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Special Issue on "Innovative Pedagogical Educational Tools in Higher Education Institutions (HEIs)".

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Abstract: While 85% of young Australians have a secondary school qualification, the Department of Jobs and Small Business forecast that approximately 90% of jobs created in 2022 would require higher qualifications. Enhancing student participation in tertiary learning, to improve their confidence and communication besides employability is the focus of this study. Elements such as communication and confidence that emanate out of participation in classroom discussions come to the foreground in this reflective study. Important factors that limit student participation are the inherent cultural shyness and language of international students. Use of language within an intercultural context could either contribute or reinforce barriers to participation in classroom discussions. This paper focuses on international post-graduate students and aims to achieve the dual objective of improved communication and confidence through classroom participation. Aiming to understand how intercultural competence can either enhanced or diminished the researcher uses own teaching and learning practices to transform the teaching and learning pedagogy to be more participatory. Using qualitative research methodology for a sample size of 149 students, this research uses complete observer method to capture the classroom participation of students in a participatory learning environment. Spread across 4 trimesters of study period, class size for this study ranges from 11-35 students. Tabular and graphical representations support the observations made. Using student engagement as a primary calibration, this paper expounds how traditional learning and teaching methods are of minimal help in trying to alleviate the inhibition and cultural shyness rampant in international students. This study delineates a few recommendations that are primarily focussing on participatory learning, peer motivation and constructive feedback, all of which help mitigate cultural shyness and language issues. The research concludes summing up the need to transform from a traditional to a participatory learning and teaching pedagogy and expounds on some gaps in the paper surrounding the use of Artificial Intelligence in higher education.

Abstract: This paper describes the experience of using a flipped classroom methodology in Portuguese higher education in the scope of the curricular unit of Didactics of Mathematics of the basic training for teachers and educators. The study was based on the research question: "What do higher education students think about the Didactics of Mathematics learning using the flipped classroom method?". The study was carried out with 39 students. The methodology used was a quantitative paradigm, namely the questionnaire, answered by 34 students, designed according to the relevant categories of the study of the flipped classroom pedagogical model. Results suggest that students enjoyed the flipped classroom model. As favourable arguments for the use of this model, students mentioned their engagement and learning, increased motivation, self-regulation of learning processes, and the development of critical thinking. This way, in the flipped classroom models, highlights go to the individualized and collaborative learning and the creation of spaces and contexts for the development of student-centred activities that involve more complex, challenging activities that are closer to the actual professional practice of future teachers. This article makes an important contribution to understanding students' perceptions of the implementation of the flipped classroom, which can be an important indicator for planning (future) curricular units and teaching practice.

Abstract: Every educational institution strives for pedagogical excellence, driven by the goal of providing the most effective and impactful learning experiences to its students. This is no different at the Polytechnic Institute of Viseu (IPV) and other Polytechnic Institutes participating in a Pedagogical Innovation Training Program developed within a consortium committed to enriching educational methodologies and tools. There is evidence that innovative pedagogical methodologies lead to enhanced student engagement, foster meaningful interactions, promote critical thinking and problem-solving skills, and ultimately better academic achievement. This study focuses on the training course on pedagogical innovation offered to the teaching staff from IPV and vocational schoolteachers from the region, by examining their reflective portfolios. We aim at illuminating the impact and efficacy of the initiative in fostering active methodologies and innovative pedagogical tools, employing qualitative analysis to uncover the nuanced perceptions of the IPV participants in the six editions of the program (2021-2023). The findings reveal that they value active methodologies, intercultural and multidisciplinary collaboration, and the integration of industry-aligned skills development, even if we encounter accounts of challenges faced during the implementation process of the training course. Ultimately, this study contributes to assessing the initiative's impact and underscores the pivotal role of innovative teaching methodologies in striving for educational excellence. In light of the findings, policy recommendations include encouraging continued investment in pedagogical innovation training programs, supporting interdisciplinary collaboration, fostering industry alignment, and addressing implementation challenges to ensure the effectiveness of such initiatives.

