number of student teachers. To obtain more precise findings about the suitability or even the impact of the seminar, there is a need to look at a larger group of student teachers. Combining self-assessment and external assessment with competency measurement is also worth considering. Additionally, interesting insights could be provided by extending the study period beyond the seminar to further course of studies or even to the start of a career through the preparatory service to explore the long-term impacts on the participants teaching methods.

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How students use learning opportunities in a first-year, Electrical Systems unit

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Abstract

This paper presents a preliminary analysis of answers to a survey taken by 118 first-year student engineers to find out how they engaged with the learning opportunities offered in an electrical systems unit. Answers were correlated against student demographics. Correlations confirm what other studies have found: some resources are more useful than others for different cohorts, while none of the resources are considered useful by all. This leads to the conclusion that in the face of increasing diversity, almost everything we try to support student learning will be effective for some students, while nothing will be 100% effective for all. There are no 'silver bullets'.

Keywords: *Student engagement; Student demographics; Learning opportunities; How students learn.*

1. Introduction

The higher education sector is constantly evolving to cater for the needs of diverse cohorts. For example, the COVID pandemic forced universities to step out of their comfort zones to explore alternative ways to create and deliver content. For some students this transition had long-lasting negative effects in their ability to engage in learning activities (Wester et al., 2021).

For learning to occur, students need to engage in learning activities. It is for teachers to provide an assortment of such activities to increase the quality and frequency of students' engagement. But some students are difficult to motivate. Student feedback shows that no matter how hard teachers try to provide learning opportunities for all, some students will be dissatisfied with the quality and effectiveness of the teaching methods. This could be discouraging for teachers, specially those who are in the early stages of their academic career (Stroebe, 2020).

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This paper presents preliminary results of a study aiming at figuring out which of the learning resources offered to students in a first-year, electrical systems unit[1] were the most effective and frequently used. The use of eight teaching resources by students from different demographics was captured in the survey. The survey was taken by 118 students, which represents 25% of the total cohort. Answers reveal that students from different demographics engage differently with teaching materials. All resources were used by some, while none of the resources was used by all. This leads to the conclusion that teachers should keep doing their best at preparing materials in different formats knowing that some students will benefit from them, even if teaching evaluations do not capture this fact.

2. Background

Curriculum design plays a pivotal role in shaping the learning experiences of students. Designing a learner-centered curriculum requires considering the diverse backgrounds and abilities of students (Biggs, 2014; Huba & Freed, 2000), while integrating interdisciplinary content, real-world applications, and aligning learning outcomes with the needs of the workforce (Broo et al., 2021). Understanding these factors is crucial for educators seeking to create inclusive and effective curriculum that caters to the diverse needs of students while supporting their transition from teenagers to adults (Ortega-Sanchez, 2023).

The increasing diversity in student cohorts within higher education institutions has become a central theme in educational research. Cultural, socioeconomic, and academic diversity among students presents both challenges and opportunities for educators. Hurtado & Guillermo (2012), emphasize the positive impact of diverse student cohorts on critical thinking, problem-solving, and creativity. However, challenges related to equity, inclusivity, and providing tailored support must be addressed to ensure all students can thrive in their academic journey.

Since students have diverse learning preferences and styles, exploring various teaching modalities is necessary. Cognitive, social, and constructivist theories highlight the importance of adapting teaching methods to accommodate different learning styles (McLeod, 2024). Also, a deeper understanding of the cognitive processes involved in learning is essential for effective teaching. Cognitive science research highlights the significance of factors such as working memory, metacognition, and motivation in the learning process (Kaufer, 2011; Macrine & Fugate, 2022).

From a pedagogical perspective, active learning strategies, flipped classrooms, and collaborative learning have been explored as effective methods to enhance student engagement

[1] Units are called subjects, modules or courses in other parts of the world. In this paper a course (Bachelor of Electrical Engineering) comprises units (Calculus, Electrical Systems, Chemistry for Engineers, etc.).

and comprehension. Moreover, technology integration and experiential learning have emerged as valuable tools to address the diverse learning preferences of students (Nilson, 2016). Sankey & Gardiner (2010) emphasize the significance of incorporating multimodal approaches that engage students through visual, auditory, and kinesthetic experiences, allowing for a more inclusive and effective learning environment.

3. Method

The results presented in this paper are a sub-set of a study aming at understanding the experience of first year engineering students. A quantitative correlation analysis was used to investigate how students from different demographics engaged with different learning activities.

The following sections present the analysis of answers to the following research questions:

1. Of the teaching materials available in the unit, which are used the most and the least?
2. Are materials used differently by students with different demographic profiles?

To find the answers to these questions students completed an online, anonymous survey that included the following items.

1) How often did you use the additional resources (PDF's with solved problems, videos to complement labs, videos to complement tutorials, recommended books)? (Options: Never, Very sporadically, Only for difficult topics, Some every week, Very frequently)

2) Rank the following learning opportunities by how much they facilitated your learning, with #1 being the most useful: Weekly lecture videos, PDF's with lecture slides, Weekly quizzes, Laboratory work, Weekly tutorials, Pre-tutorial videos, Supplementary lab and tutorial videos, Document with solved problems.

3) Which of the following describe you best. Tick all that apply: School leaver, Mature student, Domestic student, International student, Have a paid job, Living with parents, Grew up in a city, Grew up in a rural environment, Have a University Special Support Plan (Curtin Access Plan, CAP), Elite athlete, Fly-In Fly-Out worker, Parent with small children, First in family to attend university, Culturally and Linguistically Diverse (CALD).

4. Results and discussion

Answers to the survey were statistically analysed by cohorts. In the tables that follow columns represent cohorts, where ***n*** is the number of students who identified as part of that cohort (answers to question 3). Cells have been colour-coded to highlight the highest number in every

column (yellow), the highest number in every row (pink), and the highest both in the row and column (green).

4.1. Additional resources' frequency of use

In addition to scheduled teaching activities (lectures, laboratories and tutorials), students had access to resources whose use was not compulsory, but recommended. Table 1 shows how often students engaged with these additional resources (answers to question 1 in the survey).

Table 1. Students' engagement with additional resources. Columns present percentage of students in different cohorts who selected the corresponding frequency of use.

Frequency of use	All	School Leaver	Mature Student	Domestic	Intl	Paid Job	Lives w parents	City	Rural	CAP	Parent w Children	First Fam	CALD
n	118	69	17	77	32	57	68	47	17	6	5	19	22
Never	8.5	11.6	0.0	9.1	9.4	7.0	7.4	4.3	17.6	33.3	0.0	10.5	13.6
Very sporadically	16.9	17.4	5.9	20.8	12.5	14.0	16.2	21.3	17.6	33.3	0.0	26.3	9.1
For difficult topics only	34.7	30.4	64.7	33.8	31.3	45.6	35.3	36.2	29.4	16.7	80.0	26.3	36.4
Some every week	22.0	21.7	17.6	22.1	18.8	19.3	23.5	21.3	23.5	16.7	20.0	26.3	18.2
Very frequently	16.9	18.8	11.8	14.3	28.1	14.0	17.6	17.0	11.8	0.0	0.0	10.5	22.7

According to table 1, most students used the additional resources only for difficult topics. Note the high percentage of international students who used the resources "very frequently". This may indicate that this cohort is more committed to their education.

The high percentage of students who declared "never" or "very sporadically" accessing additional resources is concerning. 30% of Domestic students and 35% of students from rural backgrounds fall in this category.

International students have the highest percentage of engagement with additional resources. 47% declared to have engaged with the resources "some every week" or "very frequently". This might indicate that international students, who pay higher fees than domestic students, are more motivated, or feel more pressure, to engage with available learning opportunities.

Because of the low number of responses from students with support plans (CAP) (6) and parents with small children (5), percentages are not considered statistically significant and have been included in this paper for completeness only.

4.2. Use of teaching materials by cohorts

To understand how useful students found the teaching materials in the unit, they were asked to rank the resources according to how much each one supported their learning. Tables 2 to 4 summarise the answers for resources ranked 1, 2 and 3 respectively; 1 being the most useful.

Table 2. Percentage of students who ranked resources as number 1, the most useful.

Resource vs cohort	All	School Leaver	Mature Student	Domestic	Intl	Paid Job	Lives w parents	City	Rural	CAP	Parent w Children	First Fam	CALD
n	117	69	17	77	32	57	68	47	17	6	5	19	22
Lecture videos	15.4	15.9	23.5	14.3	21.9	12.3	17.6	21.3	11.8	33.3	20.0	21.1	13.6
PDF's with lecture slides	16.2	18.8	11.8	18.2	9.4	14.0	19.1	19.1	11.8	33.3	40.0	10.5	13.6
Weekly quizzes	8.5	7.2	0.0	10.4	12.5	10.5	11.8	10.6	5.9	16.7	0.0	15.8	13.6
Laboratory work	11.1	11.6	17.6	10.4	21.9	12.3	10.3	6.4	17.6	0.0	0.0	10.5	22.7
Weekly tutorials	23.1	23.2	41.2	26.0	21.9	33.3	22.1	25.5	35.3	16.7	40.0	21.1	27.3
Pre-tutorial videos	0.9	1.4	0.0	1.3	0.0	0.0	1.5	2.1	0.0	0.0	0.0	0.0	0.0
Lab and tutorial videos	4.3	4.3	0.0	3.9	6.3	1.8	2.9	2.1	11.8	0.0	0.0	5.3	4.5
PDF with solved problems	9.4	10.1	5.9	10.4	3.1	10.5	10.3	8.5	0.0	0.0	0.0	5.3	4.5

According to Table 2, tutorial sessions are considered the most useful learning resource by all cohorts. The percentage of mature students who ranked tutorials as number 1 is significantly higher than the percentage in other demographics. This may indicate the need of mature students to make their learning more efficient since tutorials are sessions where they can ask questions.

It is remarkable how lecture videos were not ranked as number 1 by many cohorts. These videos replaced face-to-face lectures during the COVID pandemic, and have remained as the main source of contents. It is clear that students are engaging with alternative resources to learn content.

International students ranked three resouces as the most useful: lecture videos, laboratory work and tutorial sessions. Tutorials and labs are face-to-face activities that are facilitated by an academic. It is possible that international students like attending these activities because they resemble what they experience in high school back in their countries.

Table 3. Percentage of students who ranked resources as number 2, the second most useful.

Resource vs cohort	All	School Leaver	Mature Student	Domestic	Intl	Paid Job	Lives w parents	City	Rural	CAP	Parent w Children	First Fam	CALD
n	117	69	17	77	32	57	68	47	17	6	5	19	22
Lecture videos	17.9	18.8	23.5	18.2	18.8	17.5	20.6	14.9	11.8	16.7	20.0	10.5	18.2
PDF's with lecture slides	12.8	14.5	11.8	13.0	15.6	14.0	14.7	14.9	5.9	0.0	20.0	26.3	18.2
Weekly quizzes	22.2	27.5	17.6	24.7	18.8	26.3	26.5	31.9	23.5	16.7	20.0	10.5	27.3
Laboratory work	6.8	4.3	23.5	7.8	6.3	10.5	4.4	4.3	11.8	0.0	40.0	5.3	9.1
Weekly tutorials	17.1	18.8	11.8	18.2	21.9	15.8	19.1	17.0	11.8	16.7	0.0	15.8	18.2
Pre-tutorial videos	2.6	1.4	0.0	3.9	3.1	1.8	2.9	2.1	11.8	33.3	0.0	5.3	4.5
Lab and tutorial videos	1.7	2.9	0.0	2.6	3.1	3.5	2.9	2.1	0.0	0.0	0.0	0.0	4.5
PDF with solved problems	7.7	4.3	11.8	6.5	9.4	5.3	4.4	8.5	17.6	16.7	0.0	15.8	0.0

In Table 3 weekly quizzes were ranked second more useful resource in the unit, for most cohorts. Weekly quizzes are delivered online and students have 10 days to complete each one. Quizzes are worth 10% of the unit's final mark. They are a low-stakes assessment meant to encourage students to review the material delivered in lectures. It is reassuring to confirm that quizzes are fulfilling its purpose.

Interestly, weekly quizzes were not as useful for mature, international and first in family to attend university students. After tutorials, lecture videos and laboratory work were selected as more useful by mature students. These are the three activities students expect to find in all units, the rest are additional resources for students to use if they wish. Mature students seem to optimise the use of their time by engaging only with activities that cover the content and provide opportunities to ask questions. Table 4 is very similar to table 3. It shows that weekly quizzes were also cited as the third more useful activity.

Table 4. Percentage of students who ranked resources as number 3, the third most useful.

Resource vs cohort	All	School Leaver	Mature Student	Domestic	Intl	Paid Job	Lives w parents	City	Rural	CAP	Parent w Children	First Fam	CALD
n	117	69	17	77	32	57	68	47	17	6	5	19	22
Lecture videos	12.8	13.0	23.5	15.6	9.4	21.1	13.2	12.8	29.4	0.0	20.0	15.8	9.1
PDF's with lecture slides	10.3	15.9	0.0	11.7	9.4	12.3	14.7	14.9	11.8	16.7	0.0	5.3	13.6
Weekly quizzes	23.1	20.3	35.3	26.0	28.1	26.3	19.1	27.7	23.5	16.7	40.0	31.6	31.8
Laboratory work	13.7	14.5	11.8	16.9	6.3	10.5	16.2	12.8	11.8	50.0	0.0	0.0	9.1
Weekly tutorials	12.0	11.6	11.8	10.4	9.4	7.0	13.2	10.6	5.9	0.0	20.0	15.8	4.5
Pre-tutorial videos	1.7	2.9	5.9	1.3	3.1	0.0	1.5	2.1	0.0	0.0	0.0	0.0	0.0
Lab and tutorial videos	6.8	5.8	5.9	6.5	15.6	8.8	5.9	4.3	0.0	16.7	20.0	10.5	18.2
PDF with solved problems	8.5	8.7	5.9	6.5	15.6	8.8	11.8	10.6	11.8	0.0	0.0	10.5	13.6

4.3. Students' performance in the unit

Figure 1 shows a histogram of the final mark obtained by students in the unit Electrical Systems in Semeste 2, 2023. The low fail rate and the high percentage of students who achieved 70% or more, reflect that students are achieving the unit learning outcomes. Part of this success can be attributed to the quality and diversity of learning activities. The histogram includes all students enrolled in the unit (461), while the survey was responded by 118 only. Since the survey was answered anonymously, it is not possible to analyse the correlation between achievement and engagement in each of the cohorts. That will be addressed in future surveys.

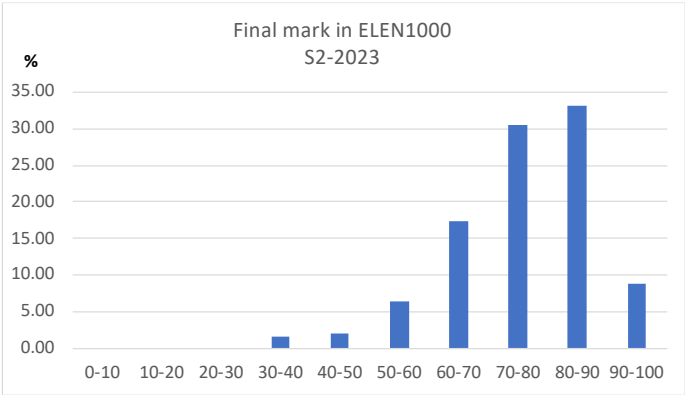


Figure 1.Histogram of final marks in the unit Electrical Systems, Semester 2, 2023.

5. Conclusions and future work

Statistical analysis of answers to the survey on student engagement applied to first year engineering students reveal that students from different cohorts engage differently with the available learning opportunities offered in an Electrical Systems unit. None of the resources came out as universally adopted by all students, however all resources were significantly important for at least one of the cohorts. The good results presented Figure 1, suggest that investing time and resources at developing learning activities in different formats have a positive impact on student learning and performance.

The survey will be applied in future editions of the unit to corroborate findings presented here, and analyse trends over time. Results will be shared with students to demonstrate to them that finding the unit's materials that suit their learning style is important to maximise their learning.

The work presented in this paper is part of a research project investigating the student experience and learning in the common first year of engineering. The project has university ethics approval number HRE2023-0341.

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Peer Pastoral Support: Working with Doctoral Students to Co-Create a Supportive Postgraduate Researcher Environment

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Abstract

This paper delves into the inception, evolution, and impact of Peer Pastoral Support Groups (PPSGs) at Newcastle University, specifically within the Humanities and Social Sciences Faculty. Originating as a response to the challenges imposed by the COVID- 19 pandemic, the PPSGs were initially designed to mitigate potential loneliness and facilitate socialisation among first-year PhD students. However, these groups continued beyond the pandemic, becoming an integral part of the Researcher Education and Development (RED) program. The paper suggests that the co-creation of support networks is vital in establishing a supportive postgraduate researcher environment.

Keywords: *peer support; co-creation; student experience; mutual support; higher education; pandemic*

1. Introduction

Establishing an inclusive and supportive environment that fosters the 'integration and socialisation' of doctoral students with their peers and the wider academic community has repeatedly arisen in qualitative research as one of the main factors that prevent early dropout during the initial stages of a PhD (Devos & Boudrenghien et al., 2017). Accessing opportunities for socialisation, however, became increasingly difficult during the COVID-19 pandemic, where typical induction activities migrated to an online space. At Newcastle University, within the Humanities and Social Sciences Faculty (HaSS) Researcher Education and Development (RED) programme, Peer Pastoral Support Groups (PPSGs) were created for new first year PhD students to mitigate the potential loneliness they might feel, not only as a result of the COVID- 19 Pandemic but the general and widely self-reported loneliness that can occur during the period of a doctoral degree (Togetherall, 2022).

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These PPSGs, being a popular feature of the doctoral training offered, then continued after the COVID-19 pandemic, providing more students the opportunity to meet researchers outside of their academic school unit and from different stages within the PhD process. The resulting analysis explores the significance of the PPSGs at Newcastle University from 2020 to 2023, summarising not only the benefits a similar system can bring to a higher-education doctoral training course but also how the doctoral students appointed as leaders of these groups adapted the support they offered, collected feedback and how, reciprocally, they grew as more thoughtful and compassionate researchers.

2. Methodology

2.1. Building the PPSG Community

The PPSG case study primarily targets stage 1 PGR students and those enrolled in the Postgraduate Training Certificate within the HaSS faculty. This initiative has been successful in establishing a meaningful peer support network among staff and students. The PPSG operates throughout the academic year, offering a dedicated space for PGRs to openly discuss their first- year doctoral experiences, including key milestones and challenges, while engaging with peers from various disciplines within the faculty. During the first semester, these groups convene six to seven times, and in the second semester, the continuity is maintained with one or two seminar groups meeting an additional four to five times.

In accordance with the findings from the study by Cahill et al. (2014), which indicate that students are inclined to seek academic and pastoral support that resonates with their goals, the PPSG has been designed to fulfil three primary objectives: 1) It provides practical guidance to help students navigate the RED framework effectively; 2) It ensures that first-stage students have consistent access to a supportive peer network, irrespective of external circumstances; 3)

It fosters an environment where colleagues facing similar academic journeys can connect, share insights, and offer mutual support, thereby enhancing their overall program experience.

2.2. Establishment the Function of PPSG

In September 2020, the PPSG was established to support new PhD students during the lockdown. Its primary aim was to keep students on course with their induction process while addressing the isolation felt by many, particularly those studying from abroad or living alone in student halls in Newcastle (Leonardo, 2021). Recognizing a gap that Student Union societies' social activities could not fill, the PPSG offered more curriculum-focused support to foster a sense of community and maintain student engagement.

To facilitate this, students were encouraged to join the PPSG and were strategically placed into diverse groups. This intentional mixing was designed to mirror the program's cross-

disciplinary nature and proved to be effective. Consequently, seven or eight small groups, each comprising ten to twelve students, were successfully established. This structure not only helped in maintaining a close-knit community but also allowed for a more personalised support system, aligning with the program's overarching goals of connection and academic progress.

2.3. Delivery and Structure of PPSG Sessions

During the pandemic, the PPSG sessions were conducted exclusively via Zoom to adhere to safety protocols. However, with the easing of restrictions in the UK, a hybrid model for session delivery was adopted post-pandemic. This new approach includes two groups continuing solely online, two groups meeting exclusively in-person, and three to four groups adopting a flexible format that combines both online and in-person meetings.

Table 1: Schedule of Sessions with Topics and Sub-topics

Schedule of Session	Topics and Sub-topics
Session 1	Welcome and Introductions
Session 2	Inductions; Basic Requirements for First-Year PhDs; Navigation and Utilisation of Essential Websites and Systems at Newcastle University
Session 3	Personal Development and Research Training Planning; Time Management; Selection of Suitable Research Training
Session 4	Learning and Researching Online
Session 5	Reflections – "How is it Going?"
Session 6	Review of the First Few Months and Looking Ahead
Session 7	Content Varies Based on Group Feedback

The PPSG activities were structured into seven distinct sessions, each focusing on a specific aspect of the program. (For a detailed overview, please refer to Table 1 above, which outlines the topics for each session scheduled for Semester One.) Initially, these sessions were held more frequently to aid student induction, gradually reducing in frequency to allow students to focus on their individual projects, while still providing regular check-in points. These sessions addressed common concerns and challenges at different stages of the program. For instance, one session was dedicated to effective time management strategies during research training and project execution.

2.4. Facilitating PPSG Sessions with Flexibility and Collaboration

To ensure a smooth progression of the Pastoral Peer Support Group (PPSG) sessions, Teaching Assistants (TAs) were equipped with PowerPoint presentations for the first six

sessions. This approach significantly reduced the need for extensive preparation, allowing TAs to focus more on facilitation. However, recognizing the dynamic nature of these sessions, TAs were granted the flexibility to modify the provided materials and topics to better align with the specific learning needs of the students in each session. This adaptability ensured that the content remained relevant and responsive to the group's evolving requirements. For the seventh and final session, a more collaborative approach was adopted. TAs were encouraged to actively engage with student feedback to shape the session's content. This process involved working collectively to identify key areas of interest or concern among the students and then developing tailored materials to address these topics. This collaborative effort between TAs and students not only enhanced the relevance of the final session but also fostered a sense of ownership and engagement within the group.

2.5. Roles, Training and Feedback Process for TAs in PPSG Sessions

The PPSG sessions were conducted by later-stage research student TAs, who brought their empathy and firsthand experiences to assist new students. In collaboration with faculty members, TAs co-created the foundational agendas and materials for each session, fostering a co-construction of knowledge that was instrumental in building rapport between staff and students (Van Schaik, et al., 2019). TAs were responsible for fielding queries and providing feedback to faculty members as necessary, creating a responsive and engaging learning environment.

To prepare TAs for their roles, the module leader conducted training and welcome sessions before each semester, as well as mid-term and concluding meetings. These training sessions and meetings aimed to align TAs with the common goals of the peer support groups, offer a platform for feedback and encourage them to share feedback about the sessions, and discuss strategies to tailor the sessions to optimally meet the diverse learning needs of students.

Considering the distinct characteristics and dynamic nature of each group, TAs were required to provide written feedback after every session. This feedback, sent via email to the module leader, includes detailed observations and reflections on how the session unfolded. This practice allowed for effective monitoring of TA engagement and commitments and gauging the overall progress of each session.

As the semester draws to a close, TAs and faculty members come together to assess the semester's outcomes. This collaborative review process also involves making strategic decisions about the number of groups to be continued or adjusted for the following semester, ensuring the program's responsiveness to the evolving educational landscape and student needs.

At the end of each semester, a collaborative review between TAs and faculty members took place to evaluate the semester's outcomes. This collaborative review process also involves

making strategic decisions about the number of groups to be continued or adjusted for the following semester, ensuring the program's responsiveness to the evolving educational landscape and student needs. TAs received both compensation for their time and valuable experience, enhancing the appeal of these roles for students looking to enrich their CVs.

3. Data Analysis

We devised a questionnaire containing 12 questions (excluding identifying data) in order to discover the impact of the PPSGs on stage 1 PhD and PGCert students in the HaSS faculty and improve the experience for subsequent cohorts. Respondents were anonymised, consented to the use of their data in this research paper and had the option to withdraw before publication. The findings from this questionnaire will also be used to improve the PPSGs for future PhD and PGCert students. The questionnaire received 11 responses from PhD and/or PGCert students from a variety of schools within the HaSS faculty. There was a minimum of 1 respondent per academic year (2020-2023), with the highest proportion of respondents attending semester 1 of the current academic year (23/24). Respondents attended either in-person or online, though the latter was more commonly observed due to the COVID-19 pandemic. Respondents were full- time, with the exception of one part-time respondent.

The respondents understood the aim of the PPSGs to be supportive, sympathetic and non-judgemental, with each session revolving around a predetermined topic. This is an accurate reflection of the main aim of the PPSGs, which indicates that the PPSGs were successful in their approach. The respondents identified that PPSGs focused on topics such as registration, time management, Annual Progress Review regulations and stress reduction techniques. Respondents noted that the PPSG leaders provided an open forum to ask questions and seek guidance on areas they needed support with, which is a particular strength of the PPSGs.

Students were overall quite satisfied with the support offered by the PPSGs, as indicated by responses to question 9 (Table 2). Many students selected 10 for this, which indicates the PPSGs are supportive environments. The responses to question 10 (Table 2) were more varied, concluding in a rounded average of 6.91. This demonstrates that there is potential to improve descriptions and understandings of the essential requirements through PPSGs. However, we have since produced a series of 12 educational resource videos, funded by the Faculty Education Enhancement Fund, as a response to this potentiality in light of previous student feedback, which aims to tackle this issue. As a result, subsequent PPSGs will direct students to these resources and then tackle any further questions within the sessions when the students require them.

Table 2: Responses to the questions assessing the satisfaction of the students, and imparting of knowledge regarding the essential requirements of the PhD or PGCert.

ID	Question 9 : With 10 being the most supportive and 1 being the least, how would you rate the level of support provided by your Peer Pastoral Group Leader?	Question 10: With 10 being the most, and 1 being the least, how would you rate the extent to which the Peer Pastoral Group has helped you understand the essential requirements of your PhD or PGCert?
HCA1	7	6
HCA2	10	10
SELL1	7	4
HCA3	8	4
APL1	7	1
LS1	10	10
HCA4	7	4
ECLS1	10	10
SML1	10	7
ELCS2	10	10
HCA5	10	10
Average	8.727272727	6.909090909

Respondents were asked to provide three words to describe their Peer Pastoral experience, as seen below in Figure 1. With the exception of two students who stated it could be improved through the continuation of PPSG groups throughout the PhD process, respondents typically responded positively.



Figure 1:Word cloud depicting all the responses to question 11. The larger text indicates a higher frequency.

Responses to question 12, an open-ended question requesting any other comments or feedback, featured ideas that are largely recommendations out of the scope of PPSGs. This included requests for groups formulated around students with 'caring responsibilities', for example, mature students or school-specific meetings. These groups are available in the wider University through societies, for example. However, the suggestion of these implies a lack of

awareness regarding community-building initiatives, which the PPSGs could draw more attention towards. Other responses request more opportunities for feedback immediately after the PPSG has lapsed to allow for continuous improvement and growth and provision past first-year PhD. We willreflect on these comments and consider how they can be implemented. Though PPSGs do not currently exist past first year PhD, the wider university hosts accountability groups for PhD students across the university at any stage. Therefore, our primary concern will be increasing awareness of the aims of the PPSG and implementing a more robust feedback protocol.

4. Reflections & Limitations

Reflecting on what made the PPSGs a success from the point of view of the leaders of this group, i.e., the PhD students who facilitated the support, it is the joint opinion of the authors of this paper that co-creation was necessary to adapt the objectives of the groups to the changing needs of the students. What this translates to is working with staff from the RED programme to review and construct sessions that are built on 'live' feedback given by participants during the PPSG sessions. For example, in the first year of the sessions, much of the discussions focused on understanding technical acronyms relating to parts of a PhD. By coming together to meet with other leaders and staff, we could then move to co-create resources that assisted new PhD students in understanding the 'language' of the programme.

While this study offers valuable insights into student expectations and the effectiveness of academic and pastoral support, it is important to acknowledge certain limitations in its design. The study utilised a relatively small sample size, which exhibited biases in terms of disciplines (only in HaSS faculty). Additionally, various contextual factors, including the students' place of residence, age, work-based learning experiences, the specific curriculum studied, and their prior educational background, might have influenced the outcomes. These variables warrant further exploration to deepen our understanding of their impact and to enhance the comprehensiveness of future research in this area.

5. Conclusion

The PPSGs were born out of the pandemic crisis but quickly turned into a dynamic and well-received feature of our faculty's offerings for PGRs. Sense of belonging in a scholarly community, social isolation and anticipation of future workload are cited as some of the main stressors for first-stage PhD students (Cornwall et al., 2019), and the data gathered for this study seems to suggest, notwithstanding the limitation of our sample, that the PPSGs have contributed to an easier and more productive transition for new students at Newcastle University.

The fundamental value of peer connections (Jackmant et al., 2023) for new PhD students was at the basis of the creation of the groups, and it was rewarding to see that our participants used words such as supportive, social, reassuring and friendly in their responses. This initial study seems to indicate that aimed peer support in the delicate period of transition into a PhD is a useful and worthwhile endeavour, but that provisions should not stop at stage one and that more could be done to provide new starters with the key information they need on processes and requirements. We have already started to respond to the feedback by creating a package of video resources and are exploring synergies with our University's PGR Community to trace a clear path of peer support across a PhD career.

The next step in our investigation will be reflecting on the intrinsic reward, both in terms of professional development, personal growth and researcher education, that leading these groups brings to our Teaching Assistant. We hope to secure further funding from the University to pursue these pedagogical research avenues and to continue to offer "invaluable" and "supportive" peer exchange spaces for all our PGRs.

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First-year higher education student environmental literacy – the Algarve University case

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Abstract

The study aims to contribute to characterizing the environmental literacy profile of students entering higher education in Portugal and to explore associations between sociodemographic variables and environmental knowledge, attitudes, and behavior. A questionnaire survey was conducted with a stratified sample of 451 first-year undergraduate students from the University of the Algarve (southern Portugal). Results suggest that students demonstrated moderate environmental knowledge, positive attitudes toward the environment, and moderately positive pro-environmental behaviors. Evidence of relationships between students' environmental literacy profiles and sociodemographic aspects such as gender and scientific areas of study provides insights for future discussions and promotion of environmental education and culture in higher education institutions in Portugal. This will enable them to play an effective role in enhancing students' environmental literacy and citizenship.

Keywords: *Environmental literacy; Environmental attitudes; Environmental behaviour; Environmental knowledge; higher education students; Portuguese sample*.

1. Introduction

For nearly 50 years, humanity has been exploiting resources and emitting pollution far beyond the planet's capacity. Efforts in environmental education have been implemented worldwide over the past decades, yet the depletion of global resources continues to escalate year after year. A populace that is environmentally literate is considered essential for improving the quality of the environment (Disinger & Roth, 1992). To assess the achievements of environmental education, scholars have focused on evaluating outcomes such as environmental knowledge,

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awareness, attitudes, intentions, enjoyment, and behavior (Stern et al., 2014). The term "environmental literacy" was introduced within the context of environmental education (Roth, 1992), with the belief that environmental education globally contributes to enhancing the environmental literacy of its target audience (Stern et al., 2014). Environmental literacy primarily encompasses knowledge, attitudes, dispositions, and competencies that individuals need to effectively analyze and address environmental issues (Hollweg et al., 2011). Environmental knowledge, attitude, and behavior are considered major components in characterizing environmental literacy (Hallfreðsdóttir, 2011; Krnel & Naglič, 2009; Negev et al., 2008; Spínola, 2014), assumptions that underpin the context of the present study.

In Portugal, limited evidence regarding the effectiveness of environmental education has emerged, particularly within the Eco-Schools Program (Spínola, 2015, 2016, 2020). The scant studies available for higher education (e.g., Amador et al., 2015; Caeiro et al., 2020; Farinha et al., 2018; Fonseca et al., 2018) suggest that the weaknesses identified at previous education levels may be further exacerbated here. A deeper understanding of the effectiveness of environmental education in Portugal is necessary to facilitate improved practices and strategies within the higher education context.

The study sought to contribute to understanding the levels of environmental knowledge, attitudes, and behaviors among students beginning higher education in Portugal, and to explore their relationships with socio-demographic aspects such as gender or family literacy.

2. Method

An anonymous survey questionnaire was conducted to characterize students' environmental literacy profiles, including knowledge, attitudes, and environmentally responsible behaviors, and to gather socioeconomic and demographic data. The questionnaire received prior approval from the Ethics Committee Board and the Data Protection Officer, and underwent pre-testing to ensure reliability and validity. It begins with a brief introduction outlining the study's aim, assures participants of confidentiality, and provides information necessary for participants to give their informed consent. The questionnaire is divided into two sections: 1) Respondent's socioeconomic status (including family income, parents' literacy), demographic variables (such as gender, age), secondary school grade, and engagement in environmental education projects and activities; 2) Respondent's environmental knowledge, pro-environmental attitudes, and behaviors toward the environment.

To assess environmental knowledge, the questionnaire addresses topics such as environmental resources and concepts, challenges and solutions, as well as broader aspects including biodiversity, sustainability, and circular economy, alongside key areas like waste, water, energy, and climate change. It comprises 39 questions presented in a multiple-choice format, where participants are required to select the correct responses. These queries were adapted from prior

surveys to cover a diverse array of contemporary environmental subjects pertinent to the Portuguese context (DeChano, 2006; Spínola, 2015). The final evaluation of environmental knowledge is based on the number of correct responses provided, with a proficiency benchmark set at 75% following the criteria outlined by Geiger et al. (2019).

To gauge environmental attitudes, a Portuguese version of the 15-item revised New Ecological Paradigm (NEP) devised by Dunlap et al. (2000) was used. Participants rate the items using a 5-point Likert-type scale, ranging from "never" to "always." A satisfactory level of internal consistency for the scale was indicated by a Cronbach's alpha of 0.74 obtained for the current NEP dataset (Nunnally & Bernstein, 1994). An overarching attitudinal score was computed, with potential scores falling within a spectrum of 15 to 75. Lower aggregate scores denote less favorable pro-environmental attitudes.

Behavior concerning the environment was evaluated using 23 items adapted from Kaiser (2020) and Spínola (2015). A 5-point Likert-type scale, ranging from "never" to "always," was utilized to assess the frequency of pro-environmental behaviors.A moderate level of internal consistency for the scale was indicated by a Cronbach's alpha of 0.65 obtained for the present behavioral dataset (Nunnally & Bernstein, 1994). Elevated totals on the sum of the 23 items correspond to more favorable pro-environmental behaviors, with potential scores ranging from 23 to 115.

A stratified sampling approach was used to select participants from all undergraduate courses at Algarve University. These courses were grouped into 7 main scientific areas: engineering, humanities, social sciences, natural sciences, agronomic sciences, formal sciences, and medical sciences. To achieve a 99% confidence level with a 2.5% margin of error, minimum sample sizes for the total population (n=251) and each scientific area were calculated. To recruit participants, at the start of the 2023-24 academic year, the researcher contacted teachers to schedule visits to their classrooms. Upon arrival, the researcher explained the project's objectives and invited students to participate. Data collection across different courses continued until the minimum sample size was reached for each scientific area.

The sample consists of 451 participants who are first-year undergraduate students at Algarve University. Among them, 65% are female, and 93% hold Portuguese nationality. The mean age of the participants is 19.8 ± 5.1 years old.

The data were analyzed to determine the levels of the main outcome variables. Descriptive statistics, including measures of central tendency, were calculated, and Cronbach's Alpha was utilized to assess the reliability of the scales. Correlations were computed between and among the outcomes and sociodemographic variables. Non-parametric tests, specifically the Kruskal-Wallis test, were employed to identify significant differences among and between groups of participants based on gender, family income, parents' literacy, course scientific areas, students' previous grades, and engagement in environmental education projects and activities. The analyses were conducted using IBM SPSS Statistics version 22.

3. Results

The mean total score for environmental knowledge obtained for the present sample of first-year higher education students corresponds to approximately 69% of correct answers, which falls below the criterion level for proficiency in environmental knowledge. The mean score of 73.7 was obtained for Pro-environmental Behavior, representing about 64% of the maximum scale score. For Attitudes towards the environment, the sample has a mean value of 58.0, indicating a positive pro-environmental attitude. Significantly positive correlations were found among the outcome variables: Knowledge with Attitudes (r=0.44), Knowledge with Behaviors (r=0.25), and Attitudes with Behaviors (r=0.19). Table 1 summarizes these findings.