Abstract: Project-Based Learning (PBL) is an educational approach that has been embraced in various disciplines, including tourism education. This article explores the role of PBL in enhancing tourism education in a higher education context. The study sought to determine the impact of PBL methods on students' knowledge acquisition, retention, practical skills development, and teamwork. The research was conducted with a class with 16 students, in a management and restaurant industry course at a polytechnic

institute in Portugal. Results were collected by means of questionnaire disclosed among the students subsequently to the event organised. Findings indicate that students, by engaging in PBL, exhibited a deeper understanding of the course material, improved their ability to transfer knowledge to real-world scenarios, and developed important collaboration, communication, and critical thinking skills. It is then concluded that PBL is an effective approach to enhancing tourism education in a higher education context. It encourages students to actively participate in their learning and provides them with skills, knowledge, and experience that better prepare them for careers in the tourism industry. The research aims to demonstrate how PBL can be a valuable tool for tourism educators. By actively engaging students in project-based learning, educators can equip them with the necessary skills, knowledge, and practical experience to excel in their future careers within the tourism industry. Ultimately, this study seeks to contribute to a deeper understanding of PBL's potential in enhancing foreign language teaching within tourism-related university courses, promoting language proficiency and preparing students for success in the global tourism landscape.

Abstract: This paper discusses the significance of entrepreneurship in higher education institutions and presents a case study of 13 Polytechnic higher education institutions in Portugal. Over the past 3 years, these 13 institutions have received European funding to promote and develop activities related to entrepreneurship within their institution. Among the various actions funded, there is one that is particularly important called Poliempreende, which involves a business plan competition in each of the institutions, culminating in a national competition. Up until now, the efficiency of each of these institutions in relation to Poliempreende has never been analysed. Bearing in mind that productivity is influenced by technical efficiency, this paper aims to analyse the productivity of these institutions. This paper presents a study on the individual performance of these institutions. This analysis is crucial for less efficient institutions to benchmark against completely efficient ones. To conduct this analysis, we apply the non-parametric Data Envelopment Analysis method, which is solved through linear programming. Our findings indicate that while some institutions are completely efficient, others have significantly lower efficiency levels. Therefore, institutions that received the same amount of European funding should observe the efficient institutions and conduct benchmarking. As far as public policies are concerned, it would be desirable to have ongoing projects to encourage the development of partnerships between institutions and with businesses, incentives for the creation of incubators and start-ups and greater diversification of financing instruments for entrepreneurs.

Abstract: Implementing innovative active learning practices in higher education has been seen as crucial for students' academic and professional success in today's world. In this context, Higher Education Institutions (HEIs) are facing new challenges and must shift the educational paradigm from the traditional teacher-centred toward student-centred learning. There is evidence in the literature that active learning methodologies improve students' learning outcomes and performance. However, there are few studies that have empirically investigated this relationship and that provide a comparison of the effects by different areas of education. The aim of this paper is to explore the students' perceptions of implementing the Problem-Based Learning (PBL) approach as an active learning practice, in both social sciences and engineering education fields. The study was carried out within the context of a Portuguese Polytechnic

Higher Education Institution – the Polytechnic Institute of Coimbra (IPC), based on a survey research methodological approach, which involved a sample of 97 undergraduate students. Overall, empirical results support that innovative active learning methodologies constitutes an effective approach to enhance students´ engagement, learning experience and competences. This positive effect of active learning methodologies at students' performance is more evident in engineering education compared to social sciences. These findings support the idea that HEIs need to change their teaching–learning environment towards innovative learning practices, more in line with the challenges of the twenty-first century.

Abstract: Between 2021 and 2023, the Polytechnic Institute of Viseu (IPV), in Portugal, conducted two interdependent projects aimed at training teachers and fostering collaboration between industry and academia. These projects involved teams of students tackling challenges posed by local companies and non-profit organisations. One such challenge, 'The Mission of Libraries', explored the future role of libraries in society, partnering with the António Lobo Antunes library. Another challenge, 'Born to Save' collaborated with ARTIDERCA – Agência Criativa to enhance people's lives, particularly through children and their engagement with first aid practices. This paper presents the methodologies, tools, platforms, and tasks employed in addressing these challenges. Through a case study methodology based on the trainees' reflections on their facilitation process, the study subscribes to the core values identified by the training entity Demola Global. These values, namely communication, action, curiosity, diversity, imperfection, and responsibility contribute to co-creation and help build bridges between academia and the labour market. Such dynamics underpin active learning methodologies, impacting students, teachers, and communities. This research highlights the importance of pedagogical innovation training in preparing teachers to integrate challenge-based learning into their teaching practices and align with the expanded mission of Higher Education Institutions. The implications for policymakers lie in the need to support projects like the Demola Portugal Initiative, fostering collaboration between academia, industry and society to address innovative, real-world challenges.

EDITORIAL

Although 85% of young Australians have a secondary school qualification, the Department of Jobs and Small Business forecast that approximately 90% of jobs created in 2022 would require higher qualifications. Focussing on communication skills for better employability, this **first paper by Anna Sekhar** expounds how higher education is incomplete without enhanced communication skills. Improving student participation in tertiary learning helps hone their confidence and communication all of which creates a conducive environment for better employability. Thus, this reflective study aims to instil leadership skills alongside employability. To achieve these stated traits, focus on participation in class group discussions come to the foreground in this reflective study. This research observes a few important factors that limit student participation in classroom activities. These include the inherent cultural shyness and language barriers faced by international students. Use of language within an intercultural context could either contribute or reinforce barriers to participation in classroom discussions. The paper focuses primarily on international post-graduate students and a handful of domestic students if any in the classroom. It aims to achieve the dual objective of improved communication and confidence through classroom participation.

Aiming to understand how intercultural competence can either be enhanced or diminished, the researcher uses own teaching and learning practices to transform the teaching and learning pedagogy to be more participatory and interactive rather than a traditional pedagogy. Along with a participatory learning and teaching approach, constructive feedback is also found to be greatly responsible for motivating students. Using qualitative research methodology for a sample size of 149 students, this research uses complete observer method to capture the classroom participation of students in a participatory learning environment. The researcher has adopted this 'complete observer' approach to arrive at near accurate results with minimal or no Hawthorne Effect. Spread across 4 trimesters of study period, class size for this study ranges from 11-35 students. Tabular and graphical representations support the observations made. Both the tabular and graphical representation helps readers decipher how with motivation and peer-to-peer support, class participation has been on a constant increase every week throughout the trimester of study. Further, the tables and graphs also display how the size of the class does have a profound impact on students' engagement amongst themselves within a classroom environment. Using student engagement as a primary calibration, this author expounds how traditional learning and teaching methods are of minimal help in trying to alleviate the inhibition and cultural shyness rampant in international students.

The **second paper by Hugo Menino, Susana Reis, & Ana Oliveira** describes the experience focused on adopting the flipped classroom methodology, a pedagogical model created by Bergmann and Sams. By distancing itself from the traditional classroom model, the flipped classroom model establishes that the basic concepts are introduced before the class, when students work autonomously, therefore allowing teachers to use their in-class time to guide students through active, practical, and meaningful activities. This experience used a flipped classroom methodology in Portuguese higher education in the scope of the curricular unit of Didactics of Mathematics of the basic training for teachers and educators The CU had a duration of 30 in-class hours, over 15 weeks. Classes were given to two classes, a group of 20 students and another group of 19 students. Each week, the dynamics were based on three core moments: autonomous work before class, group work during class and individual work after class. This exploratory study aimed to describe the potential of the use of this model for learning, in higher education, by using a set of indicators that arose from the review of relevant work in this field.