Table 1. Descritive statistics for outcome variable (N= sample size; Minim=Minimum value; Maxim= Maximum value; Mean=Mean value; SD=Standard deviation)

	N	Minim	Maxim	Mean	SD
Environmental Knowledge	451	0	37	26.7	5.8
Proenvironmental Behavior	451	13	102	73.7	8.7
Proenvironmental Attitudes	448	27	75	58.0	7.2

In the present sample, gender was not found to be significantly associated with environmental knowledge. However, gender showed a significant correlation with attitudes (r=0.34) and behaviors (r=0.15). Female students exhibited significantly higher scores in pro-environmental attitudes and behaviors compared to male students (p<0.001 and p=0.007, respectively).

The majority of students reported having a family income that allows them to live reasonably comfortably (90%), and no correlations were found between family income and the outcome variables.

Regarding parents' literacy, mother's literacy was not found to be associated with the outcome variables. However, results indicated that father's literacy is associated with students' environmental knowledge and behaviors. Specifically, students with a father who holds a PhD degree (2% of them) are significantly less knowledgeable about the environment (p<0.001) compared to students whose fathers have any other level of literacy. Similarly, this group of students exhibited significantly less environmentally responsible behavior (p=0.031) compared to students with fathers who have graduated from college (26% of the sample).

According to students' previous school grades, approximately 70% of the participants fell into the middle of the scale, indicating they were good students, while 20% achieved scores in the very good and excellent ranges. Student's grade was found to significantly correlate with environmental knowledge (r=0.33), attitudes (r=0.25), and behavior (r=0.16). Results from the

Kruskal-Wallis test suggested significant differences in knowledge and attitudes among student groups categorized by grade. Specifically, students with good and very good grades were significantly more knowledgeable and had higher attitudinal scores compared to other groups ($p<0.001$).

Significant correlations were observed between students' course scientific areas and their attitudes towards the environment ($r=0.23$). Differences were also found among students from different study areas in terms of knowledge ($p<0.001$), attitudes ($p=0.022$), and behaviors ($p<0.001$). Specifically: Engineering and humanities students displayed significantly higher levels of environmental knowledge compared to those studying social sciences ($p<0.001$), natural sciences ($p<0.001$), or medical sciences ($p=0.005$); Students from natural sciences exhibited higher scores in pro-environmental behaviors compared to those from social sciences ($p <0.001$), engineering ($p=0.002$), or medical sciences ($p <0.001$); Formal sciences students had higher attitudinal scores compared to humanities students ($p =0.017$).

Participants who are or have been members of pro-environmental organizations (about 10% of the sample) scored significantly higher in pro-environmental behaviors than others ($p <0.001$). However, participation in environmental education activities did not correlate with the outcomes.

4. Discussion

According to the present results, the mean levels of environmental knowledge among first-year Portuguese higher education students are above the criterion level typically considered satisfactory. However, these levels are similar to results obtained for students in the final stage of secondary school in different countries (e.g., DeChano, 2006; Negev et al., 2008). The attitudinal scores obtained for this sample of students could be considered as indicative of pro-environmental attitudes, and they are slightly higher than those reported in other studies (i.e., DeChano, 2006). The moderately pro-environmental behaviors observed in this study suggest that students' performance in behaviors is lower compared to their knowledge and attitudes. It is known that some ecological behaviors are easier to carry out than others (Kaiser & Wilson, 2000), and perceived behavior may appear negatively associated with actual behavior (Arnold et al., 2018).

In general, the present findings don't suggest increased weaknesses in environmental literacy among Portuguese university students, unlike prior studies (e.g., Fonseca et al., 2018). They reveal a connection between students' academic fields and their pro-environmental attitudes. In Portugal, environmental education has typically been integrated into specific subjects like biology and geography (Tracana et al., 2002). However, the results didn't show a clear pattern regarding the link between academic disciplines and environmental literacy. Engineering and humanities students tended to show higher knowledge levels, while those in natural sciences

displayed more pro-environmental behavior, and formal sciences students exhibited stronger attitudes. The evidence regarding the association between environmental literacy and students' prior curriculum-based environmental education is inconclusive. Environmental education has primarily focused on younger students, and as they progress, their involvement in environmental initiatives tends to decline (Schmidt et al., 2010, 2011). The current results confirm that Portuguese university students are presently less engaged in environmental endeavors compared to earlier years. This reduced engagement as students advance academically might contribute to the less favorable outcomes observed in pro-environmental behavior. While engagement in environmental education activities didn't correlate with environmental knowledge, attitudes, and behavior in this study, membership in pro-environmental organizations was significantly associated with pro-environmental behavior. This emphasizes that involvement in environmental activities can influence pro-environmental behavior.

The results indicated that student grade correlates positively with environmental knowledge, attitudes, and behavior, suggesting that students with good and very good grades tend to be more knowledgeable and have higher attitudinal scores. Additionally, fathers' literacy appears to be associated with students' environmental knowledge and behavior. Interestingly, family income did not impact the levels of environmental literacy in the studied students, contrary to findings by Negev et al. (2008), who found an association between knowledge and family socioeconomic status. Moreover, the present results also indicated gender differences in pro-environmental attitudes and behaviors. This aligns with a recent meta-analysis by Gökmen (2021), which suggests that gender affects environmental attitudes in favor of females at a low level. This observation was consistent with the present sample of Portuguese higher education students.

As expected, the results indicated moderate relationships between environmental knowledge and pro-environmental attitudes, supporting the hypothesis that environmental knowledge is positively correlated with environmental attitudes (e.g., Geiger et al., 2018). Additionally, positive correlations were observed between environmental knowledge and behaviors, as well as between attitudes and behaviors, although these correlations were weak. This finding is not unusual and is consistent with previous studies (e.g., DeChano, 2006; Negev et al., 2008). The results could contribute to discussions about formal environmental education in secondary schools and the promotion of formal and non-formal environmental education in Portuguese higher education institutions, aiming to enhance students' environmental literacy and citizenship.

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Promoting Efficiency in Education: The Cost-Aware Curriculum Model. An Efficient and Purposeful Approach to Curriculum Design

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Abstract

There is a growing need for efficient and purposeful curriculum design. The Cost-Aware curriculum Model emerges as a transformative approach, optimizing the educational effectiveness.

Through comprehensive analysis, we optimize the efficiency, quality and sustainability of educational programs while responsibly managing resources. By considering student dynamics, variations in study programs and staff dynamics, we ensure a curriculum that meets diverse needs. This approach reflects our commitment to excellence and fiscal responsibility. The Cost-Aware Curriculum Model aims to harmonize key parameters enhancing curriculum development efficiency and resource utilization. It seeks to strike a balance between resource efficiency and educational quality, fostering insights for optimal curriculum design.

The opportunity of this model is the creation of adaptable, responsive curricula that not only, meet current demands but also anticipate and address future challenges in education. This model serves as a tool for higher education institution management to foster a more cost-conscious mindset and approach in the (re)design of curricula.

Keywords: *Curriculum (Re)Design, Curriculum Development, Cost-Awareness, Effectiveness, Decision-making*

1. Introduction

Flemish Higher Education Institutions face the dual challenge of delivering high-quality education while concurrently managing the costs of academic programs (Vlor, 2021). At

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Artevelde university of Applied Sciences, we have developed the Cost-Aware Curriculum Model to address this imperative. This model is designed to guide decision-makers in (re)designing curricula, emphasizing an efficient and purposeful approach. Importantly, this model is not about cost-cutting our valuable curricula, but about making deliberate choices in curriculum development.

When designing future-proof curricula, it is crucial to consider various criteria, such as (1) aligning with the needs of the labor market, (2) integrating transversal competencies, (3) reflecting inclusive higher education, (4) ensuring accessibility, (5) Linking to secondary Education, (6) preparing for and connecting with lifelong learning and (7) effective use of resources. (Rationalization of the Free Universities of Applied Sciences in Flanders project within the Recovery and Resilience Facility, 2023).

The last criterion *'effective use of resources'* was specifically examined in-depth for this model, as it had the least available material, both in the literature and internally within Higher Education Institutions. The Cost-Aware Curriculum model can be viewed as a tool and reflective instrument to critically evaluate one of the seven optimization and rationalization criteria. It is essential to note that the other criteria were not included in the further analysis but are necessary for a comprehensive examination of curricula.

The demand for optimal curricula is substantial to ensure organizational feasibility in education. The 'Cost-Aware Curriculum Model' serves as a tool enabling us to pose the right questions and offer a more efficient and quality-driven educational portfolio. In this article we introduce the Cost Aware Curriculum Model, focusing on making informed decisions in curriculum design. This model presents an efficient and targeted approach to curriculum development.

2. Methodology

In the first phase, it is essential to address the existing gap in academic literature regarding comprehensive models for Cost Aware Curriculum Design in Educational Programs. (OECD, 2021). Recognizing this scarcity, our model is designed to create a bridge between critical elements in curriculum design, students and teaching practices. By integrating these dimensions, our model not only fills a void in the current literature, but also contributes to an innovative perspective to reshape discussions about cost-aware curriculum (re)design and management strategies within higher education institutions.

The second phase of our methodology involved refining and validating the initial model through a systematic process. After crafting the preliminary design, we gathered feedback from key stakeholders, including various heads of department, to assess the efficacy of the model in practical educational settings. This collaborative evaluation provided valuable insights into what aspects were effective and where refinements were necessary.

Following the initial model development and validation process with key stakeholders. Our focus shifted towards transforming the conceptual model into a practical tool that translates the complex data into a user-friendly dashboard format (De Boeck, F; Fruru I. & De Clercq, S., 2023).

The data used was gathered from 32 educational programs. These data were systematically analyzed to identify various parameters, which were subsequently utilized in the development of the Cost-Aware Curriculum model. Furthermore, and building upon the insights provided by the financial experts, our objective was to establish a strategic approach that optimally allocates resources, foster fiscal responsibility, and ensures the long-term viability of each educational program. The design of the model involved three distinct design sprints[1] within the data hub in collaboration with data experts and quality assurance peers. (De Boeck, F; Fruru I. & De Clercq, S., 2023) Throughout these design sprints, iterations were undertaken. These iterative feedback loops were instrumental in fine-tuning the visual aspects of the model, guaranteeing its utility as a support tool for decision-makers (De Boeck, F; Fruru, I., & De Clercq, S., 2023). The visual representation serves as a dynamic and accessible resource for educational leaders, enabling them to make informed decision grounded in a comprehensive understanding of the educational programs, the students and the according teaching staff within the higher education institution.

3. Cost-Aware Approach: The Practical Application of the Cost-Aware Curriculum Model

The objective of this model is to promote cost-consciousness while simultaneously ensuring the quality of education. Prioritizing workable conditions for fostering a healthy and productive work environment. The model encompasses three overarching parameters.

Firstly, it collects information about the students, including student numbers and the accumulated credit points. This provides insights into the distribution of credit points amongst students across various course components and programs.

The second parameter focuses on the educational offerings, providing details about allocated credit points, course components, the proportion of smaller course components, and the variety of trajectories.

The third parameter offers insights into the staff, including the student-to-staff ratio, the number of staff in different roles (Administrative and Technical Personnel, Academic Personnel, and others), and their correlation with student enrollment.

[1] Design sprints are rapid iterations of the design process aimed at quickly identifying and addressing flaws in the outcome, as opposed to a sequential stap-by-step approach.

The Cost-Aware Curriculum model contextualizes these three overarching parameters within the educational reality. It is imperative to consider these factors when interpreting the data and exploring potential courses of action. Are the infrastructure and scheduling conducive to specific measures? What does the Flemish legislation on education state on this matter? Does the applied Education Workload lead to a different interpretation of the situation? These questions emphasize the need to contextualize the findings within the broader educational landscape and institutional frameworks.

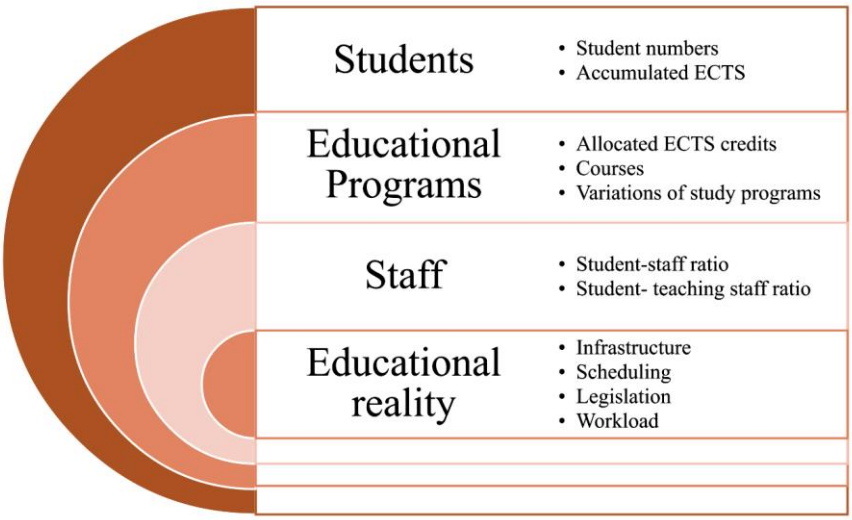


Figure1: Cost-Aware Curriculum Model. (2024).

The Cost-Aware Curriculum Model (2024) is grounded in the pursuit of more efficient resource allocation, without compromising the quality of education.

By students' numbers and their accumulated ECTS, educational programs, and staff-ratio as crucial parameters and aligning them harmoniously, educational programs can forge a balanced and cost-effective curriculum. This approach not only empowers students to realize their full potential but also ensures the financial sustainability of the institution.

4. Examining the Parameters: Students, Educational Programs, and Staff

4.1. Parameter 1. Students

The initial focus centers on the number of FTE (full-time equivalent) students[2], capturing the evolution over multiple academic years. This longitudinal approach, spanning from t-7 to t-2[3] for professional bachelor programs and t-5 to t-2[4] for associate degree programs, provides insights into the accumulated credit points for specific programs.

Understanding the average number of accumulated credit points is also essential. However, due to the initial scarcity of data to identify students who enter later in their program separately, the average number of accumulated credit points was examined for generation students[5].

Additionally, parameters such as the proportion of new students entering the program and the proportion successfully graduating are examined closely. This analysis enables programs to comprehend trends in academic progress and make cautious predictions regarding potential growth or contraction within the program.

Accurately estimating the market share of students empowers Artevelde University of Applied Sciences to make strategic decisions, allocate resources more efficiently, and optimize the learning environment for diverse target audiences. This alignment with the expectations of the target audience enhances the institution's ability to meet its goals effectively.

4.2. Parameter 2. Educational Programs

Upon analyzing the educational offerings, it was initially noted that there were no foundational parameters readily available to provide a comprehensive overview. To address this gap, a careful examination of the available datasets was conducted, and essential factors were meticulously mapped out.

The number of organized course components and their evolution delineate the growth of our curriculum—how many course components and credit points (ECTS) do we organize, and which ones are deemed necessary. Additionally, a short list of courses was applied to identify

[2] FTE (Full-Time-Equivalent) student refers to a student enrolled in a program who completes 60 ECTS (European Credit Transfer and Accumulation System) within an academic year.

[3] The term t-7 to t-2 for professional bachelors in Flanders indicates the funding mechanism based on the average number of credits taken by students in the period spanning seven years prior to the current academic year (T) up to two years prior.

[4] The term t-5 to t-2 for Associate Degree programs in Flanders indicates the funding mechanism based on the average number of credits taken by students in the period spanning five years prior to the current academic year (t) up to two years prior.

[5] Generation students in Flanders refer to students who, at the bachelor level, are undertaking their first 60 ECTS credits in higher education.

course components with sufficient student enrollment in order to be financially sustainable independently, without relying on support from other course components. We also gained insights into the number of variations of the study program linked to the student count, enabling us to identify less lucrative variations of our study programs and optimize them based on societal needs and financial feasibility.

By closely examining the available resources and maintaining a balance between quality and practical feasibility, we aim to create a qualitatively robust learning environment that is also sustainable and accessible to all students. Striking this balance is crucial to align our aspirations in offering various trajectories with the actual possibilities within existing government funding.

4.3. Parameter 3: Staff

In the final phase of our optimization study, our focus extended to parameters related to staff members. The two key parameters considered in this context are the ratio of full-time equivalent (FTE) students per FTE staff member. This ratio provides insights into the workload of our staff and enables us to evaluate whether we can provide the necessary support to our growing student population.

Furthermore, specific attention was directed towards the ratio of FTE students per FTE instructional staff. The results of this analysis have generated a growing interest in implementing a standardized workload distribution across various programs. By adopting a standardized approach, we aim to achieve a more balanced teaching assignment of our instructional staff. While acknowledging the various Education Workload that allocate different resources to programs with varying student loads, we challenge ourselves to question whether significant differences in education still exist among diverse programs.

5. Conclusion: In-Depth Insights in Cost-Aware Curriculum Design

5.1. Integrating Cost-Awareness

In conclusion, the successful implementation of our model within the institution was a multifaceted process. Firstly, it involved proactive engagement with management and experts, ensuring their informed participation in the model's development through iterative feedback loops. This collaborative approach fostered a sense of ownership and commitment among key stakeholders.

Secondly, the integration of the model was facilitated by a comprehensive analysis and data preparation process. The collaborative efforts with our Data team, alignment with Quality Assurance colleagues, with Heads of different departments and insights from financial experts played crucial roles in ensuring the accuracy and relevance of the data underpinning the model.

Furthermore, the model served as a platform for knowledge exchange at the management level. Management teams were encouraged to learn from one another's experiences, fostering a culture of continuous improvement and shared insights.

Lastly, the integration of cost-awareness into the curriculum model emerged as a foundational step during the initiation, design or redesign of educational programs. This forward-looking approach ensured that financial considerations were embedded from the outset, emphasizing the importance of 'fiscal responsibility and sustainability throughout the entire life cycle of each educational program. Overall, the holistic implementation strategy emphasizes the model's dynamic contribution to enhancing educational quality, financial efficiency and strategic decision-making within the institution.

5.3. Cost-Aware Strategies

Attaining a precise understanding of the educational offerings is crucial in a Cost-Aware approach. This involves not only mapping out the number of variations of the study programs but also delving into their structural characteristics. At the forefront of a Cost-Aware Curriculum is the emphasis on thoughtful decision-making.

In our pursuit of a Cost-Aware curriculum, we advocate for decision-making in the development of diverse variations of the study programs. This involves strategically crafting a curriculum to place students in appropriate class groups, optimizing the educational experience.

In harmonizing these efforts, the curricular analysis serves as a roadmap for elevating the efficiency, feasibility, quality, and sustainability of our educational programs. By fostering a holistic perspective on the dynamic interplay between students, educational offerings, and staff, we lay the foundation for a curriculum that not only addresses to the diverse needs of our student body but also guarantees the responsible allocation of resources for long-term success. This comprehensive approach emphasises our dedication to delivering excellence in education while upholding fiscal responsibility.

In extending our commitment to continuous improvement, our focus on ongoing research and development remains unwavering. Looking forward, we aspire to refine our approach by developing a cost-based design tool for education. This tool, based on insights from our curriculum's details, will act as a guide, highlighting potential areas for improvement and optimization.

With a keen eye on the dynamic interplay between student enrollment, educational programs, and staff allocation, the envisioned tool will employ strategic indicators or "warning lights" in our curricula. These signals will prompt a proactive response, enabling us to propose new designs that not only align with Cost-Aware principles but also create space for a more comprehensive focus on the holistic development of our students.

In essence, our pursuit involves not just an analysis of the current state but also a proactive design approach that responds to emerging trends and challenges. By incorporating in the future, a cost-based design tool for simulating new curricula, we aim to continually refine and innovate, ensuring that our curriculum evolves in tandem with the ever-changing landscape of education. This forward-thinking methodology is grounded in our unwavering commitment to providing an enriching and well-rounded educational experience for our students.

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People with disabilities in the university-work transition: a project to study networks

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Abstract

The employment of people with disabilities is a goal indicated by international and European development policies. The possibility of access to education and vocational training is a prerequisite for achieving an independent life. This paper presents a qualitative research design for studying networks, which can support education and vocational training pathways of students with disabilities. Networks play an important role in building relationships between students and other social actors, and they allow for the identification of resources to ensure equal access to education, vocational training, and labour market. The preliminary results of the legislation and scientific literature analysis indicate the relevance of two elements: a new concept of people with disabilities, considered not only as users but also as actors in the network; the contribution of educational research to human and professional development in non-formal educational contexts, such as work environments.

Keywords: *student with disabilities; internship; job placement; work-based learning; pedagogy of work; action research.*

1. Introduction

The paper is the result of the analysis carried out in the first year of the PhD in Educational Theory and Research, focused on studying networks that support students with disabilities in the transition from university to work. This constitutes the first step of a research project on the pedagogical potential of workplace experiences for university students with disabilities. This research design aims to explore how the structure and characteristics of the network of services, which revolve around the person, can contribute to improving the student's skills and increasing the chances of job placement in the future, starting from the university internship experience.

According to statistical sources and scientific literature, there is a positive correlation between the presence of an impairment (psycho-physical-sensory) and the difficulty in accessing the world of work, which results in a higher unemployment rate for individuals with disabilities

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(Istituto Nazionale di Statistica [ISTAT], 2019; ISTAT, 2022; Giovannone, 2022). Despite differences in the economic and social systems of countries, this situation persists throughout Europe (Galera & Tallarini, 2023; Nevala et al., 2015). The rate of students with disabilities obtaining a secondary school diploma and enrolling in a university course, instead, is on the rise (Agenzia Nazionale di Valutazione del sistema universitario e della ricerca [ANVUR], 2022). This trend could positively influence the chances of acquiring skills for the labour market, but it requires training paths for the human and professional development of students.

International and European legislation, in fact, promotes the protection of the rights of all citizens and provides guidelines for development policies. In the Agenda 2030 programme, for istance, education and work are two areas that aim to achieve the goals of education (Goal 4) and work (Goal 8) for all to ensure full participation in social and work life for everyone. Even though these goals and efforts are widely acknowledged as important, it remains challenging to translate rights into concrete opportunities for people with disabilities (Nagtegaal et al., 2023).

In Italy, the legislature's attention is underlined by Law No 17/99, which protects the right to study in higher education and introduces specific figures and services for students with special needs, and Law No 68/99, which supports job placement through targeted employment. Laws are essential tools, but they are not enough.

Promoting inclusion in education and access to work appears to necessitate cultural changes that are guided by pedagogical reflections and practices. According to the bio-psycho-social approach, pedagogical studies enhance a different perspective on the person with disabilities. Inclusion studies acknowledge that interactive interventions in real-life contexts offer opportunities to eliminate stereotypes and prejudices that hinder more equitable development processes for all (Cottini et al., 2016; Ciccani, 2008; Friso, 2012; Curto & Marchisio, 2020; Montobbio & Lepri, 2000; Lascioli & Pasqualotto, 2021).

Theoretical research can develop an integrated study of training and work experiences, which can improve student engagement and foster an inclusive culture in work contexts (Dollinger et al., 2023). In current society, where the person-work relationship is changing, discussing diversity issues and practices could promote the well-being of all workers.

2. Networks and the pedagogy of work

The network, which is viewed as a system of relationships between actors who collaborate to support the life project of a person with special needs, is a crucial aspect of social policies (Franzoni & Anconelli, 2022; Mastropasqua, 2004). It is defined as a tool that can efficiently coordinate the services' interventions and manage economic and financial resources. Although the network has a significant role in organising activities, it frequently promotes welfare interventions designed to protect and safeguard people with disabilities. Some public and private

projects, organised in networks, also aim at human and professional growth (Borgonovi et al., 2016; Colleoni, 2018). However, they appear fragmented throughout the country, and therefore incapable of producing positive changes in the system.

In the research project, questions related to the job placement of students with disabilities in a network logic were analysed using the contributions offered by the pedagogy of work. This field of studies focuses on work and fosters constructive interactions with economic stakeholders. In light of these observations and using the network as an analysis unit, the pedagogy of work provides valuable insights for reflecting on university-work transitions and job placement.

2.1. The generative value of work

The importance of work in the lives of both individuals and society is underlined by the pedagogy of work in the first place. Theoretical studies highlight the generative nature of work (Alessandrini, 2017; Cegolon, 2020; Costa, 2016; d'Aniello, 2019; Dato & Cardone, 2018; Ricciardi, 2022): while working, an adult interacts with reality, comes into contact with it, and transforms it. Through education and work, individuals can construct their own identity and define it in accordance with the position that work allows them to attain in society. At the same time, the remuneration of work provides the person with the economic resources to plan and realise an independent life. People with disabilities may face various barriers that prevent them from accessing work and, consequently, opportunities for personal fulfilment. By critically examining the current debate on the transformations of work, pedagogy allows for the recovery of the centrality of the person-work relationship even in the presence of special needs (Canevaro et al., 2022; Marchisio & Curto, 2019).

In a network logic, understood as educational, it is possible to support the person by creating favourable environmental conditions for the self-promotion of the subject. In order to recover the meaning of generative value of work, the person with disabilities must be considered not just a user of the network but also as an actor in it. This change, which repositions the subject with respect to the network starting from the centrality of work, makes it possible to offer better protection of rights. To be embraced, it requires redesigning educational interventions for persons with disabilities and for other actors in various contexts (family, school, social health services, workplace, etc.).

2.2. Work-based learning

The issue of work-based learning (Albert & Marini, 2022; Bobba, 2016; Marcone, 2018; Vaccaro & D'Agostino, 2020) constitutes the other contribution offered by pedagogy of work for the purpose of the research design. European policies recognise work-based learning, which blends classroom and workplace learning, as a means of facilitating transitions from school to

work. In the case of a person with disabilities, it is important to consider how, when, and where to train for work, with the support of a lifelong learning network.

In education, in general, the encounter with work is a missed opportunity for young people with special needs. Even in the Pathways for Transversal Competences and Orientation of the secondary cycle (PCTO, in Italian schools) and in university internships, the priority of organisations is often only to protect students. Instead, to fully embrace an inclusive vocation and create socially responsible environments, higher education institutions should cooperate with workplaces to make them nodes in a network that supports the potential of students.

In a network logic, work-based learning, properly designed and linked to guidance interventions, enables students to place themselves in the work experience and reflect on aspirations, projects, learning, professional foreshadowing, and skills (Aluffi Pentini, 2023; Fabbri & Romano, 2019; Pellerey et al., 2020; Terraneo et al., 2021). At the same time, it allows employers to contribute to vocational training and design pathways to make future workers competitive in the market, while also identifying reasonable accommodations for accessible work contexts.

3. The research design for studying networks

The network is a tool used to organise services in the educational and social-health fields, as previously mentioned. The Guidelines on the targeted employment of persons with disabilities of the Ministry of Labour and Social Policies (D.M. No 43/2022) reiterated the importance of networks in active labour policies in Italy. This Decree provides indications for the development of interventions in favour of persons with special needs. It promotes 'an integrated network with the social, health, educational and training services of the territory, ... for the guidance and support of the person with disabilities taken in charge in order to favour his or her job placement' (p. 36).

In light of the importance of the network, the initial research question is: What structures and characteristics should the network have, in a specific territorial context, to support people with disabilities in the labour market? I decided to analyse the network from the perspective of internship and vocational guidance for university students with special needs.

The involvement of universities in the design of training curricula makes it possible to identify them as a key elements of the network. Educational research has the potential to help recognise resources and barriers in classrooms, training experiences, and future workplaces.

To encourage the active participation of social actors, the research design uses a qualitative approach. The project is therefore developed as an action research structured in two phases: I. Survey of current networks; II. Designing and monitoring university internship paths for students with disabilities.

3.1. A qualitative analysis of current networks

In the first phase of the proposed research project, a survey of existing networks in the city of Rome will be conducted. This choice makes it possible to localise the research activities while safeguarding the possibility of carrying out a sufficiently in-depth analysis due to the size and variety of the institutions and organisations present in the Roman territory.

A semi-structured interview will be used for data collection. The sample subjects, chosen for their representativeness in terms of the to the purposes of the research, are a) representatives of associations of people with disabilities, active in the protection of workers' rights; b) representatives of the working world, both public and private, involved in the promotion of people with disabilities and in active labour policies; c) graduates with disabilities, who are looking for a job or who work.

In the interview, topics such as the generative value of work and work-based learning for people with disabilities will be explored. The data collection will be useful in detecting current needs, resources, and barriers in school-work transitions and implementing good practices. It is assumed that the analysis of qualitative data can be used to enhance existing networks and to develop a hypothesis for a model of networked intervention in higher education.

3.2. University internship paths

In the second phase, the research involves the design and monitoring internship for university students with special needs. The analysis of workplace training pathways can help to build or redefine the student's social network for job placement.

This phase of the research can only be outlined and will be redefined on the results of the previous phase. The internship path will be co-designed with the student and the head of the host organisation, with a focus on the generative value of work and work-based learning. This activity will identify the network in which the student is placed, analysing the resources present and those to be found.

Taking into account the professional skills to be acquired in the degree course attended, the internship experience will enable students to reflect on their current educational and training needs and build/redefine their network according to the challenges of an adult life.

It will be possible to engage in exchanges between representatives of educational institutions and those of vocational training who, starting from the sharing of training experiences for students with disabilities, will be able to identify and disseminate new practices to improve social and work partipation.

4. Conclusions

Based on the analysis of legislation, scientific literature and some experiences, in university courses and workplaces (Giannoccolo & Aluffi Pentini, 2023), the preliminary results that emerged from the research design bring two elements to the attention of scholars: a) a new concept of the person with disabilities as active member of the network; b) the potential commitment of pedagogy to promote human and professional development in non-formal educational contexts, building networks in contiguous fields to support individuals and workplaces in the challenges related to new needs. These findings underline the feasibility of the next steps of this research project.

As concerns methodology, the focus on the individual leads to the preference for qualitative approaches, which emphasise the centrality of people in learning and training paths and in organisations.

Finally, for universities, the possibility of dialoguing with other stakeholders through pedagogical action research projects constitutes an opportunity yet to be exploited to contribute to quality improvement in all living environments.

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Supporting the design of sustainability-related higher education: Pedagogical method mixes and their effectiveness drivers

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Abstract

This paper aims to investigate eight pedagogical methods that are discussed and used in the context of sustainability education (i.e. lectures, case studies, debates, group discussions, in-class role plays, consulting, research and service learning projects) in terms of their manifestations on nine so-called pedagogical impact variables suggested to drive teaching effectiveness. Manifestations were determined by means of a two-stage online Delphi survey conducted with experts from the field of sustainability education. Results reveal that all pedagogical methods except lecture have positive manifestations for all impact variables with variations in the degree and that a mixed picture is present for lectures. By showing in detail which method is suitable for what and how well, the results offer important insights that can assist with the design of teaching or, more concrete, the compilation of course method mixes.

Keywords: *Sustainability education; pedagogical methods; teaching effectiveness; teaching effectiveness drivers.*

1. Introduction

Against the background that higher education (HE) institutions are called to prepare their graduates to be able to tackle sustainability challenges (UNESCO, 2017), a considerable amount of literature can be observed that deal with suitable pedagogies for sustainability-related teaching. Within this context, different pedagogical methods such as real-life consultancy projects (Molderez & Fonseca, 2018) or service learning (Halberstadt et al., 2019) are recommended. However, HE courses usually involve several methods that might touch different or similar drivers of effectiveness, and a clever combination of methods is important to increase the effectiveness of courses. This paper therefore compares different potentially applicable methods and analyses their pedagogical effectiveness drivers. It shows the results of a Delphi

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study in which experts from the field of sustainability education evaluated selected methods in relation to a set of so-called pedagogical impact variables. The latter represent factors that are linked to pedagogies and suggested to influence/drive the effectiveness of sustainability-related HE. In the following, these methods and variables will be presented (ch.2). Then insights into the Delphi study will be given (ch.3), and its results will be shown (ch.4) and discussed (ch.5).

2. Included pedagogical methods and pedagogical impact variables

This study presents the manifestations of eight pedagogical methods used and discussed in the field of sustainability education (e.g. Bustamante et al., 2022a; Figueiró & Raufflet, 2015; Lozano et al., 2019) in relation to nine pedagogical impact variables developed by the authors. The methods comprise, for example, lectures, in-class role plays as well as service learning projects. The impact variables include, inter alia, the degree of student participation/activeness and emotional involvement as well as the degree of stakeholder integration and multi-sensory experiences. Table 1 and 2 provide definitions for all included methods and impact variables.

3. Methodology

Between March and September 2022 a Delphi survey was conducted with a pool of overall ten experts from the field of sustainability-related education. The experts were predominantly female and the majority of them were functioning as professors or associate professors in HE institutions of different types mainly located in Europe. Teaching experiences of experts were covering a variety of subjects, including, e.g., CSR and sustainable management, business law, banking and sustainable finance instruments, sustainability accounting and reporting, intercultural management as well as engineering for sustainability development. The experts were selected either on the basis of their presence in an extensive literature search conducted on the topic of sustainability-related teaching and information gathered in subsequent internet searches or based on knowledge through joint participation in a research project on the effectiveness of sustainability-related HE. The Delphi survey consisted of two rounds (final $N_{round1}=10$ and $N_{round2}=7$). In each of the rounds, experts were requested to complete an online questionnaire and were provided with an additional document with information on the variables contained in the survey (especially definitions of pedagogical methods and impact variables). In both online questionnaires experts were asked, among other, to evaluate the influence/impact of each presented pedagogical method on each included pedagogical impact variable by using a scale ranging from "-3" (indicating a strong negative influence), over "0" (indicating no influence), to "+3" (indicating a strong positive influence). In the second round, experts were requested to provide these ratings taking the pooled assessments of the participants of the first round (presented by their averages) into consideration.

Table 1. Definitions of included pedagogical methods. Source: Bustamante et al. (2022b).

Method	Definition
Case study	Case studies are "written summaries or syntheses of real-life cases that require students to tease out the key issues involved and to identify appropriate strategies for the resolution of the 'case'. ... A 'case' should be a complex problem written to stimulate classroom discussion and collaborative analysis, and be a student-centered exploration of realistic and specific situations." (Alt et al., 2020, p. 62).
Debate	A debate is an activity which involves ”two groups of students put[ting] forward opposing arguments on an issue” (Cotton & Winter, 2010, p. 47).
Group discussion	Group discussion ”is a free verbal exchange of ideas between group members or teacher and students” (Sajjad, 2010, p. 10), ”a give-and-take dialogue that encourages students to enrich and refine their understanding” (Alvermann & Hayes, 1989, p. 306). It can involve the whole class (whole-group discussion) or separate groups within the class (small-group discussion) and take place in written as well as oral form (Jahng et al., 2010).
In-class role play	In-class role plays (e.g. Board Meeting Game) are an active learning and teaching technique, considered to be a part of interactive simulation whereby participants act out the role of a character in a particular situation following a set of rules (Dingli et al., 2013; Rao & Stupans, 2012).
Lecture	Lecture is ”a method of teaching by which the instructor gives an oral presentation of facts or principles to learners and the class usually being responsible for note taking, usually implies little or no class participation by such means as questioning or discussion during the class period” (Good & Merkel, 1959, as cited in Kaur, 2011, p. 10).
Service-learning project	A service-learning project (for the community) is a method where ”students engage in activities intended to directly benefit other people, where the activities are integrated with learning activities in an intentional and integrative way that benefits both the community organization and the educational institution” (Hayes & King, 2006, as cited in Lozano et al., 2017, p. 8).
Sustainability-related consulting project	A sustainability-related consulting project is a ”learning by doing” method where students work on solving real business and environmental [or rather sustainability-related] problems by developing practical recommendations for a real organisation (Segal & Drew, 2012, p. 1). In their role as consultants, students assist with diagnosing the client’s situation and finding and implementing solutions (Butler, 2018, p. 1-4).
Sustainability-related research project	A sustainability-related research project is a student’s own scientific endeavor to answer a sustainability-related research question (under the guidance of a faculty mentor) that can take the form of primary empirical research, secondary data analysis, or meta-analysis (Rutgers University, n.d.).

Table 2. Definitions of included pedagogical impact variables. Source: Bustamante et al. (2022b).