The research question for this research was: "What do higher education students think about the Didactics of Mathematics learning using flipped classroom method?". The methodology used was essentially quantitative, and the instrument was the questionnaire divided into six sections that matched the following

categories: active engagement and learning; satisfaction; collaboration and communication; motivation; self-regulation; critical thinking. The response rate was 87% (34 students).

The results of the study by Hugo Menino, Susana Reis, & Ana Oliveira suggest that students enjoyed the flipped classroom and showed a high level of satisfaction with this methodology, due to students' engagement and learning, increased motivation, self-regulation of learning processes, and the development of critical thinking. Most students stated that they have felt motivated to learn the content planned for this curricular unit. Also, students said they would like to attend other curricular units where the flipped classroom model was used, although it requires more effort than the traditional classroom.

One of the limitations of this study is the fact that it was conducted with a reduced number of students and in the scope of a specific curricular unit of a training course for teachers. So, the results of this exploratory study cannot be applied to other contexts. This paper, despite this limitation, constitutes a small contribution to the study of the implementation of the flipped classroom methodology in the context of mathematics, in Portuguese higher education. Knowing students' perceptions about the impact of using this methodology, is a fundamental aspect in the preparation of teaching practice and in the constant improvement of teaching effectiveness. In short, the arguments in favour of using this model (e.g. involvement, motivation, self-regulation of learning processes and development of critical thinking) highlight the importance of creating spaces and contexts for the development of student-centred activities that involve more complex, challenging activities that are closer to the actual professional practice of future teachers.

Striving for pedagogical excellence, Higher Education Institutions worldwide continually seek innovative approaches to enhance learning experiences. Thus, a crucial contextual backdrop to this study is the pressing need for active pedagogies. This imperative is not only driven by the paradigm shift introduced by the Bologna Process and the call for quality education, but external factors, such as the global COVID-19 pandemic, also influenced it. Additionally, the evolving roles of students in their learning processes and the changing expectations placed on teaching staff further underscore the need for innovative teaching methodologies.

In response to these challenges, the Polytechnic Institute of Viseu (IPV), in collaboration with a consortium of Portuguese Polytechnic Institutes and Demola Global, launched the Demola Portugal Initiative. This multifaceted initiative comprised two concurrent projects, Aprendizagem com Base em Processos de Cocriação [Learning based on Co-creation Processes] and Link Me Up – 1000 Ideias [1000 Ideas], running from 2021 to 2023. The former was a Pedagogical Innovation Training Programme targeted at teaching staff from 14 Portuguese Polytechnic Institutes and vocational school teachers. Simultaneously, the latter was held in 13 Polytechnic Institutes, and it involved intercultural and multidisciplinary teams collaborating on real-world challenges, fostering the development of over 1000 ideas and equipping students with problem-solving skills and an entrepreneurial mindset, preparing them for the dynamic demands of the labour market.

The **third paper by Susana Amante** explores the impact and efficacy of the Demola Portugal Initiative, with a specific focus on the reflective portfolios of teaching staff from IPV and vocational school teachers in the region of Viseu who participated as trainees and facilitators in the six editions of the two projects mentioned above. Guided by the study's objectives, that is, reflecting upon the impact and efficacy of the initiative in fostering active methodologies and innovative pedagogical tools, a qualitative analysis of reflective portfolios was conducted. This analysis unveiled nuanced perceptions of the tools and approaches acquired through the training programme.

Strategic prioritisation in the analysis becomes apparent following the categories most emphasised in the portfolios, namely efficient time management, uncertainty handling, utilisation of ICT tools, opportunities for internationalisation, networking, skill diversification, and fostering effective communication and

interaction within interdisciplinary and multicultural teams. These priorities align with the Demola values and approach, central to the training programme, reflecting the inclusion of tools designed to foster curiosity, creativity, strategic thinking, and solution-oriented perspectives. Notably, the awareness that failure and imperfection lead to adaptability, continuous improvement, and growth underscores a transformative educational philosophy.

The findings of Susana Amante's study provide valuable insights into the impact of the Pedagogical Innovation Training Programme, particularly at IPV. Participants highly value active methodologies, intercultural and multidisciplinary collaboration, and the development of industry-aligned skills. Despite encountering challenges during the implementation process, the study reinforces the pivotal role of innovative teaching methodologies in striving for educational excellence. This comprehensive analysis contributes not only to assessing the initiative's impact but also to understanding the need for active pedagogies, digital integration, and a redefined role for teaching staff in the ever-evolving landscape of educational practices.

The **fourth paper by Berta José Fernandes Costa & Maria Natália Pérez Santos** investigates the impact of Project-Based Learning (PBL) on tourism education within higher education. Focusing on a group of foreign language students in the Restaurant Industry and Catering course at the Polytechnic Institute of Leiria, Portugal, during the 2022-2023 academic year, the study employs a quantitative approach, utilizing a questionnaire to assess the influence of PBL on knowledge acquisition, practical skills development, and teamwork. The research reveals that students engaged in PBL demonstrated a deeper understanding of course material, improved knowledge transfer to real-world scenarios, and the development of essential collaboration, communication, and critical thinking skills. The results emphasize the effectiveness of PBL in actively involving students in their learning process, better preparing them for careers in the tourism industry.

The article reviews existing literature, emphasizing the widespread use of PBL in foreign language teaching, particularly in tourism-related courses. Various studies highlight PBL's positive impact on language proficiency, critical thinking, and intercultural competence. Challenges in implementation, such as lack of experience and resource constraints, are acknowledged, with proposed solutions to overcome these difficulties. The article outlines key steps for successful PBL implementation, stressing the importance of careful content selection, clear objectives, and a well-defined timeline. Practical solutions to identified challenges include starting with simpler projects and involving language professionals in the process. Case studies, such as the International Gastronomic Fair, demonstrate how PBL can be applied, promoting interdisciplinary and experiential learning. The study adopts a quantitative approach, employing a questionnaire to collect data from 16 foreign language students enrolled in the Restaurant Industry and Catering course. The methodology includes an overview of the II International Gastronomic Fair, a PBL project organized by the students. Results indicate positive outcomes in language skills development, commitment, and motivation.

The questionnaire results reveal that students perceived PBL positively, with a majority acknowledging the benefits in developing oral and written communication skills, language proficiency, and motivation. The interdisciplinary approach and project phases were considered valuable, contributing to students' preparation for the labour market. The authors conclude that PBL is an effective strategy for enhancing tourism education, providing students with practical skills and knowledge. Recommendations for educators include starting with smaller PBL projects and involving students in the project design process. Despite limitations in sample size, the study suggests that the advantages of PBL outweigh its challenges. The authors also identify potential areas for future research, including expanding the sample size across institutions and countries, conducting longitudinal studies to assess long-term impacts, exploring PBL in various tourism-related courses, and investigating its role in fostering intercultural understanding among

tourism students. Overall, the study highlights the promising impact of PBL in enhancing tourism education and in the foreign language teaching process.

This **fifth paper by Fernando Teixeira & Olinda Sequeira** discusses the significance of entrepreneurship in higher education institutions and presents a case study of 13 Polytechnic higher education institutions in Portugal. Over the past 3 years (2021 to 2023), these 13 institutions have received European funding to promote and develop activities related to entrepreneurship within their institution. Entrepreneurship education is very important to the European Union, which is why significant sums of money are spent on promoting an entrepreneurial culture in the European Union. Among the various actions funded, there is one that is particularly important called Poliempreende, which involves a business plan competition in each of the institutions, culminating in a national competition. Up until now, the efficiency of each of these institutions in relation to Poliempreende has never been analysed. Technical efficiency can be used as an indicator to understand the results, allowing us to analyse the productivity achieved by each institution. This is important for benchmarking, so that the less productive institutions can learn from the more productive ones.