Impact variable	Definition
Degree of student participation/activeness	The degree of student participation/activeness describes how much opportunity students have to be active and to engage in the learning process (based on Prince, 2004).
Degree of student collaboration/group work	The degree of student collaboration/group work describes how much opportunity students have for working/ interacting in social constellations (e.g. group, team, community) to solve shared tasks (based on Strijbos, 2016), hereby enabling mutual learning and co-production of knowledge.
Degree of student emotional involvement[1]	The degree of student emotional involvement describes the degree of evoking an emotional connection of students with the material or contents being learned (based on Immordino-Yang & Faeth, 2010).
Degree of student (self-)reflection	The degree of student (self-)reflection describes how much opportunity is given to students to critically reflect on their knowledge, experiences, assumptions, beliefs, values, personal roles, attitudes, or responsibilities in relation to sustainability issues (based on Cotton & Winter, 2010; Svanström et al., 2008).
Degree of experience of real-life situations	The degree of experience of real-life situations describes how much opportunity is given to students for collecting firsthand experiences in real-world settings focused on solving actual sustainability problems/ challenges (based on Brundiers et al., 2010).
Degree of inter-/ transdisciplinarity	The degree of inter-/transdisciplinarity describes how much opportunity students have to transfer and recombine concepts and methods from different disciplines and create holistic solutions beyond single disciplines when exploring sustainability topics (based on Greig & Priddle, 2019).
Degree of stakeholder integration	The degree of stakeholder integration describes how much opportunity is given to students to identify stakeholders and their demands, to interact with them, and to consider their expectations in finding solutions within tasks during the course work (based on Plaza-Úbeda et al., 2010).
Degree of integration between theory and practice[1]	The degree of integration between theory and practice describes how much opportunity is given to students to apply and reflect theoretical knowledge in practical contexts and, vice versa, to reflect and interpret practical experiences before the background of theoretical knowledge (based on Gerstung & Deuer, 2021; Pham, 2011; Woo et al., 2012).
Degree of multi-sensory experiences[2]	The degree of multi-sensory experiences describes the degree of engaging students through providing a combination of visual, auditory, tactile, gustatory and/or olfactory stimuli and linking it to relevant academic objectives (based on Baines, 2008).

[1] Updated definition compared to Bustamante et al. (2022b)

[2] Newly introduced variable and definition compared to Bustamante et al. (2022b)

A few other changes were included in the second compared to the first survey round: Based on the feedback of experts that the impact evaluation depends on the concrete settings, possible scenarios for each teaching method were developed and provided together with the definitions of methods in the second round. Moreover, based on expert opinions related to pedagogical impact variables, the definitions for the "degree of emotional involvement" and "degree of integration between theory and practice" were updated in the second round and the "degree of multi-sensory experiences" added, replacing another suggested impact variable. Finally, several teaching method definitions were updated.

4. Findings

Table 3 presents the manifestations of the eight pedagogical methods investigated in this study in terms of the nine above introduced pedagogical impact variables. Overall, a positive influence can be observed for the majority of cases with variations in the degree, showcasing that some methods are particularly strong with respect to some variables: Consulting and service learning projects seem to have an especially high positive influence on all of the variables; debates, group discussions and in-class role plays contribute highly to participation/activeness, collaboration and emotional involvement of students; research projects to students´ participation/activeness; and case studies to the integration between theory and practice. The findings provide indications for impactful method mixes, e.g., the combination of a case study with group discussions and an in-class role play within one single course. Results show a slightly negative influence of the method lecture on four impact variables. However, negative values are only slight and standard deviations are high, indicating that experts differ in their opinions. Finally, mixed expert opinions can also be oberserved in relation to other cases, for example, the influence of debates on the experience of real-life situations or of group discussion on the integration of stakeholders.

5. Discussion and conclusion

The present paper aimed at assessing eight pedagogical methods in terms of their influence on nine pedagogical impact variables in order to support the design of sustainability-related HE courses. The results of a two-stage online Delphi survey indicate that case studies, debates, group discussions, in-class role plays, consulting, service learning, and research projects have consistenly positive manifestations and that these vary in degree. The presented matrix reveals the strengths of methods in terms of their influence on variables that are suggested to drive the pedagogical effectiveness of teaching and hereby facilitates the compilation of impactful method mixes. In regard to lectures mixed expert opinions can be observed that underline the controversial debate in the literature on this method. Limitations of the study include the limited number of included pedagogical methods, the relatively small sample of experts participating

Table 3. Manifestations of teaching methods on pedagogical impact variables.

		IV1	IV2	IV3	IV4	IV5	IV6	IV7	IV8	IV9
Case study	Mean	1.86	1.14	1.00	1.43	1.57	1.43	1.14	2.00	0.29
	Std. Dev.	.90	1.07	1.00	0.79	0.53	0.79	0.90	0.00	0.76
Debate	Mean	2.14	2.00	2.14	1.71	1.29	1.14	0.71	1.00	0.57
	Std. Dev.	1.21	0.82	0.69	0.76	1.70	0.90	1.80	0.58	1.13
Group discussion	Mean	2.43	2.43	2.29	1.86	1.00	1.14	1.00	0.86	0.57
	Std. Dev.	0.53	0.53	0.49	0.90	1.00	0.90	2.00	1.35	1.13
In-class role play	Mean	2.57	2.43	2.14	1.43	1.29	1.29	0.86	1.43	1.57
	Std. Dev.	0.79	0.53	0.69	1.27	1.70	1.11	0.90	1.62	0.98
Lecture	Mean	-0.57	-0.29	1.43	1.29	-0.71	1.00	-0.14	1.00	0.00
	Std. Dev.	1.99	1.80	0.98	0.76	2.21	0.82	1.77	0.82	0.58
Service-learning project	Mean	2.86	2.29	2.71	2.43	2.86	2.14	2.71	2.86	2.14
	Std. Dev.	0.38	0.49	0.49	0.53	0.38	0.38	0.49	0.38	0.90
Sustainability-rel. consulting project	Mean	2.00	2.29	2.29	2.00	2.71	2.29	2.57	2.71	2.29
	Std. Dev.	2.24	0.76	0.95	0.82	0.76	0.49	0.79	0.49	0.76
Sustainability-rel. research project	Mean	2.71	1.00	1.71	1.71	1.71	1.57	0.71	1.71	0.57
	Std. Dev.	0.49	1.53	0.95	0.76	0.49	0.98	1.11	1.70	0.79

IV1: Degree of student participation/activeness; IV2: Degree of student collaboration/group work;
IV3: Degree of student emotional involvement; IV4: Degree of student (self-)reflection;
IV5: Degree of experience of real-life situations; IV6: Degree of inter-/transdisciplinarity;
IV7: Degree of stakeholder integration; IV8: Degree of integration between theory and practice;
IV9: Degree of multi-sensory experiences

<= 0	> 0 - < 1	1 - < 2	>= 2

in the Delphi survey, and the subjectiveness of experts´ evaluations that are influenced by their own experiences and teaching contexts (going beyond the teaching scenarios presented to them). Future research should enrich the database, complete the teaching methods overview and/or add other reseach methods to provide even more meaningful results.

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Collaborative Learning Approach: a Safety Huddle

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Abstract

To change behaviours regarding Patient Safety (PS), it is important to select the right pedagogical strategy to promote it. The PS huddle strategy, implemented was based in a role-play situation, based on a topic included in the Portuguese National Patient Safety Plan. This strategy seems to have contributed to raising twelve students' of first edition of postgraduate course in clinical supervision awareness and interest in the PS subject. All the students indicated the strategy as a methodology that facilitates learning in class, promote creativity, critical mind and emotional inteligence development. It was also described as easily replicable for the various healthcare scenarios, regardless of the level of action. The use of new active teaching approaches in higher education are an important way to help student´s developing them soft and hard skills and should be integrated more often in the postgraduate courses.They indicated the importance of replicating in future editions.

Keywords: *Patient Safety; Huddle; Clinical Supervision;Collaboration*

1. Introduction

To change views and behaviours regarding patient safety, it is important to select the right pedagogical strategy to promote it (Paulo & Mendes, 2019). Care will only be safe if it considers the preferences and vulnerability of the patient in other words if the right care be provided at the right time (Barroso et al., 2021). In this way, and according to Paulo and Mendes (2019, p. 265), patient safety is a topic that is highlighted by health systems around the world, only possible of reach with address educational processes, allowing construction, consolidation and growth.

Among possible pedagogical methodologies to be applied by Higher Education Institutions, it is important to reflect on and apply active learning methodologies in learning Patient Safety (PS). In this context, the teacher should take a role more mediation-oriented, as a facilitator of

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learning, in which the protagonist of the method is the student themselves. This is a methodology that is based on meaningful learning, uses pedagogical activities to build knowledge and acquire skills, attitudes and behaviours that are essential for the future professional (Paulo & Mendes, 2019; Soares, 2021).

It is known that when it comes to teaching the PS thematic, it is entirely different to take part in a simulation or role-play about an hypothetic error in patient care - a moment in which students experience strong emotions and feelings - than to passively listen to a lesson on the subject (Paulo & Mendes, 2019). It is also, recommended that learning integrates case control studies, case reports, small groups activities, with simulation and role-playing taking pride of place among the recommended strategies (WHO, 2011).

The main pedagogical activities that consider the principles listed above, as well as their challenges and benefits, are those that bring the most benefits and effects, both to teaching and to practice in the daily context of health institutions (Paulo & Mendes, 2019; WHO, 2011).

However, and especially in postgraduate training, teaching based on active methodologies is highly recommended. Namely, the use of role-playing stands which allows students to improvise/write dialogues and actions in a predetermined or selected scenario, interpreting roles and dialogues in a situation or case control study. Actors, patients and/or the students themselves can be used for the role-play (Paulo & Mendes, 2019). However, the main challenges identified are: (1) writing the scripts; (2) developing situations that provoke choices, decisions, and conflicts; (3) some students may take on the role of passive spectators and (4) the performance may lose its rhythm. Although the recognized benefits are: (1) low cost; (2) be interactive and empirical once it introduces and sensitizes students to the roles that patients, families, health professionals and administrators play in clinical setting; and (3) it is ideal for exploring interprofessional work factors and communication in error prevention in clinical care (Paulo & Mendes, 2019).

The PS Huddle strategy aims to increase situational awareness and anticipate possible unsafe conditions. It is a method that increases safety awareness at the operational level, or even at the front line, and helps the organization to develop a safety culture. These consist in quick, periodic meetings that allow work to be aligned and points of situation to be assessed, promoting teamwork and systematized action for continuous improvement (Institute Healthcare Improvement, 2004; Taylor et al., 2014).

The Huddles strategies can be held for a number of purposes, namely: 1) concerns about quality and safety from the previous day or shift; 2) quality and patient safety issues from the day; 3) review of problems identified by the team or one of its members; 4) input on issues related to quality and patient safety; 5) announcements and information that needs to be shared within a team, as the use of new drugs or scheduling procedures, among others (Institute Healthcare Improvement, 2004; Kolb, 2105; Paulo & Mendes, 2019; Taylor et al, 2014).

In this sense, it is important to know, the key areas recommended to be worked on PS, on World Health Organization (WHO) perspective and from a national perspective, through the health national polities in the different countries.

Globally, the issue was analysed at the seventy-fourth World Health Assembly in 2021, with the vision of "a world in which no one is harmed in healthcare and all patients receive safe and respectful care, always and everywhere". Thus, the Global Action Plan for PS (2021) emerged, with the aim of providing strategic guidance to all stakeholders to eliminate avoidable errors in healthcare and improve patient safety in different domains of practice, through policy actions on safety and quality of health services, as well as for the implementation of recommendations at the point of care. The plan integrates a framework made available to countries, allowing them to develop their respective national action plans on patient safety, as well as aligning existing strategic instruments to improve patient safety in all clinical and health-related programs (WHO, 2011).

Still in this context, and namely in Portugal, the health policies are provided by the Ministry of Health through the National Patient Safety Plan developed to the years of 2021-2026 (PNSD 2021-2026), approved on September 24th of 2021, and published in Order no. 9390/2021. º 9390/2021, which is structured and based on five strategic pillars which should play a prominent role for healthcare professionals, namely: 1 - Safety culture; 2 - Leadership and governance; 3 - Communication; 4 - Prevention and management of patient safety incidents; 5 - Safe practices in safe environments.

1.1. Aim

This study aimed: to explore the students' points of view, reactions as well as how they felt and adjusted to the huddles strategy in which they actively participated - (role-playing and dramatization) about PS; to assess in student perspective, the teaching methodology implemented (Huddle strategy). These aims try to answer some previous questions as: i) what are the students' points of view, reactions as well as how they felt and adjusted to the huddles strategy?; ii) How is accessed the hubble strategy in students perspective?; iii) Does hubble strategy capable to contribute for a new student´s prespective about PS?

2. Methodology

2.1. Study Desgin

Integrated in the first edition of postgraduate course in clinical supervision, in academic year of 2022/2023, of Health of Sciences School in Portugal, it was developed an exploratory study based on qualitative approach with twelve nursing students enrolled in the course and attends the safety and risk management discipline.

The participants were invited to create a PS huddle. To minimize the challenges of the methodology, were considered some aspects to carrying out the work, including: i) creating groups of four elements, and invited to identify/create a situation based on the selection of one major topic included in the Portuguese National Patient Safety Plan (Republic Diary no. 187/2021, Series II of 2021-09-24); ii) the students have to write the huddle script (where they identify one clinical setting; stakeholders; problem in focus and a solution for it) during ten minutes. iii) all participants in the groups must play a defined and active role in the process; iv) the students should play a role from a different professional group, as much as possible, to be able to take on roles from a multi-professional perspective.

The fact that the time limit was set at 10 minutes ensured that the role-play would not lose pace and everyone in the group had to actively participate.

The final presentation took place online. All groups also submitted their work in written format, where it was possible to indicate the conclusions of each group, regarding the work they did throughout the curricular unit.

As data collection it was developed an individual online survey with 4 open questions, self-completed. The conclusions of the written work were also analysed in order to find out the groups' perception of the work and their perspective on learning. It was analysed the information with a content analysis (Bardin, 2020).

Fulfilled the ethic assumptions, all students signed informed consent.

3. Findings

The class was made up of 3 female participants and male nurses.

All the groups complied the huddle time and were easily able to select the key area to be worked on, as well as the clinical setting, where it would take place.

It was developed four projects in PS: one in Primary Health Care setting; three in the hospital setting. Concerning to the thematic developed: two were in PS Culture and two on Safe Practices in Safe Environments. Of the projects developed to the hospital setting, involves different medical speciality: paediatric emergency; adult emergency; orthopaedics service articulation with imaging service. In the context of primary healthcare, the work was done to prepare an audit for the certification of functional units.

In terms of the professionals chosen, there were several different areas of health professionals, namely: nursing, doctors, senior radiology, psychology, and physiotherapy technicians. Health assistants and clinical secretaries were also selected to join the huddles. No group was made up of patients.

The entire group (n=12) considered the selection of the action and evaluation methodology based on a Safety Huddle to be good (n=6) or excellent (n=6). Even those who were already familiar with its practice (n=1) validated its relevance in the context of PS and risk management.

Highlighting the individual opinions collected in the online survey, the student´s opinion about the huddle methodology in the Risk Management and Patient Safety Curriculum Unit, shows a positive student's perspective. *S8:"the methodology seems extremely appropriate to me. Rather than being expository, it was interactive (through the presentation of videos and, above all, through feedback from the teacher and colleagues). This method of assessment through group work, but practical work, seems to me to be extremely pertinent and allows the student to acquire theoretical and practical knowledge related to the area of patient safety. It's more important than giving expository content to give students the tools to effectively research and explore the areas of greatest interest, so that they can then effectively apply them in clinical practice"*.

S12: "I particularly liked the methodology, it is a different kind of work, but with a dynamic of collaborative work, which mirrored the knowledge transmitted in the course" and *S6:"I found the methodology interesting and motivating, 'escaping' a little from traditional assessment methodologies. I really liked this assessment strategy, the HUDLLE, which I already knew because this strategy was used in the dialysis clinic where I worked"*.

It was either highlighted, the fact that the presentation occurred in online format, bringing cost-benefits advantages, and comfort of being in them homes.

The students (n=12) were asked about the relevance of maintaining the methodology used. All of them positively validated the appropriateness of the huddle methodology/approach to Patient Safety (they rated it adequate [n=2] and very adequate [n=10]), and they agreed that it should be maintained in future editions. As can be seen in table 1, some emotions and feelings such as 'empathy' and 'collaboration' and some opinions such as 'dynamics' or 'orientation' were sumarized (see table 1).

Table 1. Students opinions and reactions to the strategy implemented. Source: Own Elaboration (2014).

Cathegory	Outcome	Value
Emotions/feelings	*Empathy*	n=12
	Collaboration	n=9
	Curiosity	n=9
	Surprise	n=8
	Optimism	n=4
Opinions	*Orientation*	n=12
	Clarity	n=11
	Dynamics	n=9

Highlighting the group opinions collected in the written work, to substantiate the significant contribution of this methodology, it is important to consider the opinion of a working group (S2, S6, S9, S11) who said: *"We have concluded that we have achieved the main objective we set ourselves in carrying out this work, in line with what was recommended for the assessment of the Curricular Unit. It enabled us to develop the skills needed to design and build a Safety Huddle based on one of the five pillars that support the fourteen strategic objectives of the PNSD 2021-2026*. The group highlight pillar 5, which refers: *"Safe Practices in Safe Environments", one of the principles of the clinical supervisor's work. This construction exercise allowed us to understand the phases that make up a Safety Huddle and the content to be developed in each of them. Its operationalization also enabled us to develop strategies for planning, implementation and the importance of follow-up."*

4. Conclusions

The PS huddle strategy seems to have contributed to raising students' awareness and interest in the PS subject, especially in key areas (according to what they could select) that are very useful to their services of origin or other areas that are less explored by professionals.

Most of the participants addressed topics/services of interest to their current and/or future practice. Bearing in mind that the huddle makes it possible to improve situational awareness and anticipation of unsafe conditions (all the students agreed with the methodology), they indicated the importance of replicating it in future editions of the Patient Safety and Risk Management discipline.

All the students indicated that it is a methodology that facilitates learning in class, and is easily replicable for the various healthcare scenarios, regardless of the level of action, helping them to develop them creativity, critical mind and emotional intelligence.This strategy also brings to the teatcher a challenge to interact in specific moments to generate some improvement stimuli in the learning process, demanding high control of time and insight, into knowing when to intervene and how.

Despite of the positive students' opinions concerning the online strategy to play the huddle, it is also perceived as a limitation, because it does not confront them in a face-to-face interaction, and the importance to deal with non-verbal communication. An aspect to consider for future editions, to pormove face-to-face interacions and compared the outcomes.

The use of new active teaching approaches in higher education are an important way to help student´s developing them soft and hard skills and should be integrated more often in the postgraduate courses.

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Spokespersons to explain the world: analysis of their relevance, competences and instruction

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Abstract

This research aims to understand the figure of the spokesperson in institutions such as governments and companies, in order to communicate the entities they represent (Rojo, et al., 2020; Capurro et al., 2022;. Bart W. Édes, 2000), and to identify the geographical distribution of universities worldwide that offer specific training in this area, in order to gain insight into the current state of spokesperson training in the field of communication studies and to identify areas that require improvement. The main findings indicate that only 19 universities appearing in the 2023 Times Higher Education rankings, based on their programme offerings, offer courses that touch on facets of spokesperson training, including topics such as communication skills. The majority of these universities are located in the Americas. However, this lack of specific training on the subject should be addressed to produce generations of students capable of assuming the significant communicative responsibility of presentation.

Keywords: *Spokesperson Training, Public Relations Practicioners, University, Education, Master Spokesperson*

1. Introduction

Effective communication is crucial for building trust, managing crises, and maintaining a positive image for public and private organitzations. One of the most important aspects of communication is the role of a spokesperson. Regular training is needed for spokespersons, especially the ones from "companies that are at greater risk of facing critical situations (transportation companies, chemicals, oil companies, health)" (García-Santamaría, *et al.*, 2020).

National and supranational governance institutions and private corporations have, for a long time, their spokespersons that lead communication in these organizations. However, despite the critical importance of spokespeople, in the top 100 universities with communication studies, not

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much content is taught about this issue. In this article, it is explored the importance of spokespeople, and the needs for training programs to prepare future spokespeople.

In European countries, private corporations and private universities endorse and promote all kinds of courses to train spokespersons for companies and institutions. Professional associations also promote courses to provide this type of training, for example, Public Relations and Communications Association (PRCA) from the United Kingdom. There are industry associations and organizations that offer guidance and best practices for spokespersons.

The majority of these organizations, like Public Relations Society of America (PRSA), International Association of Business Communicators (IABC) and International Public Relations Association (IPRA), provide a Code of Ethics that outlines ethical principles and guidelines for public relations professionals, including spokesperson.Therefore, it is clear that there is a gap in the public university system that social reality is trying to fill with tailor-made training, of various durations, contents and trainers, and also of different credibility.

For all these reasons, the main objective of the research is to understand the role exerted by the spokesperson in organizations, analyse the content related to spokesperson training in the curricula of the top 100 universities with communication studies, according to the THE Ranking (2023), and understand the view of spokesperson on this matter and identify its main features.

2. Theoretical Approach

The current situation in the world leads us to observe many situations where the public and citizens often need explanations to understand the dimension of events that affect governments, countries or companies or institutions. This is the job that a spokesperson should do: explain and give context in order to guarantee the transparency in democratic societies and in companies in these environments. "My job is to be the messenger between the commissioners and the outside world. Politicians cannot spend 24 hours a day explaining their policies. This is what we are for" (Runchina, 2015), commented Mina Andreeva, one of the three main spokespeople for the President of the European Commission, Jean-Claude Juncker, since November 2014. According to Arceo (2012), the figure of the spokesperson explains to the world what a company, public institution or political party is like, and in this way, the spokesperson becomes the public image of the organization: “The spokesperson is an individual empowered to publicly express documents and official viewpoints of the institution that he/she represents” (Constantin & Petrucă, 2019, p. 261).

In a theoretical review of the spokesperson role, the authors highlight the dichotomy between "expert" and "political " spokesperson (Fumanal, 2020; Peytibí, 2020). Peytibí (2020) argues that if the spokesperson is an expert has more credibility than a politician who only comes out

at key moments. Fumanal (2020) believes it is not possible to choose one model: the decision will depend on the objective, the analysis of the scenarios and the communication strategy.

The recommendation is usually to choose a single spokesperson to avoid contradictions in public appearances (Crespo & Garrido, 2020; Rojo, *et al.*, 2020). However, this approach has not been followed by the organizations, as it happened during the Covid-19 crisis (Rojo, *et al.*, 2020). A technical and institutional spokesperson allows organizations to be proactive in their messages but multiplies the risks of contradictions (Costa-Sánchez and López-García, 2020).

"Spokespersons should devote attention to their nonverbal communication in times of crisis, because it impacts their credibility, and consequently, also the attitudes and behaviour of the public towards the organization", affirm De Waele, *et al*. (2018, p. 457). The authors also give some guidelines for spokespersons that can be addressed with media and vocal training. Their competences should include telegenic qualities, protocol, knowing how to master visual (background, posture, eye gaze, appearance and hand gestures) and verbal cues. Build key messages and repeat them into short quotes. Its characteristics entail leadership, crisis communication and risk management, management of negotiation processes and lead meetings. Its professional characteristics should entail communicative skills to express effectively, ability to speak in public, mastering the voice pitch, demonstrate trust, management of non-verbal communication, emotion management and ability to make effective public presentations and showing empathy(Álvarez & Arceo, 2018); (Capurro et al., 2022); (Moreno, Tench & Verhoeven, 2021); (De Waete et al., 2020); (Bilan & Netreba, 2022).

For the oratory expert, Josep Maria Brugués, the key is the rehearsal since "a good spokesperson must manage to be credible and be himself" (Carvajal, 2022). Speaking confidently, exciting the audience with whom you need to empathize by transmitting information that makes the most abstract messages understandable is one of the keys to the success of Ted Talks speakers. A good spokesperson must speak with passion, use good stories, and use novelty (Gallo, 2016).

"The first quality of a spokesperson is to know the institution for which they work very well, to really know it beyond its rules", explained Jaume Duch, Spokesperon and Spokesperson and General Director of Communication of the European Parliament (personal communication, July 12, 2023). Moreover, according to Duch, the spokesperson should feel a true identification with this institution; this is not a job that has to be done automatically. Regarding journalists and media, according to the interviews, it was necessary to know the journalists who work on the correspondent topics of the organization or institution, have a close and permanent relationship with them, preferably have experience as a journalist and know the dynamics of operation and needs of the media. In addition, not only knowing the topics you are going to talk about but also the needs of the people you are going to talk to, be journalists, professors or representatives of European civil society organizations (Duch, personal communication, July 12, 2023).

"It is recommended that the director of communication can also perform the functions of spokesperson, although we must be certain that he/she has all the necessary characteristics," said Patrícia Plaja, Spokesperson for the Government of the Generalitat de Catalunya (personal communication, June 5, 2023). This is the case of Jaume Duch, who acts as Spokesperson and General Director of Communication of the European Parliament. According to him, the main advantage of being the same person is that they do not have to be coordinated, since "the same person who heads the house's communication services is the one who later represents the house abroad on issues that are not clearly politicians". In some organizations, the communication director acts as spokesperson for the organization on a regular basis; but, in crisis situations, there is another person who acts as a spokesperson (Matilla, personal communication, March 22, 2023).

2.1. Instruction of spokesperson: a worldwide view

Rojo, *et al.* (2020) show that there is no robust academic corpus of publications on the spokesperson area. In public universities where degrees or master's degrees about spokesperson are not detected, the study of this subject, paradoxically, is found as a research corpus of academic articles, doctoral theses or research papers of a different nature, frequently linked to the field of crisis communication (Capurro *et al.*, 2022). It was found that in Spain only four universities offer a specific optional subject for training spokespersons in the degree of Advertising and Public Relations (Álvarez & Arceo, 2018). This country has 33 public and private universities offering Advertising and Public Relations degree. Thous (2011) revealed the little training in Spain for spokespersons. At that time, many of the spokespersons of her investigation admitted to being afraid of journalists.

3. Methodology

The following research questions (RQ) were formulated:

• RQ1: How are the communications world's universities integrating spokesperson-related subjects into their undergraduate and graduate curricula?

• RQ2: What subjects related to media training are most often included in the curriculum?

• RQ3: How is it considered that a degree or master's degree teaches students about the figure of a representative and how to perform their functions?

The methodology to reach the questions of research combines a quantitative and qualitative approach. We developed a content analysis through the online publications about each university from the THE ranking. We were guided by the university selection criteria of this ranking, which includes 1,799 universities from 104 countries, making it the largest and most diverse university ranking to date (Baty, 2013; Hazelkorn, 2015; Marginson, 2014). Among this

university's universe, we selected those that offer communication studies. So, the analysis unit is formed by 100 universities and its approximately 500 web pages from which we examined its contents of both the bachelor's and master's degree programs in communication and also reviewed its PDFs to find subjects related to the spokesperson profile. As for the qualitative approach, we sent a questionnaire to different spokesperson to know their impressions about their profession and the training their received to do it.

4. Main Results

In accordance with the research methodology, that the curricula of courses related to "spokesperson training" were only found in 19 universities. We added the point of view of the professionals who answered our questionnaire, to obtain a global understanding of the situation in their job area.The first area analysed was that of the Degree programmes. Among the 100 universities included in the ranking, a mere 10 institutions offer bachelor's programs specifically tailored for the training of spokesperson.

The University of California is the only institution with a program dedicated to the study of media training. The distribution of bachelor's programs in the top 10 ranked universities, indicates that the majority (70%) of these universities are in America, while a modest proportion (20%) are in Europe, and a mere 10% represent Asia.

In the United States there are two main areas of study, according to National Wildlife Federation Press Secretary for Spanish Communications and National Campaigns, Maria Luisa Rossel: strategic communication and political communication. In both areas, according to her, topics such as crisis situations, digital communications and the use of social networks are discussed. In addition, the interviewee adds that "there is still room to develop the role of the spokesperson and its professionalization" (Rossel, personal communication, April 11, 2023).

"The Spanish degrees are mostly called Advertising and Public Relations (inherited from the old degrees prior to the EHEA) and in them, it is common for the PR's to have less teaching content -quantitatively-, more tactical than strategic and even purely instrumental -qualitatively- and be taught by specialists in other disciplines (journalism, advertising, marketing...)" (Matilla, personal communication, March 22, 2023). Out of the 100 ranked universities, only 9 offer programs in press secretary training. Among the top communication universities worldwide, only 9% offer courses related to media training. Interestingly, none of these universities use the keywords "spokesperson" or "spokespeople" to name their courses.

Table 1. Selection of world universities of undergraduate and master's programs with the designation of the position in the ranking THE. Source: Own elaboration (2024).

Bachelor Programs				Master Programs			
Ranking THE Position	**University name**	**Country**	**Bachelor Program name**	**Ranking THE Position**	**University name**	**Country**	**Master Program name**
9	**University of California, Berkeley**	United States	Media Studies	11	**Columbia University**	United States	**Strategic Communication**
14	**University of Pennsylvania**	United States	Communication	26	**Northwestern University**	United States	**Communication**
18	**University of Toronto**	Canada	Communication, Culture, Information and Technology	26	**University of Washington**	United States	**Communication**
21	**University of California, Los Angeles**	United States	Communication Studies	43	**Universität Heidelberg**	Germany	**Communication and Society in Ibero-America**
32	**University of California, San Diego**	United States	Communication	44	**Monash University**	Australia	**Strategic Communications Management**
36	**Nanyang Technological University, Singapore**	Singapore	Communication Studies	51	**Fudan University**	China	**Journalism and Communication**
50	**University of Texas, Austin**	United States	Communication and Leadership	51	**Fudan University**	China	**Communication, Media and Creative Industry**
69	**University of North Carolina, Chapel Hill**	United States	Communication Studies	56	**Seoul National University**	South Korea	**Journalism and Communications**
75	**University of Groningen**	The Netherlands	Media Studies	71	**Boston University**	United States	**Public Relations**
90	**Sorbonne University**	France	Sciences, Communication and Journalism	78	**Yonsei University (Seoul Campus)**	South Korea	**Media Cultural Studies**

5. Conclusions

In tracing the provision of spokesperson training within the academic sphere, it has come to light that only 19 universities across the world, from the THE ranking, include elements related to spokesperson training. These universities are majority located in North and South America. According to this ranking, the first communication university interested in spokesperson studies

is University of California in Berkeley (United States) and it boasts the 8th position in the ranking. No university has established a comprehensive official program solely dedicated to the preparation of spokespersons. This discernible gap in formal training within universities involves a potential area requiring attention in the forthcoming years. Spokesperson is one of the most important figures in the field of communication and one of the least studied by academia. Paradoxically, being a reputable spokesperson requires personalized training in several fields, such as Media training. As a result of the research we see that this only occurs, and in the form of a course, in private companies such as political consultancy.

In addition, the study provides an overview of the state of the media-training curriculum in the best world's universities and aims to further stimulate debate on this topic, not only in academia, but also more broadly among policy makers. In Spain, the Director General of Management and Communication Strategies Consultants, Kathy Matilla, highlights the limited presence of Public Relations subjects in university curricula, with spokesperson training often integrated into crisis communication subjects. Knowledge of journalists, their topics, and a strong relationship with the media are deemed essential. Jaume Duch, the Spokesperson and General Director of Communication of the European Parliament, emphasizes the importance of a spokesperson's genuine identification with the institution. We highlight the need for serious training in this field of PR from public universities. A possible limitation of this research could be a limitation of interviews related to the profession under study. It would also be interesting to obtain the perspective of the few academic authorities of the degrees where subjects related to spokespersons are taught. It is Spanish academics who have published the most papers in this field. However, the authors consider that this will undoubtedly be a line to continue in future research.

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Navigating Digital University: Challenges and Opportunities for Transforming Higher Education Institutions

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Abstract

The aim of the research is to recognise the views and experience of academics on the digital transformation of the Spanish cooperative university. This paper uses a qualitative methodology to understand how academical teachers perceive the digital transformation process from the perspective of challenges and opportunities. Data were analysed from interviews with conducted with twelve representatives of academic community. The analysis revealed three main pillars: quality of digital education, resources and strategy. Both the opportunities and challenges faced by university in the coming years are significant and will require further changes. Universities should have appropriate strategies, resources, and skills to effectively leverage new trends and emerge as leading figures in the digital era. Otherwise, they risk falling behind. This article may be of interest to scientists and decision-makers who need to be aware of how the processes of digital transformation are perceived by the representatives of the academic community. This understanding is crucial for both of these groups in order to study and manage HEIs more efficiently.

Keywords *Higher Education Institutions; digital transformations; challenges, opportunities, digital leadership.*

1. Introduction

Changing social and economic conditions, coupled with the development of new technologies, are gaining momentum for the change in every aspect of the functioning of higher education institutions (HEIs). HEIs, at the threshold of the greatest period of transformation, are actively moving into a new paradigm and evolving into digital universities (Fernandes et al., 2023). Although the challenges and opportunities associated with HEIs' digital transformation are increasingly discussed and researched, HEIs still lack a full understanding of how the academic

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community perceives them. In this sense, it is important to conduct a detailed analysis and develop guidance and recommendations for university authorities. Providing such support will contribute to the optimization of process management and facilitating smoother university transformation (Faria & Nova, 2015). The aim of this study was to investigate, through a qualitative survey, the opportunities and challenges presented by the digital transformation of the university. The study was conducted on a group of 12 academic teachers. The study posed the following research questions: What challenges and opportunities do teachers notice in relation to digital transformation? Do university include digital strategy in policy documents, and is this strategy known and understood by teachers?

2. Literature review

2.1.The digital transformation of HEIs and its opportunities and challenges

The research interest in the topic of HEIs' digital transformation (DT) and the challenges and opportunities it presents has definitely increased over the last five years. In order to cross-reference the existing state of knowledge, a literature scoping review was conducted: scoping review (Logan, 2021) of scientific journals available in the international Scopus database between 2018 and 2024. The literature items mapped numerically are a total of 199 papers found in the database for the phrases 'digital transformation' 'HEIs' and 'opportunities and challenges'. An analysis of their structure by subject area affiliation indicates the dominance of the research in the area of social science. From this area, 17 articles were selected for the analysis of the literature sources that included the keywords "digital transformation" "HEIs" and "opportunities and challenges.

In terms of the opportunities offered by the DT of HEIs, the emphasis is placed on the possibilities of improving learning and teaching processes. The improvements in the learning and teaching process are recognised, mainly due to access to digital tools and platforms (Criollo et al., 2023) and improvements in the sustainability of learning (Sa & Serpa, 2020). DT contributes not only to better learning and teaching process but also collaboration between students, students and teachers, improving the quality of education (Remesal et al., 2023).

By providing access to new technologies (Criollo, 2023), digital content and remote learning, sustainable, accessible (Chen & Hardy, 2023) and inclusive education is promoted (Shoel et al., 2022). It is widely acknowledged that the increase of both greater accessibility and diversity of courses for learners leads to greater satisfaction of individual learning needs. Consequently, educational innovations provide the fulfillment of educational requirements and diminish obstacles to the acquisition of knowledge (Chen & Hardy, 2023). As a result, the DT makes education more efficient (Mete et al.,2022) and effective (Kuleto et al., 2021).

Portuguez-Castro et al. (2022) highlight the opportunities that DT brings for the development of the students' and academic staff's competencies. The DT has provided the possibility for universities to conduct projects based on digital technologies and pedagogies in collaboration with different stakeholders which contributes to building and strengthening a culture of innovation (Portuguez-Castro et al., 2020). Beyond the area of learning and teaching, DT is improving management processes in HEIs. Process automation contributes to saving time, raising productivity and reducing operational costs (Criollo et al., 2023).

In addition to a range of opportunities, DT poses specific challenges for universities and their community. To a large extent, they are related to technological constraints, especially the access to new educational technologies, tools, programmes or management systems. Digital transformation implies the need to invest and thus incur financial costs (Criollo et al., 2023). Challenges associated with the need to provide training, improve competencies, and offer financial support for the development of employees are identified (Shoel et al., 2022; Farias-Gaytan et al., 2023). HEIs must provide resources and time for the planned development of new competencies (Starkey et al., 2023). DT requires HEIs, apart from developing technology and providing programmes and methods for online learning, to develop pedagogies and methodologies for learning (Marstio, 2019; Criollo et al., 2023). This is particularly important with regard to "monitoring, planning online learning, supporting student engagement and motivation, facilitating evaluation, assessment processes; increasing interaction, improving retention" (Celik et al., 2023, p.1)

The strategic challenges posed by DT are highlighted by Gaete-Quezada (2023). With the increasing use of digital technologies, the management of large amounts of data, the digitization of administrative procedures, the social responsibility of HEIs is growing. The cultural as well as the operational embedding of dt is becoming a particular challenge for HEIs.

Although there is already a wealth of quantitative and qualitative research on challenges and opportunities, this research rarely uses a case study methodology. The proposed article attempts to fill this research gap.

3. Methodology

The qualitative research was conducted based on semi-structured interviews and desk research analysis. The desk research analysis included strategic documents of university - development strategy available on the universities' websites. The qualitative interviews were conducted in the winter of 2023. Among 12 the respondents were six experienced specialist subject teachers and five experts in digital learning, responsible for a profound understanding of online education, digital pedagogy, contributing to the development of online learning through staff training, and managing various digital learning initiatives. The research was conducted in accordance with ethical standards, following approval from the research ethics committee. Respondents were

invited to attend one-on-one interviews, and each interview lasted on average 1 hour. All interviews were conducted at the university.

The analysis of strategic document and responses obtained during the semi-structured interviews was conducted using the principles of reflexive thematic analysis (Braun & Clarke, 2006; Naeem & Ozuem, 2022). All detailed steps of the analysis were undertaken following this methodological approach. After obtaining interview transcriptions and reviewing all collected data, a six-step analysis was initiated. The key words and quotes were selected, and the research material was manually coded using the Maxqda program. The main themes and subthemes were identified and verified, ensuring their alignment with the research question. The interpretation was then conducted, and a conceptual model was developed. The results were presented using quotes derived from the data.

4. Results

Due to restrictions given to the article, the presentation of the results has been limited on the most key issues. These themes will be discussed in greater detail below, presented in order of increasing frequency of emergence. The analyses were based on the qualitative data: semi structured interviews and strategy document (the university strategic plan). The analysis of strategic documents reveals that the university's cooperative has been operational for over 20 years. The teaching model establishes a network of relationships centered on the educational system. As emphasized in documents the teaching model of university establishes a network of relationships centered on the educational system. It aims to engage companies and institutions to ensure social accessibility, integrate work and study, enhance research, and provide continuing education. The university model is dedicated to social transformation, as reflected in the participatory model. During the thematic analysis of the research data, tree main themes emerged, which form a hierarchical structure of thematic nodes: quality of digital education, resources and strategy.

4.1. Quality of digital education

In the view of the research participants, within the context of digital transformation, the *Quality of digital education* node emerges as a pivotal area, considering the challenges associated with the DT of HEIs. The *Quality of digital education* node comprised elements such as methodology and pedagogy of teaching and learning, tools, methods, evaluation, and assessment. Undoubtedly, according to the majority of respondents, the greatest challenge is related to the need to develop and adopt a common methodology and pedagogy of digital learning to strengthen the process of teaching and learning. These processes must also consider the issues related to students' motivation and engagement, collaboration within groups, and with teachers. It continues to represent the most significant challenges for HEIs. One of the teacher

highlighted: "*We are in the process of digital transformation of the university. The key is the techno-pedagogical view. This is somehow to integrate digitalization and digital tools in an appropriate way. The way that we teach and somehow that digitalization has to help in all that and the objective has to be the students' development. And for that a teacher needs to know how different digital tools can help and enrich those pedagogical.*". Another teacher said "*It's not enough to know how different tools work and for that we need to know how those tools work but in a pedagogical environment. Which kind of tools like platforms, social media, other tools have an impact on students' presence in the community and have impact on learning process."*

The *Quality of digital education* - oriented pillar emerged in the context of the opportunities created by DT in terms of developing students' competencies and access to studies, making it more inclusive. One of the interviewd teacher told "*I think that digital education can meet the different learning styles of our students. It means that education can be more inclusive."*Another academical teacher added "*We introduced different active or collaborative experiences and for that we used different tools and we saw that those tools, using them in an appropriate way, have a really good impact on students' study and development.*"

4.2. Resources

The Resources pillar primarily encompasses challenges associated with digital competencies among both staff and students. In this context, the shortage of competencies, especially digital ones, becomes a challenge, along with the development of staff in this area. Training requires both time and financial resources. Moreover, the Resources pillar is perceived as an opportunity to improve institutional decision-making through the utilization of digital technologies within the university. As one teacher explained, "*(...) most of teachers have very traditional experience in teaching. I mean, they didn't study and learn online, so it's something relatively new and there is no references for that. It means that we as teachers should have strong digital competences too. Some still use outdated pedagogical approaches and teaching practices. Although we have quite an ambitious training plan for teachers, the time and motivation is not always there."* Another teacher noted that "*Challenge is through the preparation of teachers. It's necessary to prepare the teachers that we have here, and I think that that's a gap now that we have to face. Some competences are required for the teachers, but there is a gap.*

4.3. Strategy

The strategy-related pillar refers to goals, mission and values. Although digital transformation (DT) is reflected in university strategic documents, it is an area of challenge for teachers. The strategy explicitly calls for promoting DT, developing the digital educational offer and improving university services and processes. At the same time, the interviews reveal that areas are not sufficiently visible in the life of the university and its community. According to one of the teacher "*Strategic imperatives are insufficiently integrated into the fabric of university life.*

Although transformation is a fact, the challenge is how to transfer the provisions from documents to our activities and values."

5. Conclusions

HEIs are undergoing an advanced digital transformation that permeates every aspect and organizational process (Wang, 2023). HEIs must confront challenges to better harness the full potential of the transformation. This research has indicated that the key challenges and opportunities encompass the pillars of *quality of digital education*, *resources*, and *HEIs' strategies*. The integration of digital technologies into teaching methods, study programs, and instructional materials should primarily be associated with the development of methodologies and the pedagogy of the learning process (Marstio, 2019; Sa and Serpa, 2022; Al-Mamary, 2022). In this way, the process will fully rely on the collaboration, co-creation, and engagement of both students and the teaching staff. This active community of practitioners will effectively contribute to the improvement of the education quality (Sa and Serpa, 2020). For this, the continuous monitoring and assessment of the quality of online education based on systematic data collection are essential (OECD, 2023). One of the key challenges of DT at universities is ensuring access to digital resources. Ensuring equal opportunities in this area contributes to the creation of a more inclusive and diverse academic environment. HEIs must take action to ensure that the academic community has equal access to both digital tools and opportunities to develop and improve competences. The access to hardware, network infrastructure, software, educational platforms, training and other forms of competence improvement should include, inter alia: individual needs or career paths. According to the research, the third pillar of the HEIs transformation is the HEIs strategy pillar. In order to effectively implement and support DT at universities, it is necessary to understand it holistically. University leaders should pay attention to the organizational culture of the university, which is of particular importance in the strategy as a practice (Berisha et al, 2018). The effectiveness of the changes introduced depends on the involvement of all stakeholders and parties related to the university environment (Jarzabkowski et al., 2007; Golsorkhi et al., 2010). Hence, digital leadership particularly requires university leaders to support teams in making changes, adapting to them and overcoming reluctance.

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Mapping OER Movements in the Field of Mathematics

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Abstract

The purpose of the paper is to compile a list of initiatives featuring OER developers' work in Austria, Estonia, Portugal, Romania, and Spain, aiming to improve awareness, accessibility, and fostering cooperation in the landscape of OERs in mathematics.

The results reveal diverse approaches to OER in mathematics across the selected European countries. Austria initiated OER in 2002, fostering collaborative efforts. Estonia emphasizes MOOCs and national strategies, being the only one of the analyzed countries that does not have an OER repository in higher education. Portugal boasts user-friendly OER repositories. Romania actively integrates OER, and Spain encourages OER through institutional repositories and national initiatives.

Collaboration, technological platforms, and governmental support play pivotal roles in fostering the adoption and integration of OER in mathematics. These findings contribute to the broader understanding of such OER dynamics, emphasizing the need for continued collaboration, support, and innovation in OER across Europe.

Keywords: *International collaboration; OER development; OER repositories; mathematics education.*

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1. Introduction

Research has indicated that courses incorporating OER materials yield either superior or equivalent outcomes compared to courses that do not utilize OER. These studies underscore the positive impact of OER on educational effectiveness and student performance within the realm of mathematics (Khoule et al., 2021). The OER movement aims to foster collaboration among educators and institutions while offering free or affordable alternatives to educational materials, thereby reducing education costs (Clements et al., 2015).

The Gate2Math project aims to create a smart library of open and multilingual educational resources in the field of mathematics (Gate2Math Project, 2024). The paper seeks to contribute to the OER movement by compiling a comprehensive list of sites where OER developers' work in mathematics can be found in partner countries Austria, Estonia, Portugal, Romania, and Spain. By doing so, the authors hope to further enhance the accessibility and collaborative spirit that define the OER landscape.

2. Background

Notable organizations such as COL, UNESCO, Creative Commons, OpenLearn, OER Africa, and several other credible proponents and pioneers of OER have played a pivotal role in establishing fundamental guidelines, benchmarks, frameworks, and professional development modules for OER, a trajectory that should be sustained (UNESCO-COL, 2011). In 2021, more than 6000 higher education institutions, companies, repositories, government agencies, services, events, and individuals took initiatives and projects in the field of OER in Europe (ENCORE+, 2021). The development of digital education and training takes place within the framework of the European Commission's action Digital Education Action Plan (2021-2027). This action supports the “investment in high-quality, accessible, inclusive, and secure digital education and training” (European Commission, 2023, p. 6). Numerous projects and resources within the OER movement incorporate cutting-edge open content utilizing simulations, mobile apps, virtual reality (VR), and augmented reality (AR). Furthermore, some dedicated repositories and platforms exclusively provide OER materials for mathematics courses at either no cost or low cost for higher education. Some notable examples include MyOpenMath, Khan Academy Collection, Ximera open-source platform, Paul's Online Math Notes, and Desmos Classroom Activity.

3. Methodology

This scoping review follows the methodology outlined by Peters et al. (2015). The search strategy includes using variants of “Open Educational Resources” (e.g., OER, open textbooks) as search terms across academic databases (e.g., Web of Science, ERIC), institutional

repositories, Google Scholar, institutional websites (e.g., UNESCO, OER Commons), and relevant government websites. Inclusion criteria involve initiatives directly related to OER from Austria, Estonia, Portugal, Romania, and Spain, in any language, while exclusion criteria pertain to irrelevant initiatives and unavailable sources. A protocol with metadata by sources is used to document the search and selection process. The results are presented in a table summarizing the key information obtained from the identified initiatives. This methodology provides a systematic and transparent analysis process, facilitating the comprehensive identification and mapping of OER initiatives.

4. Results of the literature review

4.1. OER developers' work in Austria

Austria's OER movement began in 2002 with Geogebra software. Projects like the European Open eLearning Content Observatory Services and Catrobat further boosted OER development. The Open Education Austria platform, alongside initiatives like "Open Education Austria Advanced," facilitated OER repository creation and tools like the OERhub search engine, promoting OER adoption in Austrian higher education institutions (see Table 1).

Table 1. Directories with open resources in Austria

Key Initiative and Website	Description
GeoGebra www.geogerba.org	Dynamic geometry and algebra open-source software now encompass spreadsheets, graphs, statistics, and calculus, offering virtual books with explanations and assignments.
Catrobat https://catrobat.org	Austria's OER project empowers youth with free software, fostering their transition from users to developers through Pocket Code apps and visual programming.
Open Education Austria platform https://www.openeducation.at	Austrian universities pioneer a national OER infrastructure, promoting free educational content through open practices. This effort includes creating the OERhub search engine and merging OER repositories.
iMooX https://imoox.at	Austria's sole MOOC platform, established in December 2013 by the University of Graz and the Graz University of Technology, provides OER materials across multiple fields, including higher mathematics.

Materials across these platforms are freely available under Creative Commons licenses in both German and English, aligning with the Austrian Federal Ministry of Education, Science, and Research's official strategy (Bundesministerium für Bildung, 2022). This strategy stresses the

integration of OER materials into curricula, fostering personalization and supporting teachers, students, and stakeholders.

4.2. OER developers' work in Estonia

Estonia (see Table 2) prioritizes digital education resources through the Ministry of Education and Research (MER), aligning with the Estonian Education Strategy (MER, 2021).

Table 2. Directories with open resources in Estonia

Key Initiative and Website	Description
Koolielu Portal https://web.archive.org/web/20190418143749/ https://koolielu.ee/waramu/index/ /archived/	Until 2016, it was the primary repository for general education, hosting over 5700 resources, including animations, audio lectures, presentations, exercises, training videos, simulators, content packages, dictionaries, tests, and multimedia lectures/synopses.
e-Koolikott https://e-koolikott.ee	With over 18,700 resources, the portal contains both OER and commercial content and serves as Estonia's main educational materials repository.
KAE School https://www.kae.edu.ee	The platform offers 159 videos (inspired by Khan Academy) and 101 exercises on the practice topic of mathematics and programming, licensed under CC BY-NC-SA.
HITSA Educational Object Repository https://web.archive.org/web/20190528221650/http://www.e-ope.ee/repositoorium//archived/	Repository in higher and professional education housing over 4,600 resources under Creative Commons licenses, providing educational materials for various subjects and disciplines
LePlanner https://www.leplanner.ee/	An online platform enables teachers to create visual lesson plans and share educational resources, including OER, with students, all under CC BY license.
HEI repositories: ttps://dspace.ut.ee, https://dspace.emu.ee,https://dspace.tktk.ee	Platforms dedicated to holding study materials (some of them are OERs).

OER infrastructure such as repositories, tools and platforms help to share reusable digital resources (Põldoja & Laanpere, 2020). Cooperation with the European Social Fund supports projects for the digitalization of teaching aids. In higher education, since the closure of the HITSA-managed repository in 2020, OER has been stored in universities' institutional repositories.

4.3. OER developers' work in Portugal

In Portugal, several repositories house a wide range of educational materials, including national repositories (Nobre, 2020). These repositories serve as vital resources for educators, researchers, and students, offering access to a variety of scientific and academic documents (see Table 3).

Table 3. Directories with open resources in Portugal

Key Initiative and Website	Description
RCAPP – Open Access Scientific Repository of Portugal http://www.rcaap.pt/	Aggregates Portuguese repositories, acting as a national meta-repository and hosting service, indexing scientific content from educational and research institutions.
R UAb – Open Repository of The Open University https://repositorioaberto.uab.pt	The repository stores, preserves, and provides access to the Open University's intellectual production. Users can search for articles, theses, and other materials by themes, keywords, sources, and dates.
IAVE - Item Bank http://iave.pt/	Under the Ministry of Education, this repository offers educators resources across subjects, including exercises, exams, and assessment criteria, tailored for Portugal's educational context.
Open Repository of the University of Porto https://repositorio-aberto.up.pt/	The University of Porto repository compiles and shares scientific work from its academic community, providing open access to full-text documents. Organized into communities and collections of various document types.

Using these repositories is straightforward, catering to users of all expertise levels in Internet tools. Some repositories also offer extra tools to facilitate creating and sharing OER, promoting open educational practices institutionally.

4.4. OER developers' work in Romania

Romania actively participates in the OER movement through initiatives, projects, and governmental policies (see Table 4). The "Knowledge Economy Project" marked its initial involvement, followed by establishing of the Romanian Coalition for OER in 2013.

Table 4. Directories with open resources in Romania

Key Initiative and Website	Description
Didactic.ro https://didactic.ro	The online hub supports teachers with various materials and tools, like lesson plans, teaching materials, worksheets, games, and interactive activities.
Digitaledu.ro https://digitaledu.ro	This digital education platform, supported by the Institute of Educational Sciences, hosts 11,356 curated educational activities and OERs endorsed by experts.
Virtual Library https://roedulib.ro	OER Digital Platform with materials, mainly for the gymnasium education cycle.
Educatie.inmures.ro https://educatie.inmures.ro	Mureş County Online Educational Community platform contains a collection of didactic materials published to facilitate the work of all education specialists.
Digitaliada https://digitaliada.ro	The program, funded by the Orange Foundation, reaches more than 30000 students in 101 secondary schools in 34 counties in Romania. It comprises over 4,000 OERs, including lessons, tests, exercises, tasks, didactic projects, and video tutorials.
LIVRESQ https://livresq.com	The platform hosts various teaching materials, such as interactive lessons, textbooks, and e-learning courses. By the end of 2023, it contained 20,500 items.

The National Strategy on Digital Agenda for Romania 2020, since February 2015, and subsequent reforms in 2017-2018 further emphasized OER integration, with projects like the CRED project focusing on teacher training and development of OER resources.

4.5. OER developers' work in Spain

There has been a growing interest in OER among universities in Spain, and many institutions have started to develop and share OER (see Table 5).

The strategy of most Spanish universities is to store and distribute OER through institutional repositories (Santos-Hermosa et al., 2020). The Spanish government has also encouraged the use of OER through various initiatives, such as the creation of a national repository for OER and the establishment of a national plan for open science (Marín & Morales, 2018).

Table 5. Directories with open resources in Spain

Key Initiative and Website	Description
Procomún https://procomun.intef.es	MEFP's initiative, the Add Project, offers an educational learning platform for teachers and students to access and download learning objects in various formats.
Universidad Nacional de Educación a Distancia (UNED) https://contenidosdigitales.uned.es/fezUNED/	Repository of OER that includes a wide range of materials, including textbooks, videos, and interactive learning activities.
The Universitat de Barcelona (UB) https://crai.ub.edu/es/recursos-de-informacion/repositorios-digitales#	Institutional repositories that contain open-access digital publications derived from the teaching, research, and institutional activity of the teaching staff, students, and other members of the University of Barcelona.
MDX (Materials Docents en Xarxa, in catalan) https://www.mdx.cat	The Catalan Government's platform hosts OER for educators, students, and the public in Catalan, Spanish, and English, covering textbooks, multimedia, and interactive activities.
UPCommons https://upcommons.upc.edu	An institutional DSpace repository stores university members' academic work, under a CC BY 3.0 license.
Open Education Consortium https://www.oeconsortium.org	Several universities network to promote the use of OER in education.

5. Discussion and conclusions

This comprehensive research illustrates, on the one hand, the joint enormous interest in the educational community for OER development and, on the other hand, the variability in possibilities by the academic necessities and applications, as well as teaching and learning methodologies.

Results in Section 4 are the cornerstone to a) a first inventory of organizations (institutional and academic), working groups, and main agents involved in the transformation towards a shared space of OER creation, and b) facilitate OER development networks in favor of greater homogeneity, efficiency, and sustainability of the resulting resources. In particular, identifying and selecting the most appropriate common features in terms of general policies, standardization and promotion, dissemination, support strategies, platforms, software and development tools, and potential partnership possibilities in consortiums. The Gate2Math project also involves founding a community for creating, receiving reviews and using OERs in mathematics. The creation of a comprehensive OER inventory empowers both students and teachers, promoting greater participation in learning and the development of a global, interconnected OER development network.

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Human-Empathy Accessibility Learning (HEAL) intervention model towards critical soft skills development for career readiness among computing undergraduate students

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Abstract

This pilot mixed methods study explores the impact of Human-Empathy Accessibility Learning (HEAL) interventions on soft skills development in undergraduate computing students, emphasizing their role in job readiness and perceived employability. HEAL interventions aimed to enhance accessibility awareness, focusing on motivation, empathy, and emotional intelligence. Participants were assigned to control and experiment groups, with qualitative findings showing empathetic growth in the experiment group. Quantitative results partially supported qualitative findings, indicating statistically significant changes across measures. Despite quantitative limitations, short-term empathy interventions showed potential benefits for job readiness. The study discusses implications of mixed findings and recommends future research directions.

Keywords: *Empathy; Accessibilty; Soft skills in Computing Education; Emotional Intelligence; Employability, Motivation.*

1. Introduction

The modern workplace demands soft skills such as adaptability, empathy, and collaboration (Chhinzer & Russo, 2017; Deming, 2017; NACE, 2024; Tejan & Sabil, 2019). While disciplinary knowledge remains relevant, interpersonal and self-management abilities are crucial for graduates to thrive (Bridgstock, 2009; Chan et al., 2017). Emotional intelligence, motivation, and empathy are foundational competencies (Andrews & Higson, 2008) that enable positive social interactions, teamwork, leadership, and adaptability (Dacre Pool & Sewell, 2007; Kiss et al., 2022; Rao, 2010).

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Despite recent advancements in soft skills research within computing education, there is a lack of studies examining how targeted accessibility awareness interventions can enhance emotional intelligence (EI), motivation, and empathy among undergraduate computing students (Cotler et al., 2019) and their impact on perceived job readiness and employability (Becker & Mentz, 2019; Deming & Noray, 2020; Moses et al., 2023; Messerle et al., 2023). This study evaluates changes in EI, motivation, and empathy before and after the Human-Empathy Accessibility Learning (HEAL) intervention at two U.S. institutions: a small liberal arts college and a large, tier 1 technical research university (R1). HEAL emphasizes practical skills, knowledge, and empathy development to create accessible software solutions and fosters an inclusive mindset in future computing professionals.

This study aims to explore research questions related to the impact of the HEAL interventions on undergraduate computing students. Firstly, it investigates whether the HEAL interventions result in measurable changes in empathy and motivation among the participants. Secondly, the study assesses attitudinal changes in inclusive perspectives among the college students involved in the intervention. Lastly, the research examines the influence of these attitudinal shifts on students' perceived employability, as this is a crucial factor in their future success as computing professionals. By addressing these inquiries, our research intends to shed light on the advantages of empathy-focused education in computing programs. The findings of this study would contribute to the development of technical professionals who are more compassionate, inclusive, and empathetic, qualities that are increasingly valued in today's diverse and dynamic workforce. Furthermore, the insights gained from this research can inform the design and implementation of future interventions aimed at fostering soft skills and accessibility awareness among computing students, ultimately leading to more inclusive and user-centered software solutions.

2. Methods and Materials

2.1. Study Design and Participants

This mixed-methods pilot study comprehensively investigates the impact of Human-Empathy Accessibility Learning (HEAL) interventions on undergraduate computing students' empathy, emotional intelligence (EI), motivation, perceived employability, and attitudes towards accessibility at a small liberal arts college and an R1 technical university. Qualitative measures captured the nuances and complexities associated with the interventions, as strict experimental control is challenging in educational settings.

HEAL offers ability simulations focused on sight and hearing impairments, shifting the focus from disability to ability. By showcasing the potential of individuals living with disabilities,

HEAL challenges stereotypes and promotes a more inclusive view of accessibility, minimizing the risk of psychological harm associated with traditional disability simulations (Olson, 2014).

Participants were divided into a control group and two intervention groups that participated in an "empathy lab," featuring stations for learning assistive technologies. Table 1 details the study's sample distribution, highlighting self-selected participation from both institutions, with all participants being computing majors.

Table 1. Sample Distribution: Spring 2023

Interventions	Institution A – HEAL	Institution B – HEAL	Institution B – Control
Total number of participants	31	14	25
Gender - female	39%	21%	12%
Gender - male	61%	79%	88%

2.2. Qualitative Measures

A six-question reflection was distributed at both institutions after gaining ethics approval at both research sites. The reflections asked about Q1: Attitude and Perspective Change, Q2: Skills Acquired, Q3: Immediate Changes Planned, Q4: Future Approach to Design, Q5: Professional Applications, and Q6: Workshop Feedback. The reflections were administered after each intervention.

2.3. Quantative Instruments Used

Pre- and post-quantative intervention assessments were conducted using the Perth Empathy Scale, the Trait Emotional Intelligence Questionnaire (TEIQue), the Work Motivation Scale, and a question about perceived employability. Pre-Interventions were administered at the start of the semester and again at the end of the semester. These instruments were administered via Qualtrics to each student in the study.

The Perth Empathy Scale is a validated, 20-item self-report measure that assesses cognitive and affective empathy, including their valence-specific aspects. It gauges the accurate recognition of others' emotions (cognitive empathy) and emotional resonance with others (affective empathy) for both negative and positive emotions. The scale comprises four subscales, each with five items, without the need for reverse-scoring, adhering to recommended practices (Brett et al., 2023). Both cognitive and affective empathy are essential for effective interpersonal interactions.

The TEIQue-SF (Trait Emotional Intelligence Questionnaire - Short Form) is a validated 30-item measure of global trait emotional intelligence, crucial for understanding emotional processing and interpersonal dynamics (Petrides, 2009; Petrides & Furnham, 2006). It assesses key aspects of emotional intelligence, including well-being, self-control, emotionality, and

sociability, which are essential for empathy and communication. The TEIQue-SF's straightforward design and focus on evaluating emotional perception, management, and expression make it well-suited for studying inclusivity and understanding in technology design.

The Multidimensional Work Motivation Scale (MWMS) is a 20-item validated psychometric assessment (Gagné & Deci, 2005) that measures intrinsic and extrinsic motivation, relevant for this study as it helps understand an individual's workplace drive and commitment, key factors in technological design and development. With four subscales and no reverse-scoring, it is an efficient tool for evaluating motivational aspects crucial to the study's focus.

2.4. Statistical Methods and Data Analyses

The data were analyzed using paired samples t-tests to compare pre- and post-intervention measurements for both the experimental and control groups. Normality of the pre- and post-intervention differences was confirmed using the Shapiro-Wilk test. Equality of variances was confirmed using Levene's test.

3. Results

Qualitative data analysis was conducted for the interventions. It revealed a Kappa score of 0.69 signifying a substantial agreement between the evaluators. Table 2 presents the outcomes of the Empathy Lab workshop at two institutions, identifying key themes and providing sample quotes from participants. The table showcases a collective emphasis on empathy, soft skills such as teamwork, importance to employability, and motivation for incorporating accessibility features across both institutions.

3.1 Comparison of Data at Institution A and B (Empathy Lab)

Table 3 provides a comparison of qualitative data between the two Institutions (A is the large R1 technical university and Institution B is the small liberal arts college) regarding the impact of accessibility interventions. While both institutions reported positive outcomes from the accessibility workshops, there were differences in the nature of the changes observed. Institution A had a more diverse attitude change and focused on technology specific aspects, while institution B primarily experienced changes centered around empathy and had a strong specific technical improvement. Both institutions expressed a strong commitment to implement changes and transformed their outlooks for future approaches and professional application of the intervention content, albeit with varying emphases.

Table 2. Main Themes by Institution

	Institution A – Empathy Lab	Institution B – Empathy Lab
Main Themes Discovered	Designing with Empathy Creating Accessible Products Accessibility Features Importance to Career Teamwork Skills	Empathy Development Motivation for accessibility in design Emotional Intelligence Importance to Career Teamwork Skills
Sample Quotes (some excerpted)	"I now have a better knowledge of the impact of technology on persons with disabilities, as well as the role I may play in facilitating change." "…the website examples helped me realize how helpful screen readers are when it comes to navigating websites and how important it is for screen readers to work on every website. "I developed the skill of being able to put myself into someone else's shoes and try to navigate a task through their eyes."	"…helped me understand how important it is to do your research to see how other people experience things." "As a result of this, I plan on being a greater advocate for making sure that any project I work on is accessible." "I will apply this to my professional life by informing others about using techniques that help with accessibility."

Table 3. Comparison of Qualitative Data

Questions	Institution A	Institution B
Attitude and perspective change	71% reported a change with more diverse focus	93% reported change mostly centered around empathy
Skill development	16% reported on gaining soft skills	71% reported on gaining technical skills
Intention to implement changes	100% agreed with more distributed focus	100% agreed with strong emphasis on revising alt tags and color contrast
Future approaches	97% positive about changes focusing on tech-specific aspects	100% positive about changes with focus on tech- and people-specific aspects
Application in professional life	69% application for inclusion	93% concrete plans for implementing changes
Workshop effectiveness	87% effective workshop	78% useful workshop

In summary, both workshops were effective in changing attitudes and imparting skills related to accessibility and inclusion, but they differed in focus. Institution B had a more emphatic and holistic impact on participants, while Institution A offered a more technical, diverse set of learnings. Both had almost unanimous agreement on the need for practical changes in design and future approaches.

Quantitative analysis marginally supported the positive post-intervention qualitative responses, revealing a more pronounced increase in empathy levels, motivation and perceived employability. Overall, the control group showed no significant changes from pre- to post-intervention on any measure. For Institution A, the only statistically significant change was an increase in wellbeing post intervention. Institution B showed a borderline significant decrease in perceived employability. While most comparisons were non-significant, some measures showed small-to-medium sized effects that may be noteworthy but did not reach statistical significance. For example, Institution A showed small-to-medium increases in cognitive empathy, affective empathy, and overall empathy, while Institution B showed small increases in cognitive empathy, emotionality, and motivation.

4. Discussion

The qualitative analysis revealed that all participants expressed a commitment to integrating empathetic insights from the training into their current and future design efforts, highlighting the vital role of empathy in creating accessible technology and preparing students for STEM careers. Participants reported increased empathy, motivation, and EI, and the hands-on approach enhanced their technical skills and sense of responsibility towards creating universally accessible products. Feedback emphasized the effectiveness of the interventions in transformative learning and nurturing STEM professionals with a focus on empathy, motivation, and EI in design and development.

However, the quantitative findings did not show robust, statistically significant changes in empathy, EI, and motivation, which could be attributed to the short duration of the interventions and the complexity of altering these skills in a brief period. Despite this, the study yielded marginally significant results and trends in subjective well-being and perceived employability for some experimental conditions, while no changes were observed in the control groups. The interventions led to marginal improvements in students' mental and emotional state and inspired enhanced motivation..

Unexpectedly, students participating in the interventions showed a trend towards decreased confidence in their job prospects compared to controls. This could be due to students gaining a deeper understanding of the diversity of needs and perspectives in the workplace, highlighting skills gaps and areas requiring further development. However, this awareness could ultimately better equip students to improve these skills and be more confident in addressing workplace

diversity once given time to process the information. Providing adequate time for reflection and skill-building after exposing students to diverse perspectives could help transform uncertainty into greater adaptability, empathy, and confidence. Further research should explore the nuances of how empathy interventions impact student confidence over time.

5. Future Research

Future research should build on these mixed findings by examining specific intervention components and their effectiveness in improving subjective well-being, perceived employability, motivation, EI, and empathy. Investigating the impact of extended or repeated interventions over a longer duration, as well as longitudinal follow-up with participants after graduation, could help assess the long-term effects on career success and the integration of accessibility practices in the workplace. Additionally, larger sample sizes, multiple intervention groups, and tailored interventions for different demographics or learning styles should be explored to determine best practices and improve outcomes for specific student subgroups. Researchers should also investigate the optimal timing, frequency, and format of interventions to maximize their impact. Finally, future studies should combine robust quantitative measures with in-depth qualitative data collection through interviews, focus groups, cognitive walkthroughs, and observational data to gain a multidimensional perspective on how empathy interventions shape students' skills and mindsets. Pursuing these research avenues can help refine HEAL interventions to optimize their impact on building computing students' soft skills, empathy, and readiness for diverse workplace environments.

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Integration of emerging technologies within higher education: design and management of Laboratories exploring VR technology

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Abstract

The integration of VR within educational contexts presents various learning advantages, as resulting from literature. The following paper delineates the procedural steps undertaken by METID Learning Innovation Task Force within Politecnico di Milano university to conceptualize and establish Virtual Reality Laboratories, fostering active engagement of professors, tutors, and students with this emergent technology during instructional sessions.

The paper elucidates the process and optimal methodologies for organizing and administering VR lessons, drawing from the accumulated experience gained through the utilization of these Laboratories over a span of two years.The establishment of these VR Labs provided an opportunity to create an experimental environment wherein professors and students could engage with lesson content in an advanced manner through VR technology.

While a more comprehensive study is needed on the matter, the majority of students, based on post-classroom questionnaires, expressed a desire to repeat a similar activity in other classes.

Keywords: *Virtual Reality; Learning; VR Laboratory; Emerging technologies; VR lessons.*

1. Introduction: Realization of the VR Labs

In 2020, Politecnico di Milano decided to establish two dedicated workstations for an experimentation on the use of Virtual Reality (VR) technology in educational activities to be offered to students. The pilot project from which the experimentation arises is called 'Virtualizing Education', developed with professors R. Rota and L. Duò with the aim of integrating immersive experiences based on Digital Twins into the master's degree program in

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industrial engineering. The encouraging outcomes of the experimentation have led to the request for scaling up the solution from a single workstation to a laboratory capable of accommodating multiple students simultaneously, thereby necessitating the identification and preparation of one or more suitable spaces. Several measures, elucidated in the subsequent paragraphs and chapters, were taken for the design and implementation of two dedicated classrooms as VR Laboratories (VR Labs), where students can utilize devices tailored for the use of virtual reality technology in educational settings.

1.1. Virtual Reality in Educational context

The integration of new technologies into learning contexts has been investigated as a factor that facilitates learning methods and enhances learning outcomes by creating and managing suitable technological resources. (Bozkurt, 2020) Ardiny and Khanmirza (2018) have reported VR as a technology potentially occupying the lowest part of the Dale's Cone of Experience that shows the progression of learning experiences. The bottom of the cone is coincident with the most effective learning methods (learning by doing direct experiments) and the top with the less effective ones (learning through abstracts). (Dale, 1969) VR technology enables learners to actively engage with immersive educational experiences, allowing them to interact directly with didactic content. Moreover, VR technology can facilitate the dissemination of educational content that may be challenging to replicate in a traditional classroom setting, such as simulations of external systems or delicate mechanisms.

2. Design and Development of the VR Labs

The design of a space dedicated to a learning experience centered around Virtual Reality necessitates careful consideration (Kavanagh et al., 2017), as it must adhere to specific constraints and criteria, such as technological specifications, the number of workstations, simultaneous user capacity, and available space.

2.1. Criteria for the Design of the VR Labs

The subsequent paragraphs detail the implementation process and the criteria considered for the design of the Laboratories. The definition and choses related to the technical specifications involved initial desk research on dedicated websites and on-site experimentation with the workstations.

2.1.1. Definition of technical specifications for each workstation

The single workstation inside the Laboratory should have medium to high performance. The key component, in addition to a good overall CPU, RAM, and HDD configuration, is the graphics card as it is the most solicited element in processing 3D scenarios. Therefore, the

graphics card should be designed for gaming (applications that normally utilize its computing power) and should be compatible with the Virtual Reality headset in use. The chosen VR headset for content consumption is the Oculus Quest 2 (now Meta Quest 2), due to its availability of materials at a reasonable cost and the high number of information that could be found for support and maintenance of the devices. The headset connects to the PC via a USB port and a DisplayPort thanks to a 5-meter cable. Like other devices of this type, it has two lenses inside that allow viewing LCD screens (one for each eye) in stereoscopic mode. There are motion sensors that manage interaction with the virtual world, allowing total immersion. Interaction with VR content is through the controllers (two, one for each hand) included with the Oculus Quest 2 package. These controllers have various buttons with different functions depending on the required command.

2.1.2. Identification of spaces capable of accommodating an adequate number of students

The classrooms were selected based on specific criteria, including capacity for at least 14/15 fixed workstations, sufficient movement space for headsets and simulations, technical requirements such as electrical outlets and LAN sockets, Wi-Fi coverage, and accessible flooring. The number of workstations can accommodate up to 45 students if used in groups of three. Large windows are essential for air circulation in case of VR sickness. Classroom usage and activities will vary by course and department, requiring adaptable spaces.

2.1.3. Identification of constraints related to equipment and activities to be carried out

To accommodate multiple students per workstation and manage space effectively, colored adhesive tape delineates areas for headset use, ensuring clear boundaries. Empirical measurements resulted in a 2 x 2 meters area for each workstation. Finally, suitable cabinets and containers are needed for equipment storage when not in use. See Figure 1 for an illustrative layout of the classrooms, showing workstation arrangement and headset boundary areas.

2.1.4. Definition of the roles for the set up and managing of the Labs

Particular attention is then given to the organizational and managerial aspects of these spaces, as they are specialized environments where a wide variety of often incompatible applications must be used. For this reason, several working groups are involved, each dealing with different aspects including logistics (space reservation and collection of technical and methodological requirements), technological aspects (creation of the necessary software stack for the dedicated exercise), methodology (design of the educational experience and its corresponding lesson plan activities, observation of the methods and their effects on educational efficiency), and organizational aspects (classroom supervision by technicians capable of intervening in case of unforeseen events, providing technical support, and offering more detailed explanations to teachers). These working groups all collaborate togheter in the displacement of the lessons and dialogue with the teachers and tutors who manage the lessons.