The authors present a study on the individual performance of these institutions. During the European funding period between 2021 and 2023, all 13 institutions carried out the same activities, which allows us to have correct data sources and thus apply the non-parametric Data Envelopment Analysis method, which is solved through linear programming. Using DEA it is possible to construct a non-parametric piecewise surface over the data. This piecewise surface is called the efficiency frontier and efficiency measures are calculated relative to this frontier. DEA is a non-parametric approach, does not require a pre-established functional form. Technical efficiency is measured on a scale of 0 to 1. The authors identified the same inputs and outputs for all institutions and established an appropriate level of aggregation, which is necessary for applying the DEA method. Each of the 13 institutions represents a decision-making unit (DMU) when using the DEA method. It considers 13 DMUs, namely the Polytechnics of Beja, Bragança, Castelo Branco, Cávado and Ave, Coimbra, Guarda, Leiria, Portalegre, Porto, Santarém, Tomar, Viana do Castelo and Viseu. All 13 polytechnics have received European funding over the last 3 years to promote an entrepreneurial culture in teaching practice. The performance of each of these DMUs will be assessed, as mentioned above, by calculating the TE for each institution. In order for a DMU to be considered efficient, it must obtain a value of one. The study's findings indicate that the average TE of the 13 DMUS can be improved, regardless of whether a DEA-CRS or DEA-VRS model is used.

Another important conclusion is that 4 DMUs exhibit a 100% TE in the DEA-CRS indicating that they are using the minimum inputs required to achieve the same total output as other DMUs. This suggests that these DMUs should share their techniques with other DMUs for benchmarking purposes. One of the main objectives of using a DEA model is to allow benchmarking, precisely by indicating the DMUs that are on the efficient production frontier. It is evident that studying the effects of scale is crucial, as they are largely dependent on the environment in which each institution operates. Failure to consider the effects of scale may result in an improvement in TE for all DMUs that were not operating on the efficient frontier of production. This means that there are DMUs that are not efficient at scale while others can achieve optimal results with fewer inputs. The focus of the study by Teixeira & Sequeira is to analyse, the technical efficiency of institutions in incorporating the concept of entrepreneurship into academia and while some institutions are completely efficient, others have significantly lower efficiency levels. Therefore, institutions that received the same amount of European funding should observe the efficient institutions and conduct benchmarking.

An important challenge facing Higher Education Institutions (HEIs) is to make the required transition from traditional approaches teacher-centred to learner-centred classrooms, focused on students' interests, needs, abilities, and learning styles. Implementing innovative active learning practices in higher education has therefore been considered central to the success of the learning process, aiming students' academic and

professional success in today's world. These innovative educational practices are expected to boost student´s engagement toward the learning process. The future graduates need to acquire not only the technical skills but also the transversal and human-centred skills and attitudes, such as adaptability, flexibility, interdisciplinary collaboration, teamwork, creativity, communication, critical thinking, and complex problem solving, to be prepared to the demands of the 21st century labour market.

There is robust evidence in the literature that active learning methodologies improve students' learning outcomes and performance. However, there are few studies that have empirically investigated this relationship and that provide a comparison of the effects by different areas of education. The **sixth paper by Luis Araújo Santos, Vera Cristina Ribeiro, & Sara Proença** aims to contribute to this literature stream by providing new empirical evidence on the role of innovative active learning methods based on the problem-based learning (PBL) approach. PBL emerged during the late 1960s at McMaster University in Hamilton, Canada, in response to the growing demand for active learning practices capable of developing transferable knowledge and skills and promoting students' engagement, primarily in medical and engineering education, and it has since been gaining popularity among educators from different fields around the world. In particular, the authors explore students' perceptions of the PBL methodology effectiveness in a real teaching and learning context, namely in terms of students´ satisfaction and engagement, learning experience and competences development. The authors employed a survey research methodological approach, and it was carried out within the context of a Portuguese Polytechnic Higher Education Institution – the Polytechnic Institute of Coimbra (IPC), using a sample of students from two different scientific areas: engineering (bachelor's degree in sustainable cities management) and social sciences (bachelor's degree in media studies).