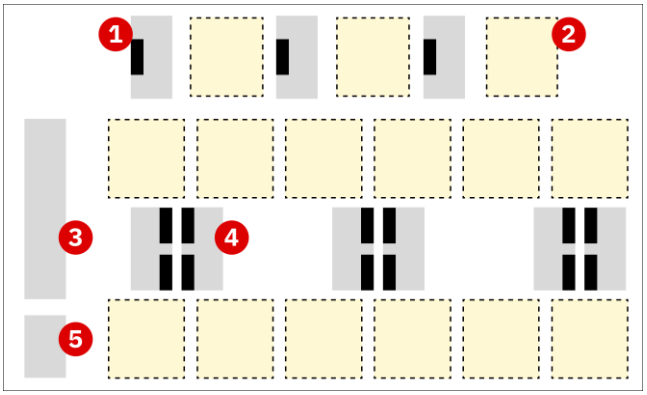


Figure 1. General layout of the VR Laboratories: 1) Working station 2) Boundaries taped area 3) Desk 4) Double working station 5) Headsets wardrobe

2.2. Research on digital and virtual applications/platforms

Once the Laboratories were organized and structured at the hardware level, actions were taken in terms of both desk research and empirical research on the software side. Various applications (both standalone applications and online platforms) potentially relevant for educational use of virtual reality technology in the classroom were studied. This research aimed to provide an initial categorization of different software application case studies, serving both internally at METID Learning Innovation as a university Task Force for lesson design support and in discussions with professors to guide them in making appropriate software choices. A dedicated resource conducted research on various VR applications, including those from Meta Quest 2, Steam VR, and internally developed ones using Unity or Unreal Engine. Cataloging these applications involved taking notes on direct usage experiences and recording technical/educational features of interest of the applications and platforms. When needed, temporary licenses were purchased, developers or platform distributors were contacted, and educational insights were developed.

3. Displacement of the lessons in VR Labs

This chapter outlines recommended procedures developed by the department's Task Force, informed by empirical experiences. Two guides, including the 'VR Vademecum' and a 'Video Tutorial' on YouTube, are tailored for faculty and students. These resources aim to familiarize students with equipment and Lab functioning before entry, and to suggest the instructors with the best procedures collected from other courses in managing the lessons into the Labs.

3.1. Procedures for the students

The educational journey in Virtual Reality requires a careful and conscious approach from students (Slavova & Mu, 2018), both for the innovative methods of lesson delivery in the classroom and to avoid purely entertaining activities that may detract from the educational objective. Guidelines provided by METID Learning Innovation are taken from the VR Vademecum priorly cited documentand from the introductory Video Tutorial for entry into the Labs. Next paragraphs introduce these tools.

3.1.1. VR Vademecum

The Vademecum's first section defines VR theoretically, introducing key concepts for lesson delivery. It then familiarizes students with the VR equipment, explaining feedback mechanisms and controls. Information on the organization of the VR Labs at Politecnico is provided, detailing layouts, capacities, and operating procedures. Instructions for approaching and using the devices, including controller functionalities and Oculus interfaces, are outlined. Lastly, VR sickness management and the importance of following instructor guidelines are emphasized.

3.1.2. Video Tutorial

An online Video Tutorial is provided to students before the lessons commence. This tutorial guides students through key steps in navigating the VR Labs, offering detailed demonstrations of how the devices function and explaining the layout of the workstations. (Fig. 2) The video is available on YouTube under a Creative Commons Non-Commercial 4.0 International License.

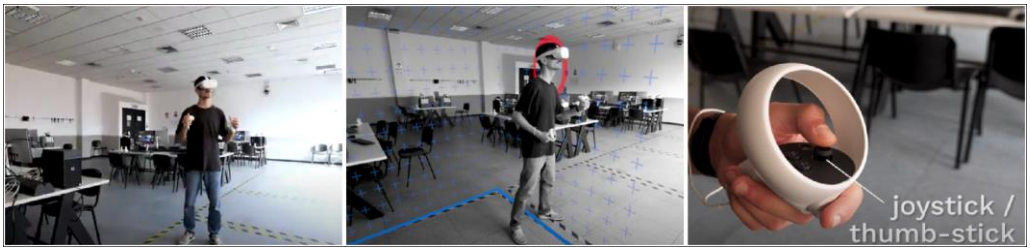


Figure 2. Screenshots from the online video reporting the first steps on how to approach the Labs.

3.2. Best practices for the instructors

Designing and executing VR lessons requires a systematic approach by educators. The following guidelines are based on observations from lessons conducted over time in VR Labs.

3.2.1. Defining suitable content for use in VR

Understanding technology advantages and disadvantages, limits and benefits, instructors identify how to set the VR possibilities to their lesson content. This lead to the identification of the suitable application or platform for the educational objectives, and they have to inquire about

licensing procedures, considering the required duration and number of students. It is needed to test the application priorly to the displacement of the lessons in order to ensure its quality and ease of use, and to prepare the different roles in approaching the content.

3.2.2. Definition of lesson structure and organization of the VR Labs

After testing the application, the next step involves integrating it into the lesson structure. This includes organizing both theoretical and practical aspects, typically done by the instructor. It's crucial to inform students beforehand about the lecture content, the new VR-based learning approach, and the lesson structure. Basic preparation rules for the Labs include ensuring equipment is charged and functioning, uploading each application onto PCs/VR headsets, pre-organizing student work, arranging group formations, providing adequate tutors for assistance, ensuring proper ventilation, and informing students about technical details.

3.2.3. Conducting the lesson and collecting feedbacks

Before the lesson, instructors ensure app and device functionality, share preparatory material, and prepare the classroom. During the lesson, they both deliver content and moderate technology use. Afterwards, discussions with students about the new experiences foster mutual interest. Students can share thoughts or doubts about the technology, while instructors explain perspectives and future plans.

4. Impact of VR Labs on the students

The recommended procedure for instructors highlights the significance of collecting feedback from students to evaluate their engagement and satisfaction with this unconventional method of lesson delivery. The department has devised an online questionnaire using the Microsoft Forms application, intended for professors to gather feedback.

4.1. Post-lesson questionnaire general structure

The description of each individual question will not be detailed as the document provided is customized by individual instructors for their lessons. The initial questions posed to students are optional and aim to assess the prevalence of VR technology and VR devices among students (e.g., 'Have you ever used VR systems?'). Responses to these questions are multiple choice. Subsequently, questions are asked regarding the experience of the lesson itself, any difficulties encountered, and the content of the lesson. Students are then asked to indicate, on a scale from 1 (negative) to 5 (positive), with 3 being neutral, their level of satisfaction with certain aspects related to the new lesson displacement method. The list of characteristics on which students are asked to express their views varies depending on the content of the lesson and the mode of VR use. A subsequent section asks questions about the mode of lesson consumption, whether in groups or individually, and the corresponding level of satisfaction with the mode and its

characteristics. The next question is an open-ended one, inquiring about aspects that the respondent particularly enjoyed. This is followed by another open-ended question, asking if there are any suggestions the student wishes to offer to the instructor for the lesson. The final question asks whether the student would like such a consumption system to be applied to other courses of study, and if the response is negative, the student is asked to specify why.

4.2. Discussion on first indicative results

Since the questionnaires are customized by instructors on a case-by-case basis, the responses cannot be considered representative of the overall functionality of the VR. This could be considered as material for further study on the topic. Results are reported only from the last question posed to students: 'Would you like a similar activity to be repeated in this course or in any other courses?' From the questionnaire results collected across eight courses held in the VR Labs, involving a total of 394 students from various departments and courses, during the academic years 2021/2022 and 2022/2023, 97.4% of respondents (384 students) indicated they would like a similar activity to be repeated. Although not methodologically conclusive due to questionnaire limitations and the sample size, this provides a qualitative initial indication of the positive impact of introducing VR as a learning tool in classrooms.

5. Conclusions

An increasing number of educational institutions are exploring the integration of emerging technologies, such as VR into their lecture formats. (Bogusevschi et al., 2020; Jiang & Fryer, 2024; Philippe et al., 2020) VR is among the advanced technologies, including Augmented Reality, Artificial Intelligence and others, being experimented with in educational settings. Initial implementations of VR in lesson delivery have shown positive impacts on student learning, leading to increased engagement and attention. (Akman & Çakır, 2023; AlGerafi et al., 2023; Marougkas et al., 2023; Yoon et al., 2024) This paper provides guidelines for the systematic establishment of VR-equipped classrooms, based on empirical insights gained from the research group's experience in implementing VR-based lessons. Since their inception in 2021, the two VR Labs at Politecnico di Milano have been utilized by various departments for a range of activities with a total of 30 activities including courses, lectures, workshops, and exams; students, from a very first indicative survey, seems to give positive feedbacks on the activities conducted into the VR Labs.

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Escape the classroom: a game to improve learning and student engagement

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Abstract

This paper examines the impact of an interactive in person escape room game on students' engagement and learning in a first year quantitative module. Developed and implemented as a formative assessment and alternative method of revision, the game aimed to enhance student engagement and academic performance. Through a captivating Cluedo narrative and integrated hints, the game facilitated an interactive learning environment. Subsequent evaluations, including peer feedback, questionnaires, and focus groups, were conducted to evaluate effectiveness. The findings demonstrate that the game significantly reinforced students' engagement and learning. Moreover, it positively influenced their performance, motivation, teamwork, and communication skills. The interactive nature of the escape room game ignited students' enthusiasm and active participation resulting in an enjoyable and immersive learning experience. Overall, the game proved highly beneficial for the module, generating positive outcomes for the participating students.

Keywords: *escape room; formative assessment; game-based learning; educational innovation; teamwork; engagement.*

1. Introduction

Educational escape room games are increasingly prevalent as innovative tools within higher education, facilitating the integration of game-based learning into academic settings. These games serve as effective bridges between theoretical knowledge and practical application, enhancing the overall learning experience for students. In an era where student engagement, motivation, and active participation are pivotal to effective learning, gamification offers a dynamic solution that meets the changing demands to move away from traditional teaching. The shift away from traditional teaching methods towards more interactive and experiential approaches underscores the importance of incorporating gamified elements into educational settings. Educational escape room games, with their immersive and participatory nature, address

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the evolving needs of students, providing an engaging platform that transcends the limitations of conventional instructional techniques.

Drawing from an extensive body of scholarly literature, it is evident that student engagement and motivation represent pivotal concerns in contemporary higher education. Martina and Goksen (2022) and Eukel and Morrell (2021) underscore the importance of addressing challenges related to student engagement and motivation, highlighting the potential of gamified interventions to enhance learning outcomes. Furthermore, studies emphasise the limitations inherent in traditional methodologies, which often struggle to generate active participation and meaningful learning experiences (Clarke et al., Sanchez, 2023).

One particularly innovative strategy involves the integration of educational escape room games into academic curricula. These engaging educational approaches diverge from conventional pedagogical norms, leveraging the principles of gamification to create interactive learning environments. Rooted in principles of problem solving and collaborative engagement, escape room games present students with challenges that demand critical thinking and collective effort for resolution (Fuentes-Cabrera et al, 2020; Lopez-Pernas et al, 2019).

This study investigates the integration of an in person educational escape room game in a first year quantitative module. By exploring the impact of the game on student engagement and learning outcomes, this research seeks to contribute to the broader discourse on gamified learning approaches in higher education.

2. Background

Over the past two academic years (2022-2023 and 2023-2024), an interactive escape room game has been implemented in a first year quantitative Introduction to Mathematics for Economics[1] module at the University of Birmingham Dubai campus. In the initial implementation phase, the game was introduced, followed by its continuation in the subsequent academic year with a different cohort of students.

The challenges encountered by first-year economics students in this module were multifaceted, including issues such as low engagement, motivation, different mathematical backgrounds and abilities among students, and overall low academic performance. The challenges were exacerbated by factors such as the condensed block teaching style and students' adaptation to university life.

During the academic year (2022-2023), a notable increase in the failure rate observed in class test 1 prompted the introduction of the game as additional support to learning. Class test 1

[1] This module has three summative assessments, class test 1, class test 2, and a final exam.

results revealed a significant proportion of failures alongside a remarkably high percentage of distinctions, illustrating the diverse backgrounds and distinct needs within the student cohort. Teaching within a small group setting, along with the predominant formation of student interactions in specific groups, prompted contemplation of alternative methodologies. Driven by the aspiration to strengthen student support, enhance interactive learning, and address the challenges faced, the implementation of the escape room game was introduced as an additional support mechanism and formative revision practice for the subsequent class test 2.

Motivated by positive feedback, which underscored notable improvements in teamwork and collaboration, communication, and student motivation, I implemented an improved version of the escape room game in the current academic year 2023-2024. Students expressed their appreciation for the game, describing it as a highly engaging activity and a fun way of revision.

3. Methodology

3.1. Design

I designed and implemented an in-person (pen and paper) educational escape room game as a revision formative assessment for class test 2 during 2022-23 and for class test 1 in 2023-2024. The format followed the structure of the summative assessment (4 questions from each topic with 5 sub-questions), and was optional, with a prior announcement for student registration to facilitate group formation.

The game occurred at the University of Birmingham Dubai campus and featured participants from diverse cultural backgrounds, maintaining a nearly equal gender balance. To ensure inclusivity and equality, [groups of four with one exception of a group of 3 due to total participants (n=31)], were formed based on students' varied mathematical backgrounds and exposure, degrees of studies, and gender. Information regarding students' mathematical backgrounds upon university entry and their current academic level was collected, facilitating the creation of groups with comparable abilities. Emphasising diversity within the groups aimed to ensure equal participation, problem solving, and competitiveness. The objective was to create groups with as equal capabilities as possible emphasising inclusivity in this activity and advancing equality. Additionally, attention was paid to forming groups comprising students who were not acquainted with each other to foster interactions among them.

3.2. Implementation

At the beginning of the game, students were prompted to assign a name for their group to create a sense of community and make the game more fun. The introduction of a captivating Cluedo story with hints made it more engaging and fun, with the students tasked to unravel a murder mystery by solving a series of interconnected challenging quantitative questions relevant to the

module material. Each question served as a clue, progressively unveiling the weapon, motive, clue and finally murderer behind the fictitious crime.

Incentivised student participation, I introduced a reward for the winning team, to boost motivation and engagement. The core objective of the game was for students to correctly solve all questions within the limited time to win the game, escape the classroom and win the prize. Progression through the game hinged upon accurately addressing the initial question and subsequently discovering the pertinent clue to proceed to the subsequent question.

This procedural framework remained consistent throughout the game, with each correctly answered question furnishing a crucial piece of information indispensable for unravelling the overarching mystery. Emphasising the interdependence of the clues, students were mandated to solve all questions with precision, discover the murderer and escape the classroom.

The questions of the game were designed to be challenging, as students collaborated in groups, aiming to stimulate critical thinking, problem-solving, and teamwork. The intentional difficulty level served the purpose of assessing their capabilities and promoting effective group work, leveraging their strengths. In alignment with the summative test rules, no formulas were provided, ensuring that students relied solely on their cognitive abilities and collaborative efforts to navigate through the challenges. In instances where students consistently struggled with a question, hints were offered to guide them toward a better understanding, encouraging continued engagement with the game.

The game was conducted in a big lecture theatre, with students initially positioned in the back rows at the commencement of the activity. All groups were simultaneously given the first question, initiating their journey through the game together. Upon successful solution of the question, groups were rewarded with a hint and subsequently progressed to the next row to tackle the next question. This sequential progression enabled students to monitor the relative advancement of other teams, intensifying the competitive aspect of the game. As the game unfolded, teams moved closer to the front rows of the lecture theatre, culminating in their eventual escape from the classroom upon successfully solving the final question where they reached the first row of the classroom. To facilitate the verification of answers and progression to subsequent questions, a designated representative from each group ran down to cross-check responses with the facilitator as quickly as possible, encouraging active participation through a dynamic approach. Across both runs of the game during the academic years 2022/23 and 2023/24, one team successfully completed the game within the time limit and escaped the classroom, closely followed by another team.

3.3. Evaluation

In the first run of the game, I conducted a quantitative analysis utilising a survey questionnaire. Also, the analysis involved comparisons of the performance of students on class test 1 before

the game, with student's performance on class test 2, for which the game was implemented as an alternative method of revision (Figure 1). Additionally, I compared the grades of students who did not participate in the game (control group) with those who did (treatment group). To gather further insights, I organised a peer group feedback session using Padlet. In the second run of the game, I employed a mixed methods approach. This included both quantitative and qualitative analyses conducted through questionnaires and focus group discussions, respectively. I applied thematic analysis for the qualitative data identifying patterns using the NVivo software.

4. Results

4.1. Discussion of the Results

Overall, the results of the game were very encouraging. Figure 1 illustrates a comparison between the mean scores and failure rates (%) in class tests 1 and 2 during the first run of the game in the academic year 2022/23. As depicted in the figure's data, when assessing performance across the two class tests, there was a notable increase in mean scores in class test 2 (for which the escape room game was designed as a formative assessment), rising from 62.88% to 68.5%. Additionally, there was a significant decrease in the number of failures, dropping from 20.6% to 2.94%. These findings strongly suggest that the game effectively supplemented students; revision efforts, contributing to improved performance.

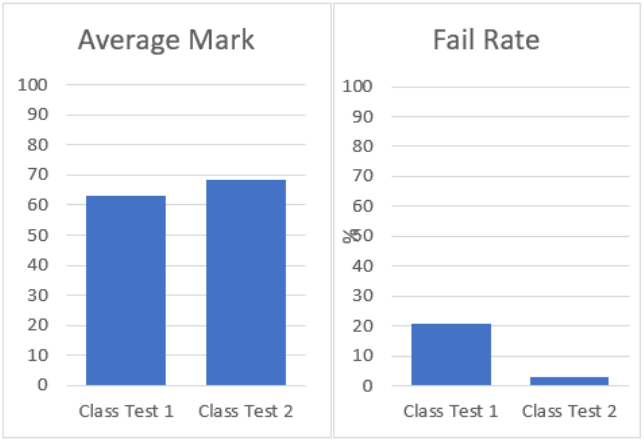


Figure 1: A comparison of the average mark and failure rates (%) in class test 1 and class test 2.

Tables 1 and 2 show the questionnaire results from the second run of the game in 2023/24. Table 2 provides additional findings regarding the assessment of the game across various dimensions. A majority of the students expressed that the game improved their communication

with their classmates and professor, made solving questions in groups more enjoyable compared to traditional methods, increased motivation for revision, and fostered a greater sense of inclusivity in the activity. Moreover, students reported that the game enhanced their understanding of the module content.

Table 1. Questionnaire Results

Questions	Results
This experience might make me more engaged with the module content	100%
The game enhanced my collaboration and teamwork skills	100%
The game has an educational value	100%
I completed the game within the time limit	9.68%
I used the hints provided during the game	45.16%

Table 2. Questionnaire Results

	Strongly Disagree	Disagree	Neither	Agree	Strongly Agree
Communication with my classmates and professor has improved			12.90%	38.71%	48.39%
It has been more fun solving questions with games in groups		3.23%	9.68%	41.94%	45.16%
This type of revision is more motivating			16.13%	41.94%	41.94%
I felt more involved in the activity		3.23%	6.45%	41.94%	48.39%
The game improved my understanding of the module content		10.00%	16.67%	46.67%	26.67%

Regarding the overall experience, some quotes from the participants: “The experience was fun and engaging. It was nice to work on some problems with a group of people. It was challenging at the start to coordinate who does what, but as it went on, we became better”. “The overall experience was very enjoyable. I had a lot of fun meeting new people, solving questions and working together. I found the system of moving down a row in the theatre very engaging as it encourages a lot of competitiveness”. “Overall experience was amazing. We had the revision and test of the course along with competition”.

On the question ‘What did you enjoy the most in this activity’ the students emphasised teamwork, collaboration, working with teammates, structure and design of the activity: styled as an escape room and meeting new people. Revised all topics in an engaging manner. And competition. The focus group confirmed the positive results and gave a more comprehensive understanding of the student’s experience of the game regarding five key areas: experience, engagement, challenges, learning and teamwork.

Thematic analysis conducted using NVivo software revealed several patterns from the focus group discussions. Collaboration and teamwork emerged as significant themes, closely linked with motivation. Students found motivation in teamwork, allowing them to meet new people,

understand different problem-solving methods, and strengthen interpersonal relationships. The diversity of backgrounds among team members provided valuable learning opportunities, enabling students to explore alternative approaches to problem-solving. The competitive aspect of the game added excitement and drive, making learning enjoyable and engaging.

Another prominent theme was revision and question difficulty. The game served as an engaging and effective revision technique, offering a more interactive and goal-oriented approach compared to traditional methods. Students appreciated the progressive increase in question difficulty, which effectively tested their knowledge and teamwork. The challenging nature of the questions was engaging and reflective of real-world problem-solving scenarios, facilitating diligent revision and practice.

Despite the potential biases, such as a few students choosing not to participate in the game, high grades were achieved in the class test, indicating the effectiveness of the game. In summary, the game increased student engagement and motivation and enhanced teamwork skills, learning and communication. It provided a unique and enjoyable revision tool before the class test, contributing to improved academic performance.

4.2. Improvements, Limitations, and Future Steps

Feedback from students highlighted some areas for improvement and suggestions to enhance the escape room game experience. One common suggestion was the need for more time to complete the game. Also, students found some questions to be quite challenging and suggested having a mixture of easier and more difficult questions to provide a better balance. They also proposed the idea of having shorter questions and the inclusion of more hints.

It is important to note that while the in-person escape room game proved to be effective and engaging in a small cohort, its scalability is limited. This is because the game relies on students working together in a physical classroom where there is a need for sufficient space. A solution to this limitation will be an online escape room game, where the number of students won't affect its applicability.

Future steps to enhance the positive outcomes of the game and support, access and monitor the progress of each cohort are going to be implemented. I am currently expanding the methodology and in the process of individual interviews of both cohorts to examine in depth their experience and whether the positive outcomes such as motivation, engagement and learning persist in other modules and as they are progressing with their studies.

5. Conclusion

In conclusion, the implementation of an in-person educational escape room game within a first-year quantitative module demonstrated positive outcomes in enhancing student engagement,

motivation, and learning. The game served as an effective revision tool, fostering collaboration, problem-solving, and communication skills among students. Positive feedback from participants underscores the value of incorporating gamified elements into educational settings to address the challenges of traditional teaching methods. Moving forward, the development of an online version of the game offers scalability and accessibility, opening avenues for further research and exploration into its impact on student learning outcomes across diverse academic contexts. By leveraging innovative approaches like educational escape room games, educators can continue to enrich the teaching and learning experiences of students in higher education.

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Principle-Focused Evaluation for STEM Persistence

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Abstract

In postsecondary STEM programs retention of students is challenging. This paper presents a principle-focused evaluation system to be applied to STEM education programs in higher education institutions to optimize student persistence. We transformed a STEM education persistence framework developed to increase STEM student retention in higher education into a set of evaluation principles. We argue that these principles provide higher education institutions with a novel practical frame for system-wide development and evaluation of their STEM education programs. Application of our principles will increase STEM education retention and inherently will improve program quality for individual students, courses, programs, and the overall institution.

Keywords: *STEM education, principle-focused evaluation, persistence, retention.*

1. Introduction

Students in STEM disciplines graduate at a substantially lower rate than students in non-STEM fields (Sithole et al., 2017), and this is particularly true for women and under-represented minority students, even though the gender gap is slowly closing (Seymour & Hunter, 2019). Enhanced persistence has been identified as a key element in reducing the number of students leaving STEM disciplines in higher education (Seymour & Hunter, 2019). The literature provides a range of recommendations for best practices and interventions to address attrition in college STEM programs (Graham et al, 2013; Green and Sanderson, 2018; Kuh, 2013; Sithole et al., 2017). A range of assessments measuring persistence factors such as motivational constructs are available (Simon et al., 2015). Overall, however, persistence in STEM education depends on the overall program quality and student experience (Xu, 2018). What is missing is an evaluation strategy that can integrate available assessments and informal feedback in a simple, systematic, sustainable way across interventional scales, from classroom to institution. Principle-focused evaluation (PFE) (Patton, 2017) provides an intriguing approach, but to date,

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there are no STEM persistence principles articulated for higher education. The work presented here describes our efforts to build a set of STEM education principles for use with PFE based on best practices in STEM persistence to help guide the development and evaluation of STEM persistence interventions across scales.

In 2013, Graham et. al elegantly summarized more than a decade's worth of research into persistence and developed a framework focused on interventions that enhance science learning and professional identification as a scientist as main determinants of persistence. They center early research experiences, active learning environments, and the development of learning communities as interventions that drive STEM learning and identification as a scientist, both of which reinforce confidence and motivation, which are critical to continued persistence. Their framework was explicitly developed to guide both the development and assessment of intervention efforts (Graham et al., 2013), and its framework has been used extensively for program development. However, to date, there has been little work using the framework as an assessment tool to compare STEM persistence intervention efforts between programs and across scales. As an example, DiBartolo et al. (2016), explicitly calls out the lack of coordinated assessment of STEM persistence efforts across institutions that share common STEM intervention efforts. Part of the reason for this is the evaluation challenge when comparing across diverse, complex, and complicated settings.

Patton (2017) proposed a system of principles-focused evaluation to evaluate interventions in just such circumstances. Principles are statements that guide actions and behaviors toward a desired result and to be effective, they must meet the criteria of being guiding, useful, inspiring, developmental, and evaluable. *"This framework prioritizes a values-based process for creating institutional change: Given the uncertainties of complex interventions and interactions, where the ends (outcomes, impacts, results) are uncontrollable, unpredictable and emergent, values can become the anchor, the only knowable in an otherwise uncertain, unpredictable, uncontrollable and complex world"* (Patton, 2017, p. 121, *emphasis in original*)." Much like adaptive management practices, PFE is a way to address the complex, multifaceted challenges present in higher education STEM student retention.

In this paper, we give a brief overview of our use of the PFE framework to develop the intervention recommendations of the Graham persistence framework into principles that can guide the development and evaluation of STEM persistence programs across scales.

2. From Intervention to Principle

In their framework, Graham et al. (2013) point to three key interventions, activities known to positively impact STEM persistence: active learning in introductory courses, early research experiences, and membership in STEM learning communities. These activities are framed by the determinants of persistence, increased confidence and motivation, and STEM identity and

learning. All have significant grounding in best practices for STEM persistence and are widely recognized and researched as practices that support student retention.

What Graham et al. (2013) did not do is articulate principles for evaluation, though the three activities are well positioned as such. To operationalize Graham's activities as principles for PFE we assess the Graham et al. (2013) activity language using the PFE principles guide (Patton, 2017, p. 38) and modify it as needed to derive principles ready for programmatic development and evaluation use.

2.1. The GUIDE to Principle Development

Patton (2017, p. 27) states that "the distinguishing characteristic of principles-focused evaluation is the focus on principles as the object of evaluation, as the evaluand". Thus, a principle must first be articulated and evaluated for its utility in PFE and Patton provides a framework and rubric for this assessment. The GUIDE framework assures that a principle is *(G)uiding*, *(U)seful*, *(I)nspirational*, *(D)evelopmental*, and *(E)valuable*. Briefly, the GUIDE looks at the prescriptiveness of a principle (Patton, 2017, p. 38). According to Patton, to provide high utility, a principle should be instructive and provide direction to be considered *guiding*. A *useful* principle explains its effectiveness. Principles *inspire* when they are grounded in purpose providing value-based meaning. Being applicable across circumstances and time makes a principle *developmental*. And finally, the principle is *evaluable* when it facilitates documentation and assessment. Following this GUIDE, principles can be developed that catalyze a whole range of aspects relevant to program quality and evaluation thereof.

2.2. Development of Sustainable STEM Education Principles

Having highlighted the existing aspects of a PFE-aligned principle present in the Graham framework, we constructed a series of "ARC" principles built on the (A)ctive learning, (R)esearch experiences, and learning (C)ommunities interventions recommended by the Graham framework. The construction process involved a recursive review of wording that captures the Graham framework key activities while following the guidance of Patton on reviewing and reflecting on the principles until they adhere to all five GUIDE criteria for principle-focused evaluation.

Guiding principles are prescriptive by saying what to do (Patton, 2017). The Graham interventions, however, are static statements of best practice but do not provide guidance. Patton emphasizes adding action verbs to provide direction such that a principle becomes transferable across systems (Patton, 2017). Thus, we add the language ***engage students***, ***provide authentic,*** and ***facilitate membership***, to the principles to provide organizations specific, actionable guidance on what they should be doing to increase STEM persistence.

The *usefulness* of principles is given when they provide specific guidance for application (Patton, 2017). The Graham framework, as developed from the research, gives examples and references that provide the reader with specific applications of all three activities. Thus, the activities as Graham et al. (2013) articulates them already speak to the useful directions for making choices and guiding implementation. Therefore, the principles provide utility by pointing at the praxis of providing ***active learning practices***, ***research experiences***, and ***learning communities***.

Inspirational means that principles are values-based, ethically grounded, meaningful, important, and evoke a sense of purpose (Patton, 2017). From the theoretical underpinning of the three Graham activities, we can see that they all center on students and the student experience. Experiential learning theory (Kolb, 2014), which roots early learning experiences, and constructivism theory, in which active learning and learning communities are grounded, all focus on the importance of personal and shared experience and learning. Thus, activities are to be implemented **s*o students construct STEM learning, so students develop and build a professional STEM competency,*** and ***so students empower each other and learn collaboratively***.

The *developmental* nature of a principle shows when it clearly points to a way to implement it across systems, continuously, and with recursive evaluation. The path for this is not clearly provided by Graham. Arising from best practices for STEM programming (Graham et al., 2013), the program-specific context is easy to envision. However, to enhance STEM persistence among diverse groups and across a diversity of programs and scales we need to ask the question if there is the flexibility to interpret these principles to apply across contexts. By adding the language ***on a regular basis, early on and throughout their education,*** and ***sharing education experiences across generations*** to the principles we address that all principles need to be implemented across grade levels and scale, from the individual experience to the institutional level.

Evaluable means that the principles lend themselves to be tools for evaluation. The Graham framework names two determinants of persistence, learning gained and scientist identification, and two cognitive indicators of persistence, motivation and confidence. Published measures and validated assessments for all of these are available in the literature (e.g. Summers and Hrabowski, 2006; Matsui et al., 2003; Murphy et al., 2019). We included language in the principles that identify the measurables. The principles describe the outcome for the students: active learning **is *leading to their increased STEM learning***, research is ***increasing their STEM identity***, and communities are ***enhancing their motivation and confidence***.

As fully articulated the ARC principles read:

(A)ctive Learning Principle: engage students in active learning practices, so students construct STEM learning, regularly, increasing their science learning outcomes.

(R)esearch Engaged Principle: provide authentic research experiences, so students develop and build a professional STEM competency, early on and throughout their education, increasing their STEM identity.

(C)ommunities Focused Principle: facilitate membership in STEM learning communities, so students empower each other and learn collaboratively, sharing education experiences across generations, enhancing their motivation and confidence.

Table 1. STEM ARC Principles Alignment with PFE GUIDE Elements.

	Active Learning:	**Research Engaged:**	**Communities Focused:**
(G)uiding	engage students	provide authentic	facilitate membership
(U)seful	in active learning practices,	research experiences,	in STEM learning communities,
(I)nspirational	so students construct STEM learning,	so students develop and build a professional STEM competency,	so students empower each other and learn collaboratively,
(D)evelopmental	regularly,	early on and throughout their education,	sharing education experiences across generations,
(E)valuable	increasing their science learning outcomes.	increasing their STEM identity.	enhancing their motivation and confidence.

Importantly, the ARC principles do not give siloed cause-and-effect rules but provide a tool that guides the continuous development and evaluation of STEM programs. For example, while the application of all three principles increases STEM learning, identity, motivation, and confidence, we chose to not link all four outcomes to all three principles. Rather we created the principles by linking the most established correlations and frameworks into one principle based on the practical ability to measure and evaluate. Application of the ARC evaluation encourages implementation of all three principles in tandem and we encourage institutions to make cross-connections between the aspects of the three principles to add richness to the interpretation of their evaluation. Using just three principles creates a simplifed picture on STEM persistence for all involved.

3. Utilization of ARC Principles for Evaluation

The ARC principles can be used to derive both process and outcome evaluation questions targeted to the scale of interest (student, course, department or program, and institutional). Using the example of the Active Learning Principle, process evaluation questions at different scales might be: What percentage of students expressed in interviews that they were engaged in active

learning (student level)? How frequently did the faculty use active learning practices (course level)? How were active learning efforts supported (department or program)? What guidance was provided to focus the institution on active learning (institutional)? Outcome evaluation questions might be: Did active learning change student motivation or confidence (student level)? Did it change students' understanding of STEM material? (course level) Was active learning applied across teaching modalities (department or program)? Did active learning implementation result in higher student persistence (institutional)?

Importantly, evaluation is not just the summative assessment of outcome data but can expand to be applied in a self-sustaining cycle where positive and negative evaluation outcomes drive the continuous design and coordination of programs. For example, in a pilot application of the ARC principles in 2018-2019, instructors and program administrators of the University of Idaho TRIO STEM Access program reviewed the principles during initial planning meetings where team members took time to talk about what implementation of the principles may look like. Subsequently, during program meetings the principles anchored progress discussions, they were assessed with survey and student focus groups at the completion of the program, and they were evaluated in a post-program triangulation meeting leading to an internal report. The initial personal conversation about what the principles looked like invigorated the team to fortify the program in small ways while yielding a type of STEM learning program where students highlighted those improvements as beneficial.

As described above, the principle-focused evaluation is ideally situated to provide such a sustainable mechanism by grounding all evaluation and program development in the principles. Thus, the principles developed for STEM persistence, Active Learning principle, Research Engaged principle and Community Focused principle, provide an arc from development to evaluation.

The application of the ARC principles is limited by familiarity with the principles and the extent to which they are utilized. At a minimum, an evaluator familiar with the principles gathers data available and feedback to create a summative evaluation. This can determine if a program is aligned with the ARC principles, however, this is insufficient for creating a culture of STEM persistence, as it can only yield information on where efforts need to be directed. At full implementation, all members of the departments delivering STEM instruction are familiar with the ARC principles and the principles guide program planning, are implemented throughout program delivery, and form the basis for program evaluation. Lessons learned from previous efforts then inform subsequent efforts. This intentional circular feedback approach leads to adaptive, sustainable approaches to enhancing STEM persistence.

Further development of the ARC principles is needed. A comprehensive literature review will identify existing assessments that can be used to measure components of these principles at different institutional scales. Understanding which of those are currently used by postsecondary

intuitions to understand STEM persistence can surface the gaps in comparison with the more comprehensive approach of the ARC principles. Research on the ARC principles implementation in case studies will provide further insight into their effectiveness for increasing STEM persistence, and how this looks when sustainably implemented.

4. Conclusion

This conceptual paper transforms the Graham STEM Persistence framework into the ARC principles for use with PFE. While PFE has been successfully applied across a range of programs in higher education, principles designed specifically for STEM persistence are new. Our articulation of these ARC principles aligns with Patton's GUIDE criteria for principle development. Formulation of the principles in this manner allows the principles to be used for both program evaluation and development across programmatic scales, enhancing their utility for comparing STEM persistence efforts across diverse and complicated contexts. A pilot application of the principles indicates the efficiency of this approach but also highlights that full implementation requires wide dissemination and adoption of the ARC principles at all levels of program management. Furthermore, when used exclusively as an evaluative tool, the ARC principles are unlikely to enhance STEM persistence, so should be paired with iterative and adaptive principles-based program development. Finally, more work is needed to identify existing assessment tools that can be evaluated within the ARC principle framework and to identify assessment gaps that require further development efforts.

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Rethinking architectural education to foster Sustainability: Literature Review of emerging trends and pedagogical approaches

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Abstract

Through a comprehensive literature review, this paper sheds light on emerging trends and innovative pedagogies to foster sustainability in architectural education worldwide. Over 700 published research outputs are analyzed and 250 are selected for this research. These considerations have been integrated across countries in North and South America, Europe, Asia, Africa, and Australia with a focus on both macro and micro scales.

The findings show that 60% of the papers use case studies to evaluate the impact of sustainability education, while theoretical discussions and investigations only represent 40% of the total. Within the case studies category, it is to be noted that efforts at the design studio or course level account for 75%, while those at the curriculum level represent only 25%.

Dealing with sustainability reflects the specific needs and challenges of each region shaped by pedagogical, socio-cultural, economic, geographical, political, and climatic factors all the while fostering common ground.

Keywords: *Sustainability; Architecture; curriculum; design studio; pedagogy.*

1. Introduction

In the wake of the complex world, climate change has a significant impact on architectural practice and urban development and represents an immediate challenge to the built environment. This brings new responsibilities and calls for enhancing the implementation of principles and values of sustainability in architectural education. A substantial shift in policies and pedagogical methodologies is needed to facilitate the transfer of knowledge between sustainable sciences and building applications and enhance the implementation of environmental sustainability within the creative design (Altomonte et al., 2012).

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The sustainability paradigm admits several definitions and various ambiguities that can be seen from diverse angles and multidisciplinary visions. It cannot be implemented as additional knowledge but asks us to rethink outside disciplinary boundaries and limits.

Therefore, many studies have been conducted to improve understanding and develop knowledge and skills, as well as abilities needed to incorporate these issues at undergraduate or graduate levels. Integrating sustainability into education requires a fundamental understanding of key concepts, principles, and frameworks. Environmental assessment methods and accreditation standards play a crucial role in determining the skills required of both instructors and students. Furthermore, the teaching methods employed are instrumental in shaping the learning experience.

This paper aims to identify emerging trends, common theories, and innovative pedagogical approaches and outlines potential future directions for the development of this relatively new and yet still undefined paradigm. By drawing lessons from diverse case studies, the research examines the content and structure of courses and programs, as well as the pedagogies and implementation processes used worldwide.

2. Method

Through a systematic and comprehensive literature review, our research explores the ‘what’ (Knowledge and content of courses and programs) and the ‘how’ (pedagogies and implementation processes for teaching methods and curriculum development purposes). By combining quantitative and qualitative analysis methods, over 700 published and referenced research papers are examined and 250 are selected for inclusion in our research.

In this context, we try not only to highlight international case studies that have pioneered efforts to incorporate sustainability within architectural education but also to provide discussions and theoretical research offering a holistic global perspective.
Within the category of case studies, efforts are being made at both the macro and micro levels, from the design studio or course level to the curriculum and campus level.

3. Literature review

The literature review highlights geographical diversity, with case studies from North and South America, Europe, Asia, Africa, and Australia. This diversity emphasizes the global nature of sustainability challenges and the necessity for context-specific solutions as shown in Figure 1.

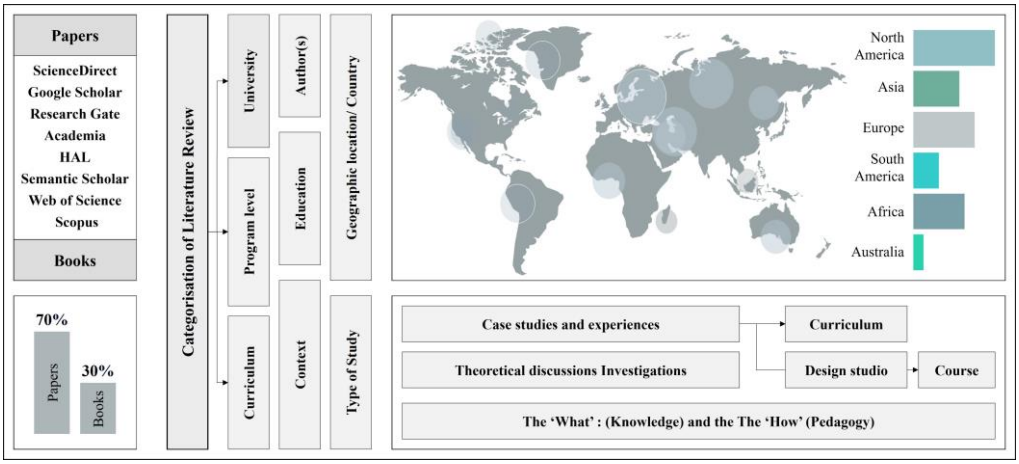


Figure 1. Research methodology and literature review categories. Source: Authors (2024).

3.1. Case Studies on a macro scale

According to the University Leaders for a Sustainable Future association, since 1990, more than 300 universities have signed the Talloires Declaration, committing themselves to the pursuit of a sustainable future. This declaration serves as a comprehensive framework for universities to integrate sustainability into their missions and operations. Some universities have successfully implemented significant initiatives to genuinely transform their campuses, incorporating sustainability into their teaching and research. Several of these institutions have chosen to take control of their built environment, while others have established transdisciplinary research laboratories focused on sustainable development. Additionally, some have created transdisciplinary training programs and/or sustainable development programs.

For example, the University of British Columbia and Oberlin College have developed their approach on multiple fronts simultaneously, ensuring a profound transformation of their institutions. However, only a relatively small number of institutions have taken major steps to truly change their campuses, and even fewer have incorporated sustainability into their teaching and research. Some sustainability advocates express concern that universities may engage in greenwashing by taking minor measures to adopt the appearance of sustainability while avoiding the deeper changes that are necessary. Others argue that educational institutions are simply moving too slowly, falling behind societies that have taken the lead on this issue. The university's role can be identified in three main aspects (Cucuzzella et al., 2010).

As an Educational Institution: This includes training programs, students, degrees, and teachers. As a Research Institution: This includes research laboratories, publications, conferences, seminars, graduate students, and researchers. As a Built Environment: This includes campuses, buildings, infrastructure, management, maintenance, construction, planning, and the local and university communities. Through these three aspects, the university's role operates on a global

scale, with responsibilities ranging from individuals to global impacts. Thus, the university becomes a living laboratory for sustainable development, a place where students are trained while living in an environment that reflects these new approaches and know-how.

In Europe, the EDUCATE Initiative (Environmental Design in University Curricula and Architectural Training in Europe) stands out among others as an academic project to promote environmental design education in university curricula and architectural education. Founded by the European Commission's Energy Agency for Competitiveness and Innovation (EACI) as part of the Intelligent Energy Europe Program 2008, this project was born from a consortium of seven academic partners in Europe

3.2. Case Studies on a micro-scale

According to a published research study, an experiment took place at the University of Miami, where the Department of Architecture and Design offers two-course options for undergraduate and graduate students to engage in the integration and implementation of Passive House principles. In the Passive and Low Energy Course, students received training on Passive House principles and the target criteria that must be met during design. This includes considerations for thermal comfort, natural ventilation, shading, insulation, solar gain, elimination of thermal bridges, and achieving low or passive energy consumption. They also explore energy modeling using software such as the Passive House Planning Package (PHPP) or WUFI Passive. During the Passive House Malta Summer Workshop, students attended lectures, organized workshops, the building trade fair, and visited various ongoing Passive House projects. They also embarked on a trip to the island of Malta, where they studied traditional Maltese stone construction. Students are introduced to heat transfer analysis software (HEAT & THERM) to analyze the thermal qualities of current Maltese construction and provide alternative solutions to enhance thermal performance. Additionally, the course on passive energy is translated into an architectural project in three stages: Familiarization: The goal is to become familiar with detailed elements (e.g., exterior walls). Analysis: The detail is then subjected to thermal analysis using the HEAT program. Modeling: Students create large-scale models of the detail to eliminate any thermal bridges and reevaluate using HEAT. The objective is to visualize the impact of design on the energy performance of a building, providing students with a hands-on understanding of Passive House principles through practical application and analysis.

An investigation study was conducted to examine the role of architecture education in Saudi universities in integrating principles, concepts, and applications of sustainable architecture**.**

The focus was on the Department of Architecture and Building Sciences at the School of Architecture and Planning, King Saud University, as well as three other universities: North Carolina State University, the University of Bath in the United Kingdom, and Queensland University in Australia. The comparison was made based on LEED standards. While there are

many similarities, notable differences were identified. The University of Bath successfully addressed the "Water Efficiency" criterion by including it in the course content, a feat not achieved by the other universities. Not all programs were able to meet the "Innovation in Design" criterion by incorporating it into their decisions. Both King Saud University and the University of Bath achieved the "Materials and Resources" standard in their programs, while the other programs did not. Regarding the remaining criteria, Bath and Queensland were closely aligned in their courses, compared to King Saud University and North Carolina State University, which were also closely aligned. Based on these comparisons, the program content at King Saud University did not encompass most LEED categories in comparison to the three other programs.

Another case study or experiment took place at the School of Engineering and Architecture, Istanbul in Turkey (Gulec Ozer & Turan, 2015) within semester seminar with a workshop aiming to raise students' awareness of sustainability and introduce them to the ecological, conscious, and responsible approach from the earliest years. The teaching pedagogy experience was based on Reflection in action. This approach, in terms of skills and knowledge received, was integrated and experienced in the workshop, including these principles: environmental issues, global warming and its effects, environmental issues and construction, green architecture, zero energy buildings, renewable energy sources and their use, solar race diagram, basic questions on ecological concepts and their use in winter/summer, day/night.

According to a research publication, an experiment was carried out at the University of Queensland where third-year architecture students engaged in projects considering the importance of natural light and its influence on design guidelines. They were encouraged to attend conferences as an introduction to sustainability and environmental challenges such as climate change and air pollution (Demirbilek et al., 2009)**.** Subsequently, they were able to empirically apply this knowledge in the studio by considering natural lighting in the design process from the initial sketches. This occurred within the framework of two workshops that addressed different methodologies: Digital Tools Design Studio involving designing a Cultural Center where students efficiently used digital tools and daylight simulation software. They calculated the sun's position concerning the volumetrics and shadows, with accountability to maximize natural light and minimize artificial lighting, considering aspects such as orientation and materials. They employed Helidon to assess the building's performance under different solar angles. This practical application of knowledge aimed to instill a deeper understanding of sustainability principles in architectural design, providing students with hands-on experience in optimizing natural light and considering environmental factors.

Following a published case study, an experiment was conducted at the Özyeğin University School of Architecture in Istanbul (Papanikos, 2013)**.** Rather than a pedagogical reform, this involved the integration of a workshop course known as the Studio-Based Environmental Control (EC) course at the beginning of the academic year. The objective was to rethink the project and adapt it to the parameters of sustainable holistic design. Additionally, the aim was

to understand the problem-solving process, learn to use information for specific purposes, and thereby develop experiential learning. During the analysis and design process, students utilized various simulation tools based on parametric thinking with the integration of diverse factors such as climate, orientation, wind, natural lighting, building materials, and envelope...

Another experiment took place at the School of Architecture, University of Patras in Greece (Kepez & Üst, 2017). One of the fundamental principles of sustainable architecture is to provide opportunities for users to adapt space to the requirements of their changing comfort. The design process should take into account the experience of space from both the architect's and the occupant's perspectives. Post-occupancy evaluation involves a series of conferences highlighting the importance and complexity of human comfort, the selection of existing buildings for study, the collection of necessary information (graphic elements, photos, etc.), and analysis of the building as a "living organism." Energy assessment considering temperature, humidity, and natural light input. Surveying occupants on thermal comfort, acoustics, and visual aspects. Scenario development for new interventions to enhance thermal, visual, and acoustic comfort, energy consumption, environmental impact, as well as thermal and visual comfort.

4. Results and Discussions

The findings as mentioned in Figure 2 show that 60% of the papers use case studies and experiences to evaluate the impact of sustainability education, while theoretical discussions and investigations only papers represent 40% of the total. Among the case studies category, it is to be noted that the work done at the course level almost equals 75% while 25% at the curriculum level with attention to both macro and micro scale.

Dealing with this paradigm in architectural education varies significantly across countries and pedagogical contexts, shaped by socio-cultural, economic, geographical, political, and climatic factors. These influences result in diverse approaches to integrating sustainable development into curricula, reflecting the unique needs and challenges of each region. Despite these variations, a shared global concern for environmental issues exists, fostering common ground in the inclusion of key sustainability. Integrating this paradigm into architectural education requires a foundational understanding of key concepts, principles, and frameworks.

In our research, we chose to highlight more the different pedagogical approaches, teaching methods, and curriculum development purposes. This does not prevent us from identifying essential knowledge areas that educators can focus on to effectively on the paradigmatic shift.

Principles of Sustainability are based on Knowledge and understanding of the fundamentals of Sustainable development, including economic, social, and environmental dimensions. Methods for Environmental Quality Assessment of Buildings emerged to assess the environmental quality of buildings to different construction types, countries, climates, cultures, and regulations. These methods assist architects and designers in ensuring the responsible nature of buildings

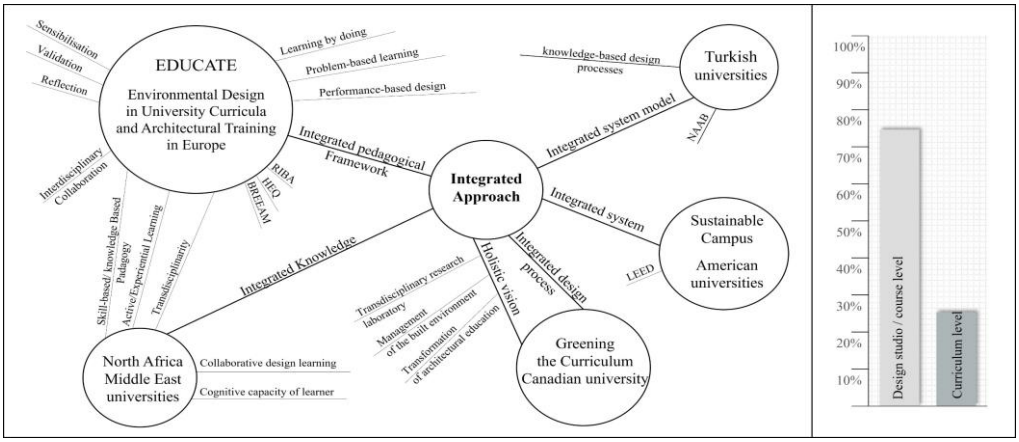


Figure 2. Mapping of emerging trends and pedagogical approaches. Source: Authors (2024).

and evaluating environmental quality. In the educational context, these tools are alternatives to ensure the learning of the sustainability paradigm and the most commonly used environmental protocols include BREEAM (Building Research Establishment Environmental Assessment Method) in the UK, NF HQE (High Environmental Quality Association) in France, and LEED (Leadership in Energy and Environmental Design) in the United States.

The literature review on case studies on different scales in architectural education reveals a dynamic landscape characterized by different teaching methods according to the Table below. The Project-based learning emphasizing hands-on, real-world projects allows students to directly engage with sustainability challenges. The Competency-Based Approach also prioritizes practical skills where the student must demonstrate knowledge, skills, and attitudes to apply in problem-solving. The interdisciplinary approach encourages students to draw from diverse knowledge areas, fostering a holistic understanding of sustainability. Guest Lectures, experts, bringing in guest lectures, speakers, experts, and Professionals from various industries related to sustainability provide students with valuable insights and connect them with real-world practitioners. Field Experiences and Site visits offer a tangible connection between theory and real-world applications and explore sustainable initiatives in their local context. In addition, other teaching methods are employed in shaping the learning experience including Knowledge-based Process, learning by doing, Collaborative Learning, Performance-based design, and the Integrated approach also known as Integrated Pedagogy which requires the use of techniques specific to architecture as a complex discipline.

5. Conclusion

The literature highlights geographical diversity, with case studies from North and South America, Europe, Asia, Africa, and Australia. This diversity emphasizes the global nature of

Table 1. Percentage of Emerging Trends and Pedagogical Approaches. Source: Authors (2024).

Case studies, Theoretical discussions, and investigations			
Macro scale	***Curriculum level*** Program structure	Integrated Curriculum, critical thinking	*10%*
		Interdisciplinary Collaboration, Holistic approach	*5%*
Micro Scale	**Design Studio** or **course level** Design Process Instructors, students	Project-based learning, Student-centered approach	*15%*
		Competency-Based Approach, Learning Outcomes	*5%*
		Knowledge-based Process, Research-based approach	*10%*
		Learning by doing, practice, hands-on experience	*35%*
		Integrated design process, Systemic approach	*20%*

sustainability challenges and the necessity for context-specific solutions. Comparative analyses within and across regions contribute to a nuanced understanding of the socio-cultural, economic, and political factors that shape macro and micro-scale sustainability initiatives.

By synthesizing insights from various geographical contexts, this body of work offers a comprehensive basis for comprehending and promoting macro and micro-scale sustainability integration in architectural education. In conclusion, this research contributes to the discourse and serves as a guide for educators, institutions, and policymakers navigating the evolving landscape of sustainable architectural education. The study brings together insights from different scales and perspectives, laying the foundation for future advances and collaborative efforts to shape a more sustainable future for the field of architecture.

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Automatic code assessment in Robotics higher education courses

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Abstract

This paper describes two automatic assessment tools developed for Unibotics, a robot programming web platform for engineering education. The first one, for style assessment, measures some quality indicators in the source code itself such as complexity, number of loops, and PEP8 compliance. A second tool runs the robot application developed by each student and measures its performance when solving the task of each exercise. For students, both tools provide instant feedback which encourages them to improve their score and so their source code. For teachers, they are automatic assessment tools which provide additional information for student evaluation. Both tools aim at improving the technology enhanced learning when using that robotics education platform. They have been used in two courses at Universidad Rey Juan Carlos with 40 real students and some preliminary analytics have been collected.

Keywords: *Educational robotics, web-based learning, robotic simulators.*

1. Introduction

Code assessment has been an active topic in education for a long time. The assessment of programming assignments is not a trivial task. There are many characteristics to take into account, compiling and executing students' programs require a lot of time, which is worse if the number of students is high. For this reason, instructors cannot assess all characteristics of the assignments or have to perform a more superficial assessment. Without adequate feedback, students rarely have the opportunity to learn from their mistakes. When programming, students need instant feedback to improve, however giving immediate feedback is not a simple task. There are many errors that could be solved before submitting a piece of code with the appropriate feedback such as, syntax and semantic error detection, software metrics analysis, structural similarity analysis, keyword detector, plagiarism, diagram analysis, infinite loops logical errors or unused statements. These errors can be detected automatically but since many universities still check their student's code manually, some of them are overlooked (Striewe & Goedicke, 2014).

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Rees (1982) suggested that by making programming issues visible and measurable for students they learn to pay attention to them. Based on his work, many authors developed code analyzers for programming languages such C, Ada, Fortran, etc and even relatively new programming languages such as Python have a module to evaluate the programming style of a given code. Important for any learning process, assessment can guide the students' learning providing feedback to both the student and the teacher. In this sense, automatic code assessment may help the teacher to evaluate their students' code in a fair and objective way. In addition, it will allow the students to do code checking more frequently (Yang, Liu, & Yu, 2018). There are many studies in the literature that provide assessment techniques and assessment tools to give student's appropriate and automated feedback for them to learn (Ihantola et al., 2010).

Regarding the teaching of robot programming, one of the main evaluation criteria is whether the robot succeeds in performing the task for which it was programmed and, if so, with what degree of efficiency. Robotic competitions typically use similar criteria to rank the participants in an objective and quantitative way, they have tools for evaluating the effectiveness of a robot's code and make fair comparisons between attendant's robot programs. Robotic competitions such as RoboCup, ARIAC, MBZIRC and Darpa Robotics Challenge have traditionally been a key element in research and in higher education. Also, VEX Robotics Competition, FIRST LEGO League, RoboCup Junior, World Robot Olympiad are examples of interesting competitions in secondary education where serve as a stimulus for students. Several illustrative examples may be found in Evripidou et al. (2020). Many of the competitions are with physical robots and recently some of them are also with simulated robots, which may simplify the automatic evaluation.

In this work we present the automatic code evaluation system implemented on the Unibotics platform. Unibotics is an open collection of exercises to learn robotics in a practical way, based on Gazebo simulator and ROS middleware. It includes an automatic code effectiveness evaluator and an automatic style evaluator. The system has been tested with 40 real engineering students and some preliminary results are also described.

2. Automatic code assessment of robot programming

The question of code quality assessment was born along with the programming. Code developed in a certain programming language to solve a specific problem can be assessed using three different questions: (1) Functionality: Does the developed code solve the problem? (2) Code Style: Is the developed code the most suitable for the proposed problem (speaking in terms of efficiency, re-usability, easy to read and understand for other programmers...)? (3) Algorithm: Taking into account a more abstract issue: is the algorithm implemented by the code adequate and effective to solve the problem?

Functionality is the easiest to assess. A key question here is a correct and precise definition of the problem proposed to students and the measurable requirements for the solution. Beyond robotics competitions, in some robotics areas some standardized quality metrics and benchmarks have already been proposed and are widely accepted. For robot navigation (Xia et al., 2020), for visual object detection in robot perception systems the accuracy and recall computed on certain datasets (Padilla et al., 2020), for self-localization algorithms the error on some SLAM datasets (Huletski, Kartashov, & Krinkin, 2015), for autonomous driving the combination of route completion and the infractions penalty (Yumaganov & Agafonov, 2021).

The programming style, or coding conventions, is an important aspect when writing code, since it can make the written program intelligible to other programmers. However, code style assessment could be less objective. Nevertheless several authors describe many style of coding criteria that any programmer agrees with. The style rules of programming are indeterminate, inconsistent and contradictory (Roque et al., 2019. Different ways of using factors such as indentation, alignment and comments can be found in several books that address the topic. Lack of consensus can be traced to the lack of definition of what exactly is programming style, and what factors contribute to its definition.

Third question intends to assess a more abstract and complex idea, if the algorithm behind the code is the most adequate to the proposed problem. Maybe the code solves the problem, the style is perfect but the algorithm that the code implements is inefficient or to complicate for a simple problem.

An interesting example of program assessment in a robotics context is described by Siegfried et al. (2017). The authors used simulated robots and provided real-time feedback and gamified hints to the students, who reduced the average time to write a correct program and the percentage of them successfully writing a correct program also increased.

3. Unibotics platform for educational robotics

Unibotics is a robot programming web platform with engineering higher education contents (Roldán-Álvarez et al., 2023). It allows the robot programming from the web browser and uses state-of-the-art robotics tools such as ROS middleware and Gazebo simulator. It provides more that 20 academic units on service robotics, autonomous driving, drones, computer vision and mobile robots.

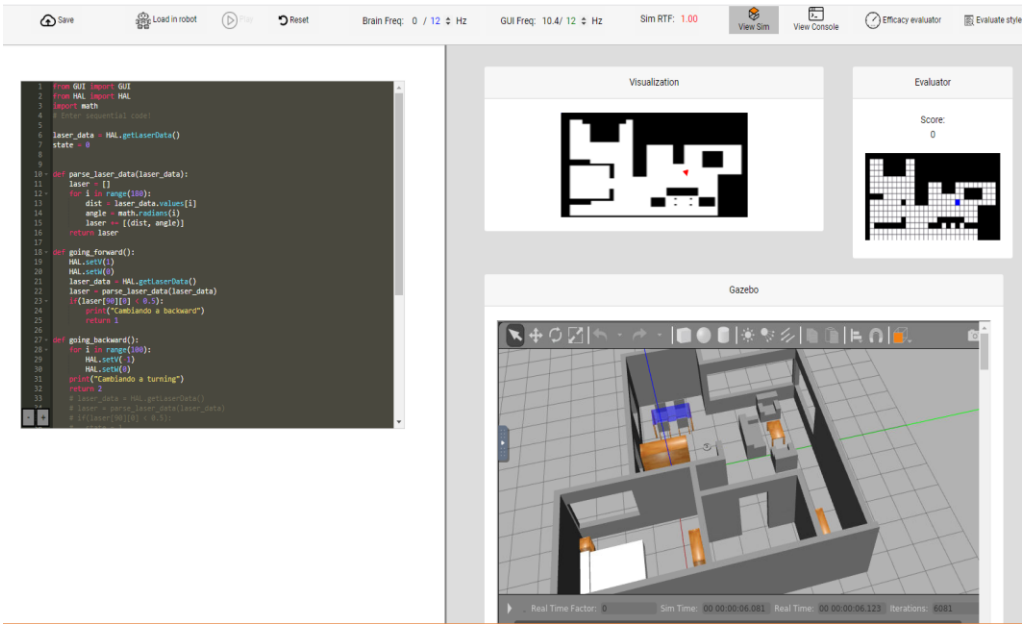


Figure 1. Example of the Vacuum Cleaner exercise web page

The platform provides several challenges where the student has to program the robot in Python to solve a specific challenge (such as cleaning a full room with a vacuum cleaner) in a simulated Scenario. For each exercise Unibotics already provides the Scenario, the robot sensors and actuators through ROS topics, and the task to be solved.

The web page of each exercise is divided in three main parts as it is shown in Figure 1. In the left side an inline text editor is be used to write the robot program. The right side includes a view of the simulated world to see the robot behavior, a debugging console for text messages and several exercise-specific widgets to show debugging information such as the processed images. Then in the top area of the web page there is a toolbar which is used to implement the basic operations of the platform: saving the current code, loading the code into the robot, running the simulation, resetting it, showing and hiding some GUI widgets and two buttons to evaluate the efficacy of the code and the programming style.

4. Automatic assessment tools in Unibotics

One of the main advantages of the platform is that the user is offered the possibility of evaluating the code automatically and receive feedback.

Regarding the *style of the code*, the platform uses the rules from the PEP 8 style guide. This evaluation offers information about how well-written the code is. This is an area that, in our

case, many students at the university often do not pay attention to when programming, focusing only in if the code works and solve the issue, leading them to write unintelligible code that can not be maintained nor updated in an easy way.

Regarding the *efficacy evaluation*, it heavily depends on the exercise itself. Two of them will be described here for illustrative purposes. First, in the FollowLine exercise the challenge is to program an autonomous F1 Car to complete a lap of the circuit in the shortest possible time by following a red colored line drawn throughout the circuit. The car is equipped with an onboard front camera and its motors accept forward speed V and angular speed W commands. Figure 2 shows the Gazebo scenario and the Formula1 car used. This exercise is designed to teach basic reactive control, including PID controllers as well as introducing students to basic image processing, for example color filters, morphological filters or segmentation of the red line from the track. The typical solution involves segmenting the red line and making the car follow it using a PID based control. The GUI of this exercise includes a bird's eye view widget to know the current position of the car inside the track.

The efficacy evaluator here gives a evaluation based on the time it takes for the car to go round the circuit. Then, the score is calculated according to this formula: $score = \min(10, 10 - (seconds - 60) * 1/60)$, where seconds represent the time it took the car to go round the circuit. Taking 60 seconds or less would give a score of 10. Then, the score is reduced one point for each extra minute. If a student did not manage to complete a lap, both the time and the final score will be a 0.

Second, in the BasicVacuumCleaner exercise the challenge is to program a robot, similar to iRobot Roomba, to clean an apartment in a given time. The more area covered in a stint of 5 minutes, the better its efficacy. It is intended to teach coverage algorithms. The covered percentage of cleanable surface is the score, which is shown to the student at the top right area of the exercise webpage, as can be seen in Figure 1.

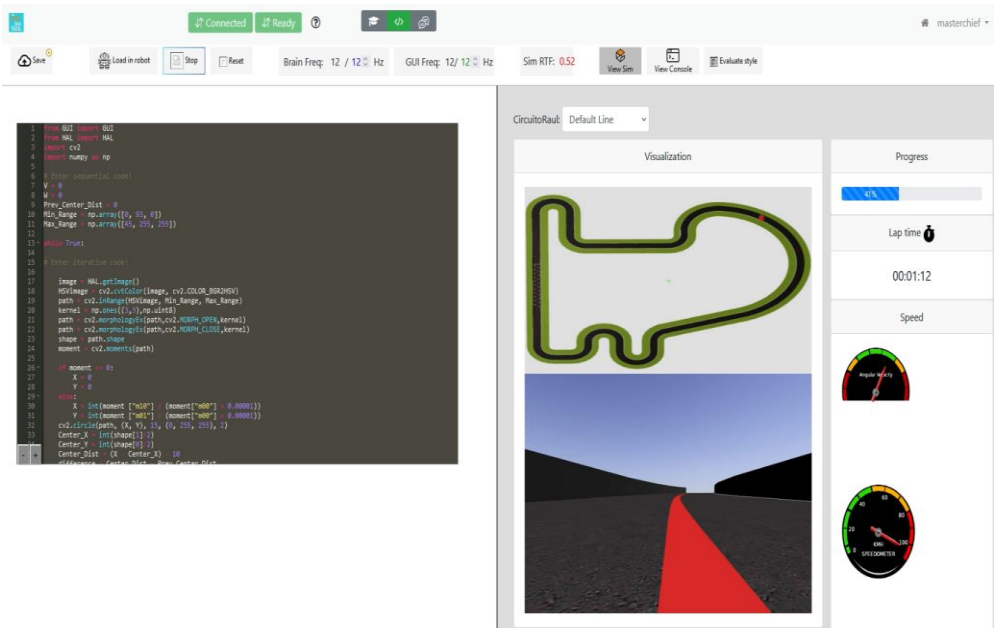


Figure 2. Example of the Follow Line exercise web page

5. Preliminary pilot study

In order to test the efficacy evaluator that Unibotics provides we carried out two pilot studies. 26 students from the Mobile Robotics course at the Robotics Software degree at URJC took part in the first one. 14 students enrolled in the Computer Vision Master at the URJC also participated. During their courses, they had to complete the Follow Line challenge. Both groups were able to use the efficacy evaluator while they were carrying out the task. The goal of this study was to check if the efficacy evaluator worked consistently and to analyse differences between both groups.

The final results of the efficacy evaluator for both pilot studies are shown in Table 1.We present both the time the student took to go round the circuit and the final efficacy score.

Thanks to the efficacy evaluator the students can have an idea about the performance of the code they have written. Moreover, they are able to improve their code to check if the score is higher after adding those improvements. The students know before starting to code, that the maximum score would be achieved if the car is able to do a lap in 60 seconds or less. Therefore, they had the basis to improve their codes before the submission deadline until their goal score was achieved. The final marks of the challenge were not calculated only with this score, but also other factors such as the style of the code.

Table 1. Students' efficacy score

	Degree students		Master students	
Id	**Time**	**Score**	**Time**	**Score**
1	240	7	0	0
2	154	8.43	223	7.28
3	60	10	215	7.42
4	120	9	79	9.68
5	0	0	90	9.5
6	50	10	173	8.12
7	45	10	105	9.25
8	90	9.5	162	8.3
9	166	8.23	110	9.17
10	126	8.9	157	8.38
11	120	9	156	8.4
12	122	8.97	142	8.63
13	54	10	138	8.7
14	86	9.57	133	8.78
15	0	0		
16	0	0		
17	110	9.17		
18	321	5.65		
19	360	5		
20	190	7.83		
21	71	9.82		
22	210	7.5		
23	92	9.47		
24	167	8.22		
25	0	0		
26	40	10		

6. Conclusions

This work presents the automatic code assessment system in the Unibotics robot programming platform. It includes a style evaluation based on PEP8 standard compliance and efficacy evaluation which heavily depends on the robot task. A preliminary study with 40 students has been performed URJC in which the students use an automatic efficacy evaluator to check the performance of their code when completing the FollowLine challenge. The students continuously received direct feedback about the performance of their code from the assessment system, and were able to further refine it before delivering the final version.

Regarding future lines, further work should study how they use the efficacy evaluator along the whole learning process, how many times students modify and evaluate their codes until they reach the final version. It would be interesting to study if the use of the efficacy evaluation tool affects the learning results of the students. Introducing spatial deviation from the red line as a new factor in the FollowLine score is under development.

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Using ChatGPT for Creating Computer Science Exercises – a Case Study from the Real World

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Abstract

Using ChatGPT (Chat Generative Pre-trained Transformer) to support the tedious work of creating programming exercises seems obvious and helpful. This paper explains in detail the experience of working with the the artificial teaching assistant ChatGPT. The usage for the creation of lab assignments for a bachelor and a master level course is described, followed by the evaluation of the powerful yet not flawless tool for this specific use case. The article details a workflow that shows the steps for creating content and the necessity of feedback loops through the expertise and competence of the teachers. This article provides insights into the advantages, disadvantages and risks and possibilities that occur when working with this technology.

Keywords: *AI;computer science; teaching experience, STEM education.*

1. Introduction

ChatGPT (Chat Generative Pre-trained Transformer) has turned the usage of artificial intelligence systems upside down since November 2022 when it was published in version 3.5 by OpenAI (Roose, 2023). It enables anybody to use a Large Language Model (LLM) with natural language requests and receive structured text, source code, summaries or solutions to all kinds of queries (OpenAI, 2022). LLMs are part of the lives of students and teachers nowadays and they offer a chance for more efficient work but also require working with the students to teach them to assess the output and gain hands-on experience on the advantages and disadvantages that the models offer. The critical points need to be examined and students need to be made aware of the risks, chances and possibilities of these models (Domenech, 2023).

Kasneci et al. (2023) discuss in detail in which domains ChatGPT can be helpful for teachers and lecturers: planning of courses, support while/in learning a new (programming) language or in the evaluation and assessment of teaching material as well as the creation of multiple choice questions. They also mention that the development of personalized course materials are a

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common use case for teachers. Despite the positive effects of reducing the work load of teachers for preparation of course materials or generating feedback reports to students (Mosaiyebzadeh et al, 2023), the use of ChatGPT also provides risks for teachers and learners. It is obvious, that copyright issues may cause troubles as ChatGPT does not reveal its references and even worse hallucinates output and references (Zuccon et al., 2023). Major implications can arise as ChatGPT's generated output might be biased and foster inappropriate stereotypes or lead to unfairness with respect to ethnic minorites (Kasneci et. al, 2023). According to Denny et al. (2024) generated programming solutions might also show bad programming habits and contain security flaws.

On the other hand, Students can use LLMs as never-tiring assistants for research assignments, receive support for the structuring and summary of texts and get help in assessing a problem from different view points (Kasneci et al., 2023). To get more insights into the advantages, disadvantages and risks and possibilities that occur when working with this promising technology, we performed a case study about the usage of ChatGPT as a teacher assistant in the bachelor degree programme *Applied Computer Science and Communication Technology* and master degree *Computer Aided Engineering* at the University of Bundeswehr Munich during lecture periods spring and fall/autumn 2023. ChatGPT was used for the creation of computer science lab exercises including sample solutions. The following sections detail the intention of the usage of ChatGPT, present the prompts and results and evaluate the actual benefit. By example it illustrates how ChatGPT can help teachers and students but also how its output needs to be carefully processed and evaluated before presenting it to students.

2. Usage of ChatGPT

2.1. Intent

Computer Science education usually includes programming exercises. These vary according to the courses content and teaching goals. There are usually programming classes, teaching algorithms, data structures and often the specifics of a particular language such as C/C++, Python or Java. There are also subjects such as Internet of Things (IoT) or Robotics and Sensors which often times convey a large variety of topics such as sensors, communication stacks or the principles of object detection in a robot (ACM and IEEE, 2020). These subjects usually contain labs with assignments that also include programming tasks. The large variety of frameworks, programming languages and last but not least hardware that runs the programs makes it challenging to keep up with the developments while providing the students with a broad overview of available technologies and teaching methods and not only technology stacks. The usage of ChatGPT appears to be a promising help in creating up-to-date exercises and solutions.

2.2. Example 1 – Lab for IoT Course – Undergraduate Level

For the class Internet of Things in a bachelor level computer science course, a lab to learn about the REST API (Representational State Transfer Application Programming Interface) in the programming language Python was created with the help of ChatGPT. REST APIs are widely used for example to request and process information from interfaces over the internet.

The method to work with ChatGPT was as follows:

1. Tell ChatGPT: "You are a professor. Create a lab for a computer science course to show the usage of a REST API in Python."
2. Request: "Create a sample solution for this lab. "
3. Optional: Create a formated output for the lab assignment description, e.g. a LaTeX, HTML or markup document.

Output of the first step: The specific task was the to create a small program to request weather information such as temperature and humidity for a given location and print this information. The output was structured into different subtasks including how to hand in the assignment.

For the second step ChatGPT's output included the advice to read the API documentation of the chosen REST API *OpenWeatherMap* (OpenWeather, 2024) which is freely available as well as sample code snippets that worked and gave a solution for request the temperature of a given location.

```
response=requests.get(f"http://api.openweathermap.org/data/2.5/
       weather?q={city}&appid={api_key}")
```

The temperature in the sample solution was in Kelvin and the code snippet included a simple calculation to achieve the conversion.

```
# convert from Kelvin to Celsius
temperature = data["main"]["temp"] - 273.15
```

However, ChatGPT didn't follow its own advice to read the API carefully. The *OpenWeather-Map* API includes a switch to use metric units which results in the temperature being in Celsius and makes the previous calculation unnecessary.

```
url=f"http://api.openweathermap.org/data/2.5/weather?q={city}
       &appid={api_key}&units=metric&lang=en"
```

The use of ChatGPT for the creation of a lab and a sample solution seems easy enough and produces output that compiles without errors, but at the same time, the sample solution doesn't live up to ChatGPT's own standards. It doesn't use the possibilities that the Open Weather Map API offers, but instead "hallucinates" an unnecessary calculation. This doesn't actually teach

the students well. The authors used the output to adapt the assignment and discuss with students about the correct usage of the API and make them aware of possible mistakes.

2.3. Example 2 –Application for Robotics and Sensors Course – Graduate Level

After an initially positive experience with ChatGPT as a learning tool assistant, it was used for lesson planning and lab creation in a graduate level course for Robotics and Sensor Systems. It is important and creates more in-depth output to give ChatGPT context such as the role of the prompting person (professor) or the audience of desired output (graduate level students of computer science). For the course Robotics and Sensors – a master level class – the teaching goals included gaining knowledge about object detection in general. Classes of detected object can include cars or pedestrians as in driver assistant system applications or faces and gestures. Naturally hands-on experience leads to more in-depth knowledge. Similar to the IoT domain, the topic of robotics and sensors includes a wide range of hardware, software and a large variety of software frameworks and libraries. For a teacher it can be very time consuming to keep up with the toolchains. In this master class it was decided to specifically study and apply the recognition of faces and gestures. To achieve this, two different libraries – OpenCV (OpenCV, 2024) and Mediapipe (Mediapipe, 2024) were chosen by the teacher. Both libraries are very popular and include hundreds of functions which are well documented. ChatGPT was used to create several labs on different levels – an introduction lab to get aquainted with the object detection and computer vision library OpenCV, an advanced lab to learn about filters to track a specific point in a detected face with the same library. For the third lab, ChatGPT was initially prompted to provide information and guidance on the specific topic of gesture recognition. ChatGPTs output included naming different application areas such as gesture recognition, sign language interpretation, virtual reality applications to immersively control hand or finger move–ments, medical applications or usage in automotive applications. Its response also included the potential of the technology such as the support of people with special needs. To practically explore gesture recognition the Mediapipe framework was used which includes a large amount of functions amongst them methods to recognize hands, fingers and finally gestures such as the victory sign. The output of the lab assignments by ChatGPT included the requirements for installing the programming language and respective packages, the assignments and a sample solution – the authors added teaching goals, references to APIs and specific classifier files and an adapted sample solution.

It can be noted that ChatGPTs output was more promising the more specific the prompts were and the more context they contained. As in the previous example ChatGPT proved to be a helpful assistant with structured output even in the desired format (LaTeX) for the lab assign-ments. It supported the teacher and enabled the usage of more frameworks. As a result an exploration of a wider range of practical applications was easier to prepare and to include in the lessons. However, ChatGPT didn’t include any valid references (compare e.g. Zuccon et al.,

2023) such as web pages for further reading or links to API documenation. The code that ChatGPT produced compiled and was correct. The authors assume that this is caused by the popularity of the chosen libraries and their assumingly big share in ChatGPT's training data. Generating the correct code, was an iterative process. Because the author had used the libraries quite extensively before a quality assessment of ChatGPTs output was possible.

2.4. Established Workflow

Figure 1 shows the workflow that was developed and used for the specific use case of computer science labs described above in section 2.2. and 2.3. At first, an idea for the lab is "discussed" with ChatGPT. Secondly, the sample solution for the lab is generated by ChatGPT and tested and validated by the teacher. Thirdly, a lab assignment document is generated in the desired output format. The fourth step includes a refinement adding references and teaching goals to the ouput. The first two steps require an iterative feedback loop led by the teacher to mitigate hallucination effects from ChatGPT. The teacher must be familiar with the libraries used in ChatGPT's output and needs to be competent enough to assess the quality of the generated source code.

3. Evaluation

Our experience with using ChatGPT confirms the findings of Kasneci et al., 2023, that in general, LLMs can provide teachers with output that can support lesson planning. In our case it enables a more diverse usage of libraries and frameworks for lab assignments. The output is structured and well formulated, its generation saves time and enriches the lessons. However, ChatGPT has no concept of right or wrong, there might be copyright issues and the data from LLMs can be biased due to unfair training data. Another risk of using LLMs for lesson preparation is that the output can be shallow. More alarming risks include that ChatGPTs output can be plain false and/or include incorrect parts, also known as "hallucinating". This can lead to a false sense of security and thus to superficial learning and a false confidence on the side of the students (Denny et al., 2024). When using LLMs in the classroom their advantages, disadvantages and the above mentioned risks need to be conveyed clearly to the students.

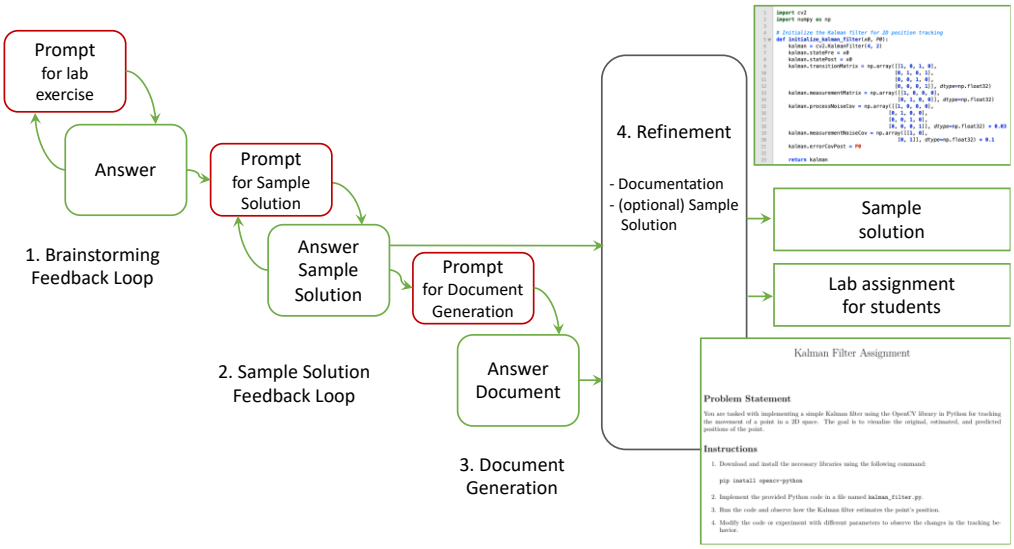


Figure 1. From an idea to a lab assignment - workflow for the lab generation with ChatGPT

4. Conclusion and Outlook

The authors used ChatGPT to create one new lab assignment on bachelor level and three new labs on master level. The labs include the actual assignment description in a directly usable output format (LaTeX), a sample solution in Python and additional teaching materials. Confirming the experience of others, ChatGPT proves to be a powerful yet not flawless tool. It can enrich lessons, bring more variety and be helpful to the teacher in the tedious tasks to create lab assignments. It is essential to critically assess ChatGPT's output and have sufficient experience and background know-how in the relevant topic. This is necessary to be able to foster and convey the critical thinking regarding this tool and its output to the students. Students benefit on various levels and teachers also need to stay up to date and validate output and enhance their own knowledge. Neither teachers nor students shall rely too much on the model. The Golden Rule of Usage for LLM Models shall be applied: *"Don't use the output of an LLM if you cannot verify its correctness." (Markgraf, 2023)*

In the future it will remain a challenge to find the balance of necessary study work to shape the ability in a certain domain like software development and therefore also the ability to critically assess output of LLM models and the use of tools like LLM models to enable broader views, easier access and adapted learning.

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University Online Module Structure Design: Consistency or Individuality?

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Abstract
This article considers the challenge of uniform high quality online module structure design in Learning Management Systems (LMSs) and its impact on expressing individual teaching style. It presents a three-element model that brings consistent structure design to any online module, and which also affords individualisation depending on the lecturer's needs and preferences.
The work is based on the analysis of actual online module structure design in SETU, modern learner needs, and personal work experience. The analysis highlighted the importance of unified online module structure approach that is not just a question of structure, but also depends on the teaching and learning process and the ability to support Universal Design for Learning (UDL) and Gamification approaches, Inclusive teaching, Active online learning, Co-creative and Collaborative work between staff and students.
The three-element approach is LMS- and course design-agnostic, learner-centred, and can be embedded and modified due to individual preferences of every lecturer.

Keywords: *Higher Education1; LMS2; Module Structure3; Online Learning4.*

1. Introduction

The challenge of developing an effective LMS predates the proliferation of online access systems. For example, (Richardson, 2003) describes the development of an effective LMS built around the physical distribution of a CD-ROM, a dedicated website, and a textbook, for "use by 1400 students, in several countries with varying delivery modes, educational requirements and different technology infrastructures". However, some of the challenges presented in that work were relevant subsequently, including the "context of modern education, the characteristics of today's learners and how they are using technologies" (Conole, 2013) and are still relevant today (Adedoyin, 2023).

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Usability, Accessibility, and the User Experience (UX) are essential to the success of technologies and software and that is clearly the case when students are the users of an LMS, but equally so for lecturers who want an accessible means of producing a module environment that is high-quality, informative and readily updated. An introduction to the field for academics and learners has been presented in (Rajesh, 2022), which emphasizes the importance of "Knowing the Users." In this work, and especially given the many learner types, this has also meant the adoption of UDL design principles to inform the UX and the User Interface (UI), for an overall better experience with the LMS (Al-Azawei, 2017), (Wendrich, 2018). These design principles feed into the eventual module structure design in the next section.

The objective of this research is to present a module structure design that is easily replicable across all LMS's to make university modules of consistently high quality by following UDL design principles and Gamification. The research findings open a gateway to lecturers of various design levels, while also affording the possibility for individuality and personalization and a consistently good and engaging experience to all learner types.

2. Background

Like many HEIs, our University (SETU) uses a LMS to streamline and enhance the teaching and learning experiences. Having an LMS means we can promote blended learning, support diverse learning styles and needs and in some instances integrate with other educational technologies and resources. The LMS has been used to a limited extent to provide data-driven insights to improve teaching and learning practices, for example, to highlight at-risk students based on the period of time since their last interaction. For our academics, this means primarily delivery and communication, assessment and evaluation, academic integrity monitoring and sometimes tracking and analytics. For our students, this can be to access course materials, submit assignments, communicate and interact with each other and the lecturer and to track progress. Overall, this can lead to an enhanced teaching and learning experience, increased efficiency and accessibility, and good course communications.

However, the design of online module pages and module structure on LMS's can be challenging for academics, leading to inconsistent approaches and even questionable quality. Many of our lecturing staff started in the profession prior to the existence of the LMS and others, for a variety of reasons, may not have invested sufficient time to become well-versed.

Across the country, universities do not all use the same LMS and there may even be cases, due to mergers, where temporarily more than one LMS is in use. This issue is exacerbated in Ireland in recent times following the establishing of Technological Universities, formed by the merger of independent Institutes of Technology, usually with different LMSs. With the formation of SETU, we got two LMS's, Moodle and Blackboard, with a consequent lack of consistency in approaches to module structure design.

3. Reflection: 'Important' elements in an Online Module Structure Design

Ideally, every university should have a clear guidance and understanding on online module structure design, with some scope for the individual preferences of lecturer or department, school and faculty. The questions under consideration are what should be seen as an *'important'* structural element and how to identify which elements are important enough to be ever-present.

This article presents an individual approach based on instructional design practice and collaborative and co-design work with students, lecturers and subject matter experts, analysis of module structure and page design across our university and the possible levels of experimentation with graphics and content while striving for consistency of layout, as well as analysing its impact on teaching and learning quality. From this, it is possible to speak about *three elements* that can be considered as *'important'* in an online module structure: (1) a **Lecturer Information block**, (2) a **Gamification element**, which in our case has been given the disarming title of Mr. Deadline, and (3) an **LMS Banner**.

One of the key criteria that author used for identifying the level of 'importance' is the impact of each element on the teaching and learning process if *not in* the structure. Each element has also a significant role in the development of social, cognitive and teaching presence (Shea, 2022). Another key criterion was for the design to be independent of the LMS, in that each element can be easily reproduced in any LMS.

3.1. Lecturer Information Block

Informal observation in our own LMSs indicates that the *Lecturer information block* in many cases is poorly addressed and even confusing. Some information blocks are used (some not), but often neglect to share the right level of information with students, such as contact details or preferred methods of communication or available office hours. Sometimes lecturers add their contact details in welcome messages to students but in such a way that it is difficult to notice them. There are good examples as well, but, overall, the lack of consistency can be very misleading and make learners feel sometimes lost in the learning process. The example in Figure 1 shows how a lecturer shared contact details by simply adding the screenshot from LinkedIn.

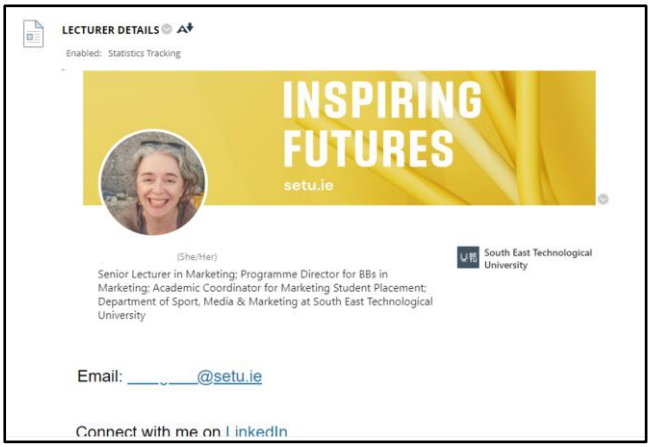


Figure 1. Example of lecturer information block. Source: SETU Blackboard LMS (2023)

Interestingly, the lecturer and the learner may think differently about what is important to include in the lecturer information block, e.g., learners want to see direct lecturer email or webinar links in the block, while the lecturer may think that it is easy to find without it. A well-designed lecturer information block in an online module structure may encourage collaboration and develop a good rapport with the learners. It is also a way to support the development of a social, cognitive and teaching presence and can be considered as part of the UDL and Equity, Diversity and Inclusion (EDI) approach.

3.2. Mr. Deadline or Gamification Element

Another 'important' structural element in online module design is a gamification element. There are different ways to add gamification in the module through continuous game-based activities or course design. For example, it can be part of the forum activity, where students are not only sharing their ideas but also playing a game focused on some course related topic. There are ways of organising the presentation of materials in game-based forms and many other options as well. The gamified element that proved to be successful for the author, was an HTML block in the LMS, which was created in response to learners' needs and constant demand to be able to see the assessed tasks in an easy way. This block was named Mr. Deadline, with an individual signature for announcements and even online channel persona in SLACK channel that was used on the programme instead of LMS forums. Mr. Deadline, eventually, became almost like a real-life person wearing many hats and faces depending on the weekly events and seasons. His work responsibilities grew throughout the course from just announcing new assignments to making weekly announcements and different type of news and reminders.

Mr. Deadline is an example of a gamified element in the online module structure. There are many other ways to add gamification into the teaching and learning process, e.g., embedding a

Level up plugin in LMS to praise students for completing some tasks, or embedding gamification approach into the design of activities. The Figure 4 shows several examples of Mr. Deadline block and Level up! Block used as part of gamification approach.

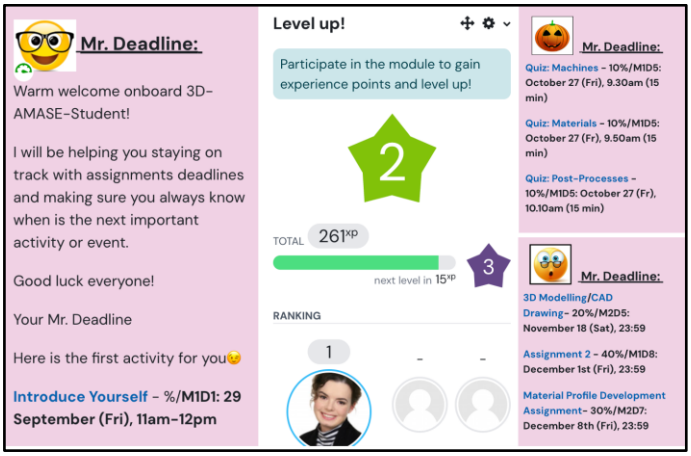


Figure 4. Examples of Mr. Deadline block and Level up! block. Source: SETU Moodle LMS (2023)

Mr. Deadline, as a gamified element in the course design, helped to develop a good rapport between staff, students and subject matter experts. It added an element of humour and supported ongoing jokes and a positive attitude to assessment. It allowed collaboration between staff and co-design between staff and students and made everyone feel involved in the teaching and learning process.

A gamification element can be more than a teaching approach or part of the course design or online module structure. A gamification element can facilitate a more positive attitude to challenges like assessment. It can encourage further development of the social, cognitive and learning presence on the course and influence the development of other resources and activities for learners.

3.3. LMS Banner: Interactive or not?

Another 'important' online module structure element is the *LMS Banner*. Typically, in our university's case, **banners** are **non-interactive** images that can contain an image, the name of the module, short message and used on the front page or any other welcome page as can be seen in Figure 2. The question is how powerful or valuable such non-interactive banners are for the learners and how to make a better use of them?

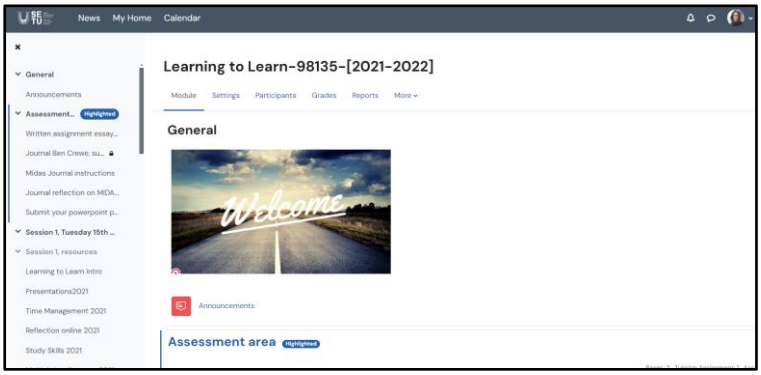


Figure 2. Example of non-interactive LMS banner. Source: SETU Moodle LMS (2023)

The banner is sometimes one of the first things our learners see before the start of the module and before the lecturer makes the module content available for them. It is an opportunity to make a first impression and encourage curiosity. One of the ways to add value to the banner is to make it interactive. In the background to this work, interactive banners were created for nine modules in Moodle via Genial.ly for different programme modules, although any other platform would work equally well. The image in Figure 3 is an example of interactivity that can be hidden in a banner.

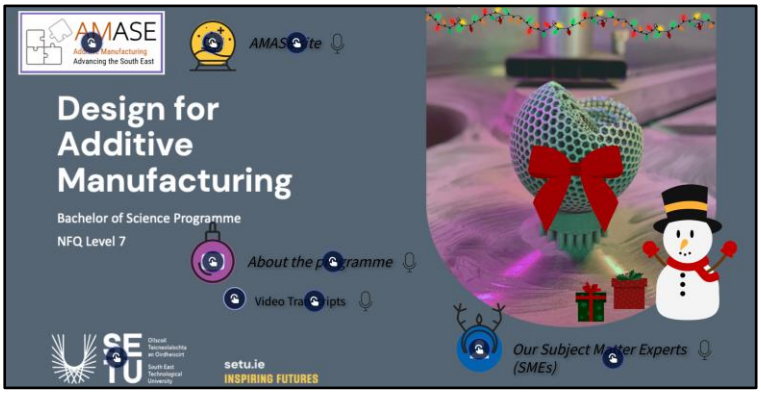


Figure 3. Example of interactive LMS banner. Source: SETU Moodle LMS (2023)

An **interactive banner** is an LMS banner (designed via Genial.ly and embedded into the LMS) with added interactive elements that allow learners to get more information. It can be used at the start of the module page or any other welcome page. It should present some interesting facts about the course (e.g., subject matter experts, campus location, link for the first webinar, or let students hear and watch the lecturer before the first class).

As can be seen in *Figure 3*, the banner is not just a source of information but also a powerful interaction between the lecturing team and the learners, e.g., by adding a Christmas theme or important instructions before a group trip.

A banner with added interactivity is more than just an element in the online module structure. It is an important element of the UDL approach that can encourage and provide better communication between staff and students, a different and engaging way of information presentation, support the development of social presence. It can also play a significant role in graphic design or even be part of the activity that a lecturer would organize in the learning process. It is also important to say that there should be a balance in the amount of interactivity to avoid the risk of cognitive overload for students (Warrick, 2021).

4. Conclusion

The online module structure with all three elements may look differently in different LMSs, e.g., in Blackboard all three elements can be visible on different pages, in Moodle - on the same front page as shown in Figure 5.

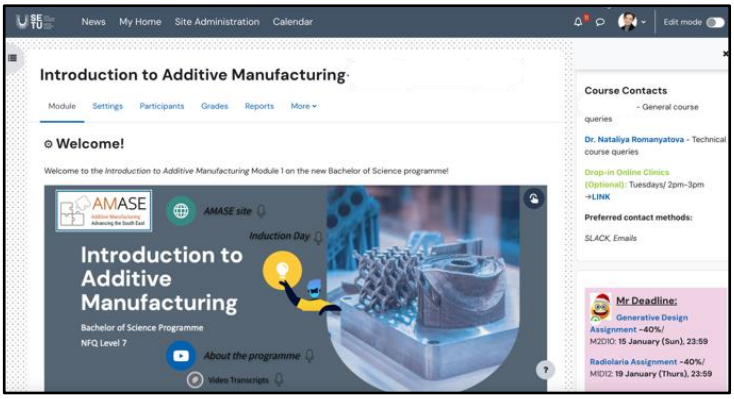


Figure 5. Example of three elements on the same page. Source: SETU Moodle LMS (2022)

It is important to say that this work does not suggest including specifically Mr. Deadline or only the interactive banner in every online module structure. There is also no intention to give a specific list of information that the lecturer information block should necessarily contain.

The aim of this article is to present a model, based on personal experience, consisting of three elements that could be part of any online module design and the ways of possible individual approaches to the development of these elements and their overall value for the online module structure and the teaching and learning process. As was mentioned above, there can be variants or similar and modified approaches for the same elements in online module design.

To conclude, it is possible to identify the elements in online module structure design that could be adopted by a university for consistency and high quality, with the possibility for different

level of individualization and modification. The three-element approach described here demonstrates that the 'importance' of online module structural element is not just a question of structure as such. The importance of each element largely depends on their value in the teaching and learning process and their ability to support and encourage UDL and Gamification approaches, Active online learning (Salmon, 2013), collaboration between staff and students, experimentation and creativity in teaching and learning design. In the cases implemented so far, feedback from the learners and lecturers has been very positive. Students found the Lecturer block, Mr. Deadline and interactive Banner helpful and easy to use. The Mr. Deadline idea offered to students turned into a collaborative co-design project that worked well, the same as Lecturer block and interactive Banner, for several iterations of students and for staff, including staff from other schools. The three-element approach offered in this article is LMS independent and course design agnostic, learner-centered, and can be embedded and modified according to the individual preferences of every lecturer.

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The impact of extrinsic pressure on the entrepreneurial intention of business students

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Abstract

Selecting a business education brings increased intrapersonal and external pressures for students, adding to the challenge of balancing personal expectations with external pressures. The study aims to investigate the influence of external factors on the entrepreneurial intentions of business students, focusing on the impact of academic knowledge amid diverse external pressures.Using the EIQ questionnaire and statements, business students' attitudes about the influence of external pressure on entrepreneurial intentions were collected. A moderate negative correlation ($r=-0.219$; $p < 0.05$) indicates a visible negative relation between academic knowledge and random actions. There is a statistically significant positive relationship ($r=0.441$; $p < 0.05$) between family expectations and random actions concerning students' intentions. The research findings indicate a tendency where academic knowledge does not necessarily support entrepreneurial behavior in business students, factors influencing students' entrepreneurial intentions often extend beyond the scope of academic knowlege.

Keywords: *Entrepreneurial intention; external pressure; extrinsic factors; business education; business students.*

1. Introduction and theoretical background

In further enhancing business education, it's essential to consider new factors that characterize the dynamic evolution of the entrepreneurial landscape, such as the impact of unforeseen circumstances and informational, social, and temporal pressures. Many university-level degree programs are tailored to equip aspiring entrepreneurs with the necessary skills and knowledge, so considering that most students are typically only at the early stages of their professional development, the concept of entrepreneurial intention remains both conceptually and empirically relevant (Bae et al., 2014). Research on student entrepreneurial intentions is still relevant, especially as today's young individuals show greater enthusiasm for entrepreneurship in the midst of their academic pursuits compared to previous generations (Wasilczuk & Karyy,

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2022). The identification of intention is crucial for understanding and modeling why numerous prospective entrepreneurs decide to start a business long before looking for opportunities (Krueger et al., 2000). Studies (e.g., Vamvaka et al., 2020) on the attitude towards entrepreneurship in student groups across different time periods, using Ajzen's (1991) Theory of Planned Behavior (TPB) paradigm, has shown that when the entrepreneurship attitude is low or absent altogether, individuals tend to have weak business intentions. However, other studies (e.g., Bhinekawati et al., 2020) found no significant relationship between entrepreneurial intentions and attitudes towards entrepreneurship among students. Skinner (1974) emphasizes the need for gradual stimulation of the desired behavior; if the behavior is not reinforced, it gradually weakens and eventually disappears. However, attitudes should not be conflated with generalized emotional states that arise devoid of specific goals or cognitive structures (Fini et al., 2010). Scholars argue that external factors merely serve as trigger that create a conducive environment for business activities (e.g., Janse van Rensburg & Tjano, 2020). However, extrinsic pressure as an external factor is classified to the group of non-psychological factors because it is external, such as an excessive amount of information or a large flow of ambiguous information, can lead to misinformation, changing decision-making and behavior patterns or an individual under this pressure completely abandoning one's intentions. External pressures can create an imbalance in the management of personal risks, which is an important condition for the realization of business intentions.

2. Multiple perspectives of extrinsic factors and influence to entrepreneurial behavior

While some people try to pursue the “risky career” of an entrepreneur, others want to be employees with a guaranteed salary (Turulja et al., 2020) and job satisfaction (Gaile et al., 2020). Entrepreneurial behavior is considered to be planned, conscious behavior, so Ajzen (1991) argues in TPB that people behave in a certain way because they are influenced by external factors and other objective conditions, and not just by their individual will. A study examining Main Life Decisions involving university students highlighted the impact of a realistic social environment on shaping their beliefs (Maheshwari & Rai, 2021). The external environment exerts influence on decisions regarding starting a business from multiple perspectives. Firstly, it encompasses a spectrum of conditions that include social, economic, and political aspects. However, research is increasingly asking whether the decision to start a business depends only on the social, political and economic environment, because during the crisis, when the economic situation worsens, a negative rate of new business creation has been observed, and this situation has encouraged some people to become entrepreneurs, because the opportunities to be a worker during the economic crisis are limited. On the negative side of a business started during a crisis, it has been observed that the life of the business could be relatively short in some cases (Al-Qadasi, 2021). In this case, external pressures will have affected the longevity of entrepreneurial

behavior. Second, external factors that can be classified under the non-psychological group, such as random actions that are random in nature and can influence decisions, must be taken into account. Some individuals accept to the influence of chance, undertaking risks stemming from random circumstances or unforeseen situations. Similarly, more specific social influences such as family expectations and time constraints can significantly impact an individual's entrepreneurial intentions. While these factors are external and fall into the category of non-psychological influences, their effect on an individual's mindset is profound. External pressure should be considered as an important factor that causes individuals to act rashly or make decisions under external pressure. Positive pressure arises when individuals are confident in their ability to uphold task goals and adapt cognitive strategies, whereas the next step is a psychological factor - stress, which can occur if the individual feels unable to achieve the set goals and make decisive decisions independently (Maule & Summers, 2016). This confirms that time and risk management and organizational skills play an important role in improving student competencies.

3. The effect of external pressure on entrepreneurial intention

When making decisions, individuals can rely on their own information, referred to as "internal information," as well as information provided by others, termed "external information" (Zadelaar et al., 2021). As individuals approach the early stage of maturity (around ages 20-24), it is anticipated that decision-making becomes less impulsive. However, studies indicate that young individuals may still exhibit spontaneous and thoughtless decision-making behaviors even as they transition into early adulthood (Avilés-Reyes et al., 2023). According to Super et al. (1996), during this developmental period, young individuals engage in several tasks that significantly influence their future path. “Pressure" refers to the force that compels an individual to act in ways they may not be entirely certain about or to act hastily. Yielding to pressure and conforming to others' expectations or desires can lead individuals to make erroneous decisions. Consequently, the outcomes of decision-making processes are not solely determined by individual choices but are shaped through interactions with public opinion. Gopi & Ramayah (2007) found that individuals may start entrepreneurial ventures due to social pressure, regardless of their initial intentions. Studies show that being around entrepreneurs or those making business decisions can boost one's own entrepreneurial intentions (e.g., Linán & Chen, 2009). However, a study conducted in Latvia on citizens' intentions to start a business reveals that only 12% of respondents perceive encouragement from family and friends as a motivating factor to start their own business (SEB, 2023). In order to clarify the influence of extrinsic factors, the following hypotheses were formulated:

H1: Business students’ Entrepreneurial intentions are positively related to Family expectations.
H2: Business students’ Entrepreneurial intentions are negatively related to Time pressure.
H3: Academic knowledge of business students are positively related to Entrepreneural intention.

H4: Business students' Academic knowledge are positively related to Family expectations.
H5: Business students' Academic knowledge are positively related to Random actions.
H6: Family expectations are positively related to Random actions.
H7: Time pressure is positively related to Random actions.
H8: Family expectations is positively related to Time pressure.
H9: Business students' Entrepreneurial intentions is positively related by Random actions.

4. Methods

The study employed a questionnaire to collect individuals' views and attitudes. The study aims to explore how extrinsic factors impact the entrepreneurial intentions of business students, including how academic knowledge impacts students' business intentions, particularly under various external pressures. A total of 167 participants business students took part in the research.162 questionnaires were considered valid for collecting the research results. The Entrepreneurial Intention Questionnaire (EIQ) Version 3.1, developed by Liñán, Bradley, Basuki, & Redford (2006), was used for the research. The survey underwent translation into Latvian and aprobation. Consent for the survey's usage was obtained. This scale includes four subscales: attitudes towards entrepreneurship, subjective norms, perceived behavioral control, and entrepreneurial intention. All items were measured using a Likert scale ranging from 1 to 7. The constructs of 'Family Expectations,' 'Time Pressure,' and 'Random Actions' each consisted of 4 points on the Likert scale within this range. Additionally, academic knowledge was assessed. Descriptive statistics of constructs are shown in Table 1. All investigated commitments are depicted in the theoretical model shown in Figure 1.

Table 1. Descriptive statistics. Source: Authors' research data.

Construct	N	Minimum	Maximum	Mean	Std.Deviation
Entrepreneurial Intention	162	3,67	7,00	5,6831	1,05659
Attitude toward behavior	162	2,83	5,83	4,3272	,58062
Subjective norm	162	2,67	5,33	4,1605	,56731
Perceived behavioral control	162	3.00	5,00	4,1926	,49542
Time pressure	162	,00	2,00	1,2284	,52470
Family's expectation	162	00	2,00	,7654	,48789
Random actions	162	00	1,50	,9136	,36904
Academic knowledge	162	1,00	3,00	2,1481	,69121
Valid N (listwise)	162				

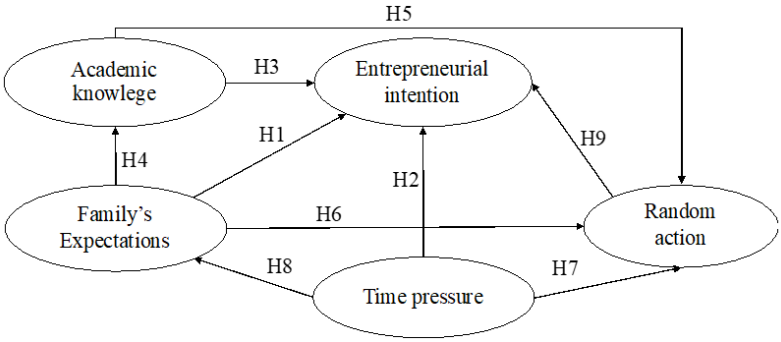


Figure 1. Theoretical model. Source: Authors'construct.

5. Data collection

Correlations between all main variables were calculated, as shown in Table 2.

Table 2. Descriptive statistics and correlations between variables. Source: Authors' research data.

Variable	*M*	*SD*	1.	2.	3.	4.
1. Entrepreneurial Intention	5,6831	1,05659				
2. Attitude toward the behavior	4,3272	,58062				
3. Subjective norm	4,1605	,56731				
4. Perceived behavioral control	4,1926	,49542				
5. Time pressure	1,2284	,52470	-,105	-,170	,218	-,248*
6. Random actions	,7654	,48789	,145	0,32	-,246*	,106
7. Family's expectation	,9136	,36904	-0,18	-0,71	-,231*	,010
8. Academic knowledge	2,1481	,69121	-,020	-,029	,066	-,114

*. Correlation is significant at the 0.05 level (2-tailed).

The research results confirm H1 and H2, showing a weak positive correlation ($r = 0.145$; $p < 0.05$) between family expectations and entrepreneurial intention (H1), and a negative correlation ($r = -0.105$; $p < 0.05$) indicating a weak negative relation between time pressure and entrepreneurial intention (H2).This means that family expectations can impact business students' entrepreneurial intention. However, as time pressure increases, entrepreneurial intention tends to decrease. The correlation is weak, indicating that time pressure may not be a significant factor influencing entrepreneurial intention in this context. A very insignificant negative correlation ($r=-0.020$; $p < 0.05$) does not indicate a linear relationship between academic knowledge and entrepreneurial intention (H3). Business students' academic knowledge are positively but insignificant related to family expectations (H4). However, these variables are essentially independent of each other. A moderate negative correlation ($r=-0.219$; $p < 0.05$) indicates a visible negative relation between academic knowledge and random actions (H5). Random choices tend to decrease as academic knowledge increases. The results show a significant positive correlation ($r=0.441$; $p < 0.05$) between family expectations and random

actions in the context of students' intentions (H6). The correlation between time pressure and random actions is negative ($r = -0.090$; $p < 0\ .05$) and insignificant (H7). The hypothesis has not been confirmed. Time pressure is very weakly but positively related to family expectations (H8), and a very small negative correlation ($r=-0.018$; $p < 0.05$) does not indicate a linear relationship between randomnes and entrepreneurial intention (H9). These variables are essentially independent of each other.

6. Conclusion and implications

Latvia is one of the leading countries in terms of the proportion of young people with skills and knowledge in starting a business, making up almost 50% of the proportion (GEM, 2022/2023). However, according to the data of the 2022/2023 Global Entrepreneurship Monitor, the entrepreneurial intentions of adults (18-64 years) in Latvia were 14.2% (GEM, 2022/2023). Research in the student group indicates no linear relationship between academic knowledge and entrepreneurial intention, however, these variables are essentially independent of each other. Significantly, others studies that analyze the effect of entrepreneurship education on etrepreneural intentions show that regardless of whether an individual has a strong attitude towards entrepreneurship (either positive or negative), academic knowledge does not affect the intention to etrepreneural behavior (e.g., Prasetyo, 2019, Gaile et al., 2022). The significant differences in the indicators found in Latvia could indicate the presence of other factors affecting intentions, taking into account the findings of scientists Vaiz and Ekemen (2022), that such factors as self-control and self-efficacy, or motivation for success, are closely related to conscious planned behavior and can become a determinant of entrepreneurial intention. Interpersonal factors often play a significant role in influencing students' entrepreneurial intentions.

Time pressure is important contextual factor that influence individuals' cognitive strategies. The study proves that prolonged time pressure can contribute to a decrease in entrepreneurial intention. The time pressure does not significantly affect entrepreneurial intentions, however, the intensity of the intention decreases in the long term. This phenomenon could be described as “Time-sensitive entrepreneurial intention decay”. The time pressure also leads to changes in a decision maker’s affective state Maule et al. (1993). Time constraints induce alterations in both negative and positive emotional states. However, it remains unclear whether these emotional shifts have any impact on the cognitive strategies employed by individuals. Also, time pressure can act as a catalyst for individuals to act on their entrepreneurial intentions. This increased motivation can encourage them to overcome obstacles and pursue their business goals with more vigor. However, research findings indicate a tendency where academic knowledge does not necessarily support entrepreneurial behavior in individuals. Factors influencing students' entrepreneurial intentions often extend beyond the scope of acdemic knowlege.

However, developing critical thinking skills, managing staff risk, albeit a gradual process, is a consistent and conscious investment by teaching staff.

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Applying the Photovoice methodology to the resolution of numerical modeling problems

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Abstract

The use of mathematical/numerical models poses a crucial challenge in the learning process: determining which simplifications to adopt depending on the specific case. This decision can compromise the reliability of the model or make it impractical due to excessive computational power requirements. In this work, an innovative methodological proposal is presented that applies Photovoice, a technique commonly used in action research, to numerical modeling subjects.

The main goal of the proposal is to encourage individual and group reflection, both in groups of 2-4 students and in the entire class, including the professor. This is achieved by providing an appropriate context through the creation of photo-narratives as a guide for problem analysis. The results suggest an improvement through more active participation, as well as the development of skills such as effective communication and critical thinking.

Keywords: *Photovoice, numerical modeling, critical thinking, motivation, effective communication, experiential learning.*

1. Introduction

Mathematical modeling is a broad umbrella that encompasses a wide range of tools to address issues in technical and social disciplines. The quantity and diversity of existing models are immeasurable, ranging from more deterministic ones—based on the implementation and resolution of well-established laws and principles—to more statistical/stochastic ones, such as neural networks or artificial intelligence (AI). The subjects covering these numerous tools, in turn, encompass very diverse application areas and a varied range of application scenarios.

This combination of factors places students in a situation that, in the authors' experience, often poses a greater challenge than understanding the models from a theoretical standpoint: the need

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to learn how to determine which model to use and with what simplifications. After all, a model is nothing more than a simplification of reality that facilitates its understanding and analysis. This decision, which may seem trivial at first, becomes particularly critical, as failing to adapt the appropriate model to case study requirements can often result in a significant loss of precision and/or the use of high computational resources that render the model impractical.

This paper proposes a methodology designed to address this challenge in numerical modeling education. Our proposal is inspired by the Photovoice technique, a participatory methodology. It usually involves participants taking photographs connected to their environment and subsequently writing narratives based on them. This process enables them to subjectively identify and represent topics of importance. However, despite its use in Participatory Action Research (PAR) and community development, the use of Photovoice as a teaching tool is limited. There are documented experiences with teenage students (Leivas, 2020) and in higher education (Musanti & Steren dos Santos, 2020; Pierce & Longo, 2020). Although, as highlighted by Ortega-Reig et al. (2023), the use of this technique has traditionally been excluded from STEM disciplines—Science, Technology, Engineering, and Math. According to the authors' most up-to-date knowledge, there is no case of educational application of Photovoice in these fields or, in the teaching process of numerical modeling applications.

Our case study employs Photovoice in a numerical modeling course with Computational Fluid Dynamics (CFD) applied to environmental engineering. In this field, the modeling scenarios are diverse, ranging from estimating wind resources or wind loads on buildings, sediment transport, operation of hydraulic structures, wave action and dispersion of pollutants in fluids.

For this reason, our proposal aims to fill this gap, exploring Photovoice as a methodology for active learning in this field. We also explore its contribution to mitigate some issues identified by Ortega-Reig et al. (2023) in STEM teaching: lack of motivation and involvement, limited communication and reasoning skills, surface learning, and lack educational environments where students can engage in discourse beyond traditional academic subjects and materials.

In this context, the main goal of the present work is to foster modeling students' debate and reasoning skills, to be able to converge, and propose sound numerical fluid modeling solutions for environmental engineering problems. To achieve this, the following specific objectives are:

- **SO1:** Apply the fundamental and theoretical concepts covered earlier.
- **SO2:** Address a variety of practical problems related to numerical modeling.
- **SO3:** Engage in the expression of ideas, comparison, exchange of feedback, and improvement through discussions with peers.

2. Innovation development

Apart from taking Photovoice out of its traditional application scope, our methodological proposal introduces a difference from the classical approach of the technique. The traditional approach involves participants taking photos and creating collective narratives about them (Leivas, 2020). In our case, students do not take the photos; instead, they are exposed to them, with the methodology somewhat related to Photo-elicitation.

Therefore, neither students nor professors need any materials to carry out the methodology beyond a device for viewing the photos and/or consulting supporting documentation (e.g., course notes, literature, etc.), as well as writing materials for notetaking.

The proposed activity follows four successive phases, ideally carried out in a single session of approximately three and a half hours. In each stage, participants work individually, in small groups, or even as a whole class. The methodological development and expected outcomes for each phase are elaborated in the following subsections and summarized in Figure 1.

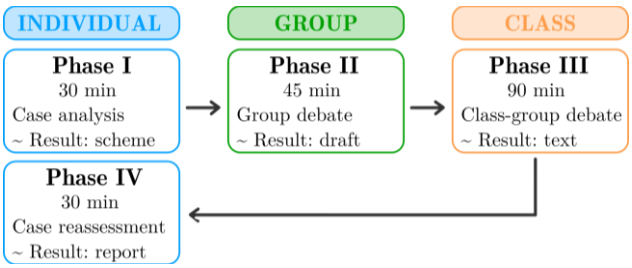


Figure 1. Workflow of the activity.

2.1. Phase I (estimated duration: ~30 minutes)

Initially, the professor explains the methodology for 15 minutes, and each group of 2-4 students is assigned a collection of pictures related to a realistic practical case that could benefit from the use of a numerical model. This process is carried out individually, and students do not know who else shares the same practical case. Figure 2 shows example photographs from practical cases of CFD numerical modeling in environmental fluid mechanics. Note that the pictures may include specific textual explanations to provide context.



Figure 2. A. Myanmata Bay, Japan (Cordington, 2005). B. Wind Park in Apiti, New Zealand (Jondaar, 2012). C. Brighton Breakwater (U.K.) (Thomas, 2014). Reproduced under Creative Commons license.

During the next 15-minute period, students reflect individually and outline a scheme (result of Phase I) with the key ideas of the model they would propose to address the phenomena observed in the pictures, based on the knowledge acquired throughout the course. This situation is one that students commonly face in their future professional lives.

2.2. Phase II (estimated duration: ~45 minutes)

In the second phase, students will meet with others having the same case study. Once in a group, they will share individual schemes developed in Phase I. Over a 30-minute period, students are expected to debate and assess the strengths and weaknesses of their respective approaches. The professor should encourage each student to provide and receive feedback. During the last 15 minutes, it is essential to emphasize the need to reach a consensus and draft a photo-narrative about the most suitable modeling approach (result of Phase II).

2.3. Phase III (estimated duration: ~90 minutes)

In the third phase, the following procedure will be followed for each group with a shared case:

a) The professor will briefly present group's case to the rest of the class (2-3 minutes).
b) Each group, through a spokesperson or collectively, will present its consensus draft from Phase II to the rest of the class (4-6 minutes).
c) The class, including the professor, will reflect on the approach presented by the group, discussing and providing constructive feedback (5-7 minutes).

Once the strengths and weaknesses of their respective approaches have been assessed, based on the feedback received, groups must reach a consensus on a final text (result of Phase III).

2.4. Phase IV (estimated duration: ~30 minutes)

In the fourth phase, students will again work individually. The aim is to reflect individually on their experience and the evolution of their Phase I proposal and prepare a report with a firm modeling strategy to adopt for the practical case (result of Phase IV).

If the activity is part of the evaluation process, it is recommended to assess the evolution of each proposal throughout the phases, the ability to provide feedback and integrate received critiques, and participation during the activity. The evaluation can also include peer-evaluation.

Additionally, the work (or a selection or best-rated photo-narratives) could be presented to a more general audience, as was done after the case study experience.

2.5. Methodology and Teaching Context

The activity involved 12 students, the entire class of Atmospheric Aerodynamics in the Master's program in Computational Fluid Mechanics at the Universitat Politècnica de València (Spain), for the academic year 2022-23. The students formed 6 groups and worked on cases related to the modeling problems mentioned in Section 1. The assess the acquisition of modeling skills, the individual initial scheme (Phase I result) was used as pre-test, while the final narrative (Phase IV) was used as post-test. In evaluating the intervention, both the improvements in the adequacy of the approach and in the model setup were compared qualitatively.

To assess student's satisfaction with the use of Photovoice as a teaching tool and obtain information for improvement, students responded to the SEEQ questionnaire (Students' Evaluation of Educational Quality), using a 5-point Likert-scale. SEEQ is a formative evaluation instrument that analyzes the efficiency of teaching (Andrade-Abarca et al., 2018). It is a robust, internationally verified, and recognized survey with high psychometric characteristics (reliability, validity, internal consistency, etc.) (Marsh, 1982). SEEQ provides information on different categories, the ones assessed in this work are: learning, group interaction, and overall assessment. A last category of open-ended questions also gave space for other non-covered aspects.

3. Results

Acknowledging the limitations of the reduced sample, preliminary results show the proposed activity is suitable for developing the skills necessary to translate fundamental and theoretical concepts from the course into the practice of numerical environmental modeling. The creation and improvement of a narrative serve as a tool for deepening and critically reflecting on the more qualitative aspects of modeling. The approach resembles the strategy to address such problems in a professional environment. The activity encourages the exchange between groups addressing different examples of numerical modeling.

3.1 Professors' valuation

After Photovoice activity, the professors observed a qualitative leap in the students' ability to tackle numerical modeling CFD problems in environmental fluid mechanics. This is evidenced by comparing the initial individual narratives (Phase I) with the final reports (Phase IV). The main aspects indicating qualitative improvement are: a) a better problem-solving and reasoning approach, b) a more accurate selection of model setup (achieving higher precision with lower computational cost), and c) a better overall understanding of the process, focusing on even the smallest details of the proposed models. These aspects seem to contribute to a deeper learning (although being the first year the course is taught makes not possible to use former years as control group). Professor's perception as well as open-question student's responses show that students valued positively feedback processes and working in a less traditional atmosphere.

3.2 Students' valuation

As observed in Figure 3–C, students highly value the methodology: 100% agree or strongly agree with the fact that it is a good methodology and would recommend using it in other courses.

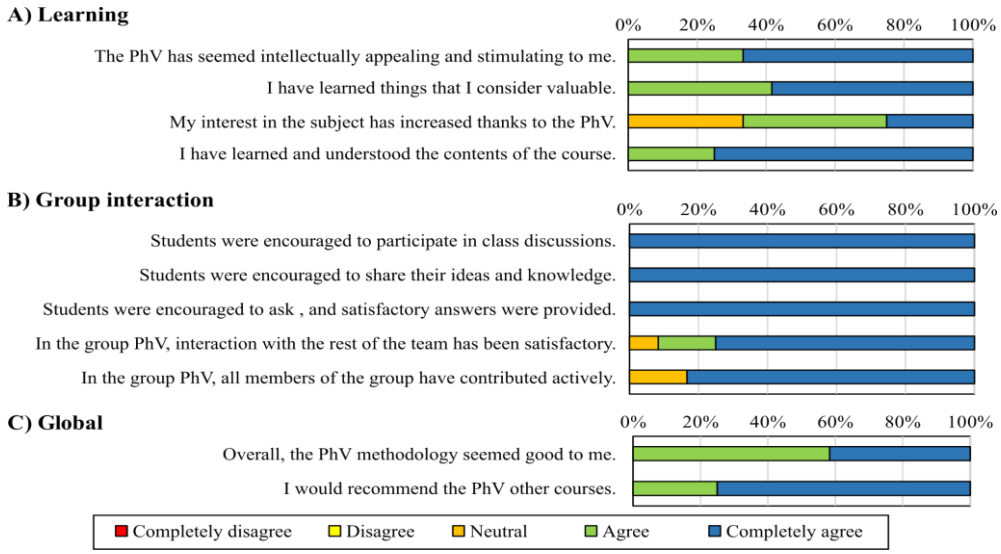


Figure 3. Overall assessment of Photovoice (PhV) by students.

Figure 3–A also shows students' responses regarding aspects related to their satisfaction with the methodology and how it has contributed to improving their interest in the subject. It is noteworthy that all students perceived this tool as "intellectually appealing and stimulating" and indicated that it helped them understand the course content and learn valuable things.

Regarding the improvement of motivation, Figure 3–A shows that 25% strongly agree on Photovoice increasing their interest in the subject, while 42% agree, and 33% remain neutral.

Results of the assessment of group interaction (Figure 3–B) show, overall, that students perceive they have been able to actively participate in discussions, share their knowledge, and receive satisfactory feedback (100% of students strongly agree with these aspects). The evaluation of group interaction and participation indicates the effective performance of the activity.

4. Conclusions

Starting from common principles inherent to the Photovoice tool, this technique has been adapted and implemented to the specific teaching context of a numerical modeling course. This adaptation has led to addressing modeling problems as a "divergent" question, allowing for multiple responses and fostering creativity. This has allowed students to apply their knowledge in a more flexible way and in different contexts. On one hand, photographs have been useful to narrow down environmental fluid mechanics modeling cases and frame them in a real context. On the other hand, the creation of narratives has been used to work on the reflection process around a case study related to specific aspects of the course, fostering critical thinking and effective communication (oral and written). This implies mobilizing abilities such as analyzing, evaluating, and creating, usually requiring higher-order thinking skills (in Bloom's taxonomy). Delving into this type of analysis provides future modelers with a crucial skill, which is knowing which model and what simplifications to apply when and where, perhaps the most challenging aspect for those facing these disciplines.

The potential use of individual and collective narratives as a tool for critical reflection on numerical problems presents a potential application to STEM disciplines. Compared to a more traditional 'practical' application format (such as problems solving), this methodology offers the potential to develop a higher level of analytical skills, through initial individual reflection, followed by justification and comparison in small groups, as well as discussion with the class and providing/receiving feedback.

In a context where the use of artificial intelligence (AI) in higher education is of increasing importance due to notable opportunities and implications for teaching and learning processes (Domenech, 2023), with one of its applications being the support for rapid text generation, the creation of narratives in a face-to-face, 'analog,' and 'non-automated' way offers a learning opportunity where students face this task without support. Furthermore, their revision and rewriting ensure students perform this activity and exercise their communication skills.

Moreover, in line with recommendations to adapt teaching and assessment to the advent of AI, Photovoice allows for a change in the educational approach and offers an additional alternative –in line with "Reflective Reports on Learning" (Sweeney, 2023)– to the writing of critical essays or practice reports (the latter being common in STEM disciplines), placing greater emphasis on judging critical thinking and conceptual understanding, rather than simply measuring data retention or the mechanical application of algorithms or models to solve problems. Additionally,

the proposal includes the evaluation of in-person work and its oral presentation; both are robust ways to assess the degree of knowledge and skills acquisition by students, avoiding possible dishonest practices, such as plagiarism or unauthorized use of generative AI.

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How to Promote Socially and Emotionally Responsible Language Learning and Teaching in European Teacher Education

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Abstract

The "SOELE - Socially and Emotionally Responsible Language Education" collaborative project of two European universities aims to advance language education and teaching. It seeks to integrate thematic and structural innovations by developing a comprehensive framework centered on socially and emotionally responsible language education and by promoting Collaborative Online International Learning (COIL) practices. This initiative not only seeks to deepen the understanding and appreciation of the social value of languages among students and educators but also strives to equip future language teachers with the skills necessary for fostering an equitable, socially and emotionally responsible educational environment. By addressing the challenges of social (in)justice in language education within the context of increasing educational internationalization and student mobility, the project contributes to the advancement of social responsibility and well-being in language education.

Keywords: *socially and emotionally responsible language education, Collaborative Online International Learning (COIL), Critical Cultural Awareness (CCA), linguistic and cultural diversity, language inequalities, well-being, European teacher education.*

1. Introduction

In the rapidly evolving educational landscape, the "SOELE – Socially and Emotionally Responsible Language Education" project emerges as a beacon of change and progress. The project's primary aim is to challenge traditional language teaching, transforming it into a holistic learning environment that caters to the intellectual, emotional, and social needs of an increasingly diverse student population. This endeavor will be carried out in partnership between the University of Teacher Education Lucerne (Switzerland) and the University of Oslo (Norway), featuring international workshops, seminars, and publishing opportunities.

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Recognizing the limitations of conventional educational models, the SOELE project seeks to foster a learning environment that is not only intellectually stimulating but also emotionally nurturing and socially conscious language education. The project ensures that all students, regardless of their cultural, linguistic, or social backgrounds, have equal opportunities to succeed and thrive. This involves addressing issues of social justice in language education, particularly in the context of educational internationalization and student mobility. By promoting a deeper understanding of social justice and its implications, the project empowers students to critically engage with and challenge society.

The SOELE project underscores the importance of creating safe spaces and promoting well-being in language education. It advocates for the integration of theoretical frameworks such as critical cultural awareness, social justice, language decolonization and well-being into the curriculum. This interdisciplinary approach not only enriches the learning experience but also fosters a deep appreciation for diverse cultural identities and experiences.

By interweaving these approaches into the educational fabric, the project envisions classrooms as thriving systems where every student is seen, heard, and valued. This shift from traditional academic goals towards a more inclusive and equitable learning environment equips students with the necessary skills to flourish both academically, socially, and emotionally. It nurtures individuals who are ready to contribute positively to an increasingly diverse and dynamic society.

1.1. Theoretical Background

The SOELE project is committed to establishing learning environments that are inclusive, equitable, socially and emotionally responsible. To achieve this, the project integrates various theoretical frameworks such as critical cultural awareness (1), social justice (2), language decolonization (3), and the creation of safe spaces that promote psychological well-being (4). The aim is to develop learning spaces where students from diverse social, educational, and linguistic backgrounds can thrive and succeed.

1.1.1. Critical cultural awareness

Expanding upon the importance of critical cultural awareness, it is essential to create a learning environment that not only acknowledges but also actively embraces the diverse cultural backgrounds of all students. This approach entails more than simply recognizing differences; it requires educators to value and appreciate the unique cultural identities and experiences that each student brings to the classroom (Gay, 2018). By fostering a deep understanding of students' cultural backgrounds and connecting the curriculum to their lives and cultural contexts, teachers can create an inclusive and equitable learning environment. This approach promotes a sense of belonging among students, acknowledges diversity, and helps to bridge the gap between home and school experiences.

1.1.2. Social justice

In addition to promoting critical cultural awareness, the concept of teaching social justice aims to address and dismantle systemic inequalities and oppression within the classroom and beyond. Social justice education is rooted in the principles of equity, fairness, and social change, seeking to confront various forms of discrimination, such as racism, sexism, homophobia, and ableism (Bell, 2016). This approach encourages educators to engage students in critical discussions about social issues, raising their awareness of the challenges faced by marginalized groups and inspiring them to develop a sense of social responsibility.

Teaching social justice goes beyond merely discussing social issues; it provides students with opportunities to take action and connect their learning to real-world contexts. This empowers students to become active agents of change in their communities and the wider world, contributing to the creation of a more just and equitable society. By fostering a sense of agency and social responsibility among students, educators can help them recognize their potential to make a positive impact on the world.

Furthermore, social justice education challenges traditional power dynamics and hierarchies that perpetuate inequality and marginalization (Ayers et al., 2018). It promotes student voice, creating an environment where students feel empowered to express their thoughts, opinions, and experiences. This approach also emphasizes the importance of civic engagement, encouraging students to participate in their communities and contribute to positive social change. By fostering a culture of civic engagement and student empowerment, social justice education can help create a more inclusive and equitable society.

1.1.3. Language decolonization

Additionally, the SOELE project prioritizes language decolonization as a strategy to combat language disparities and promote sociolinguistic equity. Current sociolinguistic research indicates that language practices can either exacerbate social inequalities or stimulate social change (Rosa, 2020). Rosa's work underscores the necessity of an educational framework that proactively counters linguistic inequalities through 'linguistic disobedience,' a concept that corresponds with the SOELE project's commitment to all- encompassing language education. Linguistic disobedience denotes the active challenge and subversion of dominant language practices that relegate certain communities to the periphery. This can be realized through diverse methods, such as the endorsement of multilingualism, recognition of non-standard language forms, and the promotion of language practices that echo the cultural and linguistic plurality of speakers.

In the SOELE project, linguistic disobedience is an essential instrument for redressing language disparities and fostering inclusive language education. This can involve contesting the dominance of specific languages or dialects in educational contexts, inspiring students to

converse in their family languages , and weaving a range of language practices into the teaching content. Linguistic disobedience also encompasses raising consciousness about the political and social consequences of language use, which can facilitate a critical understanding of how language practices can either reinforce or contest social inequalities.

Inclusive language education seeks to disrupt ingrained linguistic hierarchies and champion linguistic diversity, incorporating indigenous and marginalized languages (Paris & Alim, 2017). This approach includes the use of culturally pertinent resources, collaboration with families and communities, and the advocacy of language rights in educational settings (Flores & Rosa, 2015). By appreciating students' linguistic repertoires and nurturing a more inclusive learning environment, educators can establish a space that acknowledges and benefits from the rich linguistic diversity of all students. One effective strategy for implementing linguistic diversity in language education is digital storytelling. This technique allows students to articulate their creativity, impart their cultural heritage, and contest assumptions while honing their language skills. Digital storytelling encourages an inclusive and captivating learning environment that values diversity and nurtures cross-cultural understanding (Rosen & Korte, 2012).

Tackling language inequalities necessitates the disassembly of language biases and the advancement of linguistic rights. Comprehensive shifts in educational policies and practices are required to guarantee equitable access to high-quality language education for all learners, regardless of their backgrounds. The selective valorization of linguistic diversity underscores the importance of inclusivity in language education. Scholars such as Duchêne (2009), Flubacher et al. (2018), and Urciuoli (2015) highlight the varying degrees of capital assigned to different languages in the workplace, indicating a broader societal pattern of language and speaker exclusion.

1.1.4. Safe space and well-being

In the realm of language education, establishing safe spaces is crucial for fostering an inclusive and equitable learning environment that supports students' emotional, social, and linguistic development. Safe spaces enable learners to feel at ease while experimenting with new languages, making mistakes, and engaging in meaningful communication, all of which are inherent aspects of the learning process.

The term "safe space" refers to a physical or emotional environment where individuals can gather to share experiences in a protected and supportive atmosphere (Flensner & Von der Lippe, 2019). Historically, safe spaces aimed to protect marginalized groups from violence, threats, and hatred. In recent years, "safe-space policies" have gained significance at universities and schools to prevent discrimination, harassment, hate, and threats, fostering openness to diverse perspectives and opinions while establishing guidelines for fair idea exchange (Goldstein, 2005; Holley & Steiner, 2005).

Safe spaces in language education also pave the way for the exploration and appreciation of cultural and linguistic diversity. By nurturing an environment where students feel valued and respected, educators can inspire learners to share their cultural backgrounds, linguistic experiences, and personal narratives. This not only enhances the learning experience but also fosters cross-cultural understanding and empathy.

To strike a balance between establishing "safe spaces" and fostering critical thinking, teachers must be aware of the tension between comfort and assessment and ensure trustworthy relationships (Gayle et al. 2013; King, 2000). The foundation for a conducive classroom climate is sustainable and trustworthy student-teacher relationships, which require sustained attention throughout the course (Helm, 2009).

Universal Design for Learning (UDL) offers a structure for creating inclusive and engaging educational environments that cater to a wide range of learning styles and preferences, fostering equity and inclusion (CAST, 2018) and safe spaces within the classroom. UDL principles include presenting information in various formats, offering different avenues for students to demonstrate understanding, and creating engaging activities relevant to their interests and experiences. By incorporating UDL principles, educators can design flexible, adaptable, and accessible curricula and instruction for all students, irrespective of abilities, backgrounds, or learning preferences. This involves fostering a welcoming, inclusive, and respectful classroom culture that addresses students' emotional and psychological needs. Providing support and resources to help students manage stress, anxiety, and other challenges is also vital. By creating safe spaces that prioritize students' emotional, social, and linguistic development, educators can empower learners to engage confidently and authentically in the language education process.

In the neurobiological perspective provided by Stephen Porges' Polyvagal Theory, intersubjective connections play a significant role in promoting feelings of safety, enhancing overall well-being, and ultimately improving educational achievements. Dana (2018) emphasizes the importance of establishing safe environments as a foundation for healing and development. By cultivating safe spaces, educators can foster a sense of belonging, encourage active engagement, and support academic and personal growth in students.

The Polyvagal Theory links the evolution of the mammalian autonomic nervous system to social behavior and underscores the importance of the physiological state in the expression of behavioral problems and psychiatric disorders. The theory identifies three distinct branches of the nervous system – the ventral vagal complex (VVC), the sympathetic nervous system (SNS), and the dorsal vagal complex (DVC) – which work together to regulate responses to safety, danger, and life threats. Three neural circuits regulate reactivity: Immobilization, Mobilization, and Social Communication/Social Engagement. Neuroception, a key concept from Polyvagal Theory, plays a crucial role in this process. It refers to the subconscious detection of safety or threats in the environment, which impacts physiological states and emotional responses,

influencing social engagement. In educational settings, applying Polyvagal Theory aims to enhance students' ability to engage healthily with their environments and relationships.

2. Methods

The SOELE project adopts a multifaceted approach to achieve its objectives, focusing on both thematic and structural innovations in language education. This section explores the methodological aspects of the project, providing a detailed account of the strategies and techniques employed to foster socially and emotionally responsible language education.

The project's primary objective is to drive the development of socially and emotionally responsible language education internationally, with a focus on fostering equal opportunities in language education and teaching. This objective is realized through two interconnected areas – thematic and structural. On a thematic level, the project is dedicated to generating and sharing knowledge on how languages, cultures, and socioeconomic inequalities intersect, thereby initiating a comprehensive dialogue on equal opportunities within the sphere of language education. Structurally, the goal is to create an innovative learning environment that bridges institutions, transcends linguistic boundaries, and fosters intercultural exchange, laying a foundation for a more inclusive approach to language education.

2.1. Aims of the Project

The project is structured around three main objectives: enhancing international collaboration and knowledge exchange among universities (1), developing a socially and emotionally responsible language education framework in Collaborative Online International Learning (COIL) courses (2), and examining the professional growth of future teachers within this newly established framework (3).

Firstly, the project enables collaboration between two European universities, the University of Teacher Education Lucerne (Switzerland) and the University of Oslo (Norway) that fosters internationalization in Swiss higher education and academic knowledge exchange.

Secondly, the project aims to develop a comprehensive framework for socially and emotionally responsible language education, providing educators with the tools and strategies necessary to promote social responsibility, critical cultural awareness among students, and well-being. In order to achieve this goal, we will apply Collaborative Online Internation Learning (COIL) courses including Swiss and Norwegian students in the first implementation of the framework.

Thirdly, the project evaluates the experience of future teachers with the framework and the COIL course by applying mixed methods, such as questionnaires, interviews, and narrative protocols.

The project's ambitious endeavor reflects an emerging consensus in contemporary educational research, addressing both thematic and structural innovation within language education. This initiative corresponds to a wider trend in education that seeks to comprehend and incorporate the intricate interconnections between language, culture, physical and psychological well-being, and socioeconomic status. Moreover, it pioneers efforts to improve teacher professional development by implementing international co-teaching practices.

The project's thematic focus on the intersection of languages, cultures, well-being, and socioeconomic disparities is rooted in recent academic inquiries into the role of language in mediating social inclusion and exclusion. Research by Darvin and Norton (2015) delves into the concept of investment in language education, emphasizing the deep interconnection between learners' engagement with language education and their identities, social positions, and perceived returns on their investment. This framework underscores the importance of understanding the nexus of language and socioeconomic disparities for developing more effective and equitable language education practices.

In line with this, the project aims to execute the "Framework for Socially and Emotionally Responsible Language Education" via the "Collaborative Online International Learning (COIL)" program. This involves students from the University of Teacher Education Lucerne and the University of Oslo in interactive learning experiences. Movetia-sponsored workshops in Lucerne and Oslo are conducted to bolster the project's goals, and research outcomes associated with the project are released to contribute to the academic community. An international symposium is coordinated as a concluding event to share the project's discoveries and underscore the significance of nurturing environments conducive to equitable language acquisition.

The integration of international co-teaching practices also speaks to the increasing recognition of the value of global competencies in education. A study by Boix Mansilla and Jackson (2011) underscores the importance of preparing teachers to navigate and teach in a globally interconnected world. Experiences of international collaboration and co-teaching can equip educators with the skills and perspectives necessary to meet the challenges of global education.

By situating its goals within these contemporary educational discussions, the project embodies a comprehensive response to the call for more equitable and effective language education practices.

Through its dual focus on thematic and structural innovation, the project not only aims to advance academic understanding of the complex dynamics at play in language education but also to enact tangible changes in the way language teaching is approached. This, in turn, contributes to the professional growth of educators and the development of a more inclusive and socially responsible educational landscape.

2.1.1. Thematic Innovation

This project is committed to addressing the intricate issue of social (in)justice in language education by fostering socially responsible language education within an international context. To tackle social injustices in language education, the notion of physical and psychological well-being, and the creation of safe spaces, it is crucial to critically examine the complex relationships between languages, cultures, and social disparities.

At the heart of this project lies the development of a deep understanding of the cultural milieu and power structures inherent in language teaching. Moreover, the project aims to empower current and future educators to cultivate critical cultural awareness and reflect on their roles in either perpetuating or challenging the social order through language education.

To support educators in this endeavor, the project team will create a framework for socially responsible language education and implement it in pre- and in-service teacher training programs through co-teaching (see structural innovation).

2.1.2. Structural Innovation

The internationalization strategy of the University of Teacher Education Lucerne (UTE Lucerne) is rooted in relational internationalization, emphasizing institutional and interpersonal relationships in knowledge production and exchange. In alignment with this approach, the project aims to introduce innovative teaching practices, specifically international co-teaching in collaboration with the University of Oslo (UiO).

Co-teaching offers numerous benefits for both students and teachers, with values such as equity, critical thinking, and partnership central to the co-teaching model. To underscore the importance of inclusivity, the co-teaching approach will incorporate translanguaging, which involves utilizing learners' complete linguistic repertoires for input and output in the classroom. Translanguaging also aims to encourage critical thinking, creativity, and cross-curricular learning.

In terms of structural innovation, the project's commitment to implementing international co-teaching practices represents a forward-thinking approach to teacher education. Co-teaching, especially in an international context, has been identified as a powerful method for professional development. It offers teachers the opportunity to collaborate, share pedagogical strategies, and reflect on their practice in a culturally diverse setting. According to Walsh and Mann (2019), such collaborative practices can lead to a deeper understanding of pedagogical principles and a more nuanced appreciation of cultural diversity in teaching and learning. This, in turn, can enhance teachers' ability to create inclusive classrooms that respect and celebrate linguistic and cultural diversity.

By situating its goals within these contemporary educational discussions, the project embodies a comprehensive response to the call for more equitable and effective language education practices. Through its dual focus on thematic and structural innovation, the project not only aims to advance academic understanding of the complex dynamics at play in language education but also to enact tangible changes in the way language teaching is approached. This, in turn, contributes to the professional growth of educators and the development of a more inclusive, socially and emotionally responsible language education.

2.2. Practical examples

In order to achieve these goals in the planned framework we introduce some examples of lesson series on the core content listed below:

Critical Cultural Awareness

Show a documentary film that explores the cultural diversity of a specific region or country and discuss the different cultural characteristics to learn to identify and challenge cultural stereotypes. Finally, create a language education game incorporating colloquial expressions and idioms from different cultures.

Social Justice

Develop a lesson plan that teaches students about systemic inequalities and their impact on society and create a role-playing activity where students can explore different perspectives on a social justice issue. At the end of the lesson series design a debate or discussion forum where students can discuss and analyze social justice issues. Afterward, students explore their biases and privileges in a reflective writing assignment.

Language Decolonization

Develop a lesson plan that teaches students about the history and impact of language colonization. students then research and present on indigenous languages and their revitalization efforts. Afterward an Input about linguistic diversity and language rights. students explore their language background and its impact on their identity in a reflective writing assignment.

Well-being – Polyvagal Theory in Language Expression

Begin with an introduction to polyvagal theory, specifically how it relates to voice modulation and the physiological aspects of speech in different emotional states. Illustrate with examples how a calm, connected state (ventral vagal) can improve language skills and expression. Proceed with a practical exercise where students engage in language activities that require them to identify and adjust their nervous system state using polyvagal theory principles, such as deep

breathing or mindful listening. This session aims to enhance students' language proficiency by fostering a physiological state conducive to clearer and more effective communication.

3. Results

A primary outcome of the project is the creation of a holistic framework for socially and emotionally responsible language education. The framework is rooted in the principles of critical cultural awareness, social justice, language decolonization, safe place and well-being, ensuring it addresses the intricate relationships between language, culture, and socioeconomic status in educational contexts.

Thematically, the framework consists of:

1. Critical cultural awareness: Understanding language's role in social inclusion/exclusion and addressing inequalities in teaching.
2. Culturally responsive teaching: Utilizing students' cultural backgrounds for an inclusive learning environment.
3. Translanguaging strategies: Leveraging diverse linguistic repertoires for creativity and cross- curricular learning.
4. Safe Space creation: Ensuring students' emotional and physical security for authentic expression.
5. Intersubjectively Sensitive Teaching (Polyvagal): Fostering secure connections for improved well- being and educational outcomes.

Structurally, the framework consists of:

1. Promoting and implementing international co-teaching practices: Collaborative teaching for professional development and cultural understanding.
2. Setting up workshops in Switzerland, Norway, and elsewhere.
3. Publishing research findings related to the project.
4. Organizing an international conference as a closing event to disseminate the project's findings.

Cultivating student agency and collaboration is another pivotal strategy for creating an inclusive and socially responsible classroom. Inspiring students to play an active role in their learning and to collaborate with their peers can promote engagement, critical thinking, and a sense of ownership over the learning process (Freire, 1970). By offering opportunities for student-led discussions, group projects, and collaborative problem-solving, teachers can establish a learning environment that values and respects the voices and perspectives of all students. This approach also aids in developing students' social and emotional skills, such as empathy, communication, and teamwork, which are vital for navigating a diverse and interconnected world.

The incorporation of technology in the classroom can also significantly contribute to promoting inclusivity, equity, and social responsibility. Furthermore, technology can facilitate differentiated instruction, enabling teachers to customize learning experiences to the unique needs and abilities of each student. This personalized approach can help ensure that all students have equal opportunities to engage with and benefit from the curriculum, irrespective of their background or learning style.

4. Discussion

The outcomes of this initiative have the potential to significantly contribute to the advancement of both cantonal and institutional objectives related to diversity, inclusion, and equity. Moreover, this project aligns with federal and international sustainable development goals, emphasizing the development of individuals' and institutions' capacity to take responsibility for the future through lifelong quality education.

The United Nations' "2030 Agenda for Sustainable Development" highlights the importance of quality education as a crucial factor in creating a more stable and sustainable world. In line with this, our project aims to ensure that future secondary school teachers in Switzerland acquire and implement 21st-century skills, such as creativity, innovation, critical thinking, problem-solving, communication, and collaboration, in their teaching. This commitment to fostering a more socially responsible education system will make a significant contribution to the establishment of educational equity in Switzerland and Norway.

Our project's thematic and structural innovations will occur within the context of international cooperation with experienced partners from the University of Oslo. International knowledge exchanges will be integrated into the pre- and in-service teacher training at the University of Teacher Education (UTE) Lucerne. This alignment with objective 6 of the common political objectives in training established between the Confederation and the cantons aims to anchor exchanges and mobility in education and training at all levels.

A notable innovation of this project is the introduction of social justice themes in language education for teacher trainees in Switzerland. This thematic innovation could serve as a model for other Swiss institutions. By training numerous prospective primary and secondary school language teachers in Central Switzerland on this subject, the project will contribute to a more socially equitable language education in the region. The project's impact will be further extended through recurrent in-service teacher training and the creation of an impulse group, ensuring the continuous development and promotion of socially and emotionally responsible language education.

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