Overall, the empirical results from Santos, Ribeiro, & Proença support that innovative active teaching-learning methodologies, by implying that students become engaged in their learning process by thinking, discussing, investigating, and creating, constitutes an effective approach to enhance students´ satisfaction, learning outcomes and transversal competences considered essential for career success in the 21st century, such as critical thinking, creativity, teamwork, communication, and data analysis. Results show that over 90% of the students consider that the PBL methodology enables the classroom dynamics and productivity, with positive effects on students' performance. Moreover, results give evidence that students would like to see this active learning practice implemented in other course units. When comparing the results according to the education area of the students (social sciences and engineering fields), it is observed that the perception of engineering students about the effectiveness of the problem-based learning approach is always more positive than the perception of social sciences students. Finally, the findings of this study support the idea that HEIs need to change their teaching–learning environment towards innovative learning practices, more in line with the challenges of today's world.

From 2021 to 2023, the Polytechnic Institute of Viseu (IPV), in Portugal, conducted two interdependent projects with the primary goal of training teachers and fostering collaboration between industry and academia. In their third and fourth joint editions in 2022, two teachers had the opportunity to facilitate two teams of students while attempting to solve the challenges presented by a local company and a non-profit organisation. One of the challenges, titled 'The Mission of Libraries,' questioned the future purpose of libraries. The partner entity for this challenge was the António Lobo Antunes library, adding a real-world context to the exploration of libraries' changing dynamics. Rethinking the role and mission of libraries was, thus, of utmost importance. How to do it? The challenge was framed as follows: *Once upon a book… what and how will the libraries of the future be changed?* The article explores the overall direction of libraries and discusses various ideas contributing to addressing this societal challenge.

The second project, known as 'Born to Save,' aimed to make meaningful contributions to people's lives, particularly children, by enhancing their knowledge of first aid practices. The partner for this challenge was ARTIDERCA-Agência Criativa. This challenge provided students of Plastic Arts and Multimedia with an

opportunity to collaboratively explore solutions to a health-related case tailored for children to handle. 'Born to Save' offered children a unique opportunity to make a difference by providing them the space to perform first aid techniques, participate in the so-called chain of survival and, potentially, even save lives. The target audience for this challenge was children aged between 5 and 10 or 12 years old.

In this **seventh paper by Susana Amante, Filipa Rodrigues, & Ana Isabel Silva**, the aim is to present some of the tools, platforms, and tasks that framed the two challenges described above. Both projects emphasised values such as communication, action, curiosity, diversity, imperfection, and responsibility, contributing to co-creation and building bridges between academia and the labour market. Initially developed by teachers, guiding their students collaboratively towards a common goal, the methodology adopted is a case study relying on trainees' reflections on their facilitation process. As a result of the training and facilitation process, participants argue that these values are upheld, in collaboration with the training entity, Demola Global. These dynamics form the foundation for active learning methodologies, with a far-reaching impact on the profiles of students, teachers, and the surrounding communities.

Both challenges brought all participants into contact, emphasising new teaching and learning techniques that promote active student participation and interaction, fostering the co-construction of knowledge, skills, and values. All participants actively engaged in proposing solutions and developing communicative, social, and project-enhancement skills for future situations. The co-creation model provided students with a sense of security in sharing ideas and confidence in decision-making. Amante, Rodrigues, & Silva suggest that the established success of the Demola methodology significantly contributes to its marketability and reputation. This success allows us to argue that the groundwork has been laid for the inception of analogous initiatives worldwide, replicating innovative pedagogical approaches and enhancing educational practices, taking into account other levels of education beyond Higher Education.

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NOTE FROM THE EDITORS

As an interdisciplinary indexed journal, *The Journal of Global Business and Technology (JGBAT)* serves academicians and practitioners in the fields of global business and technology management and their related areas. JGBAT is also an appropriate outlet for manuscripts designed to be of interest, concern, and applied value to its audience of professionals and scholars. Readers will note that our attempt to bridge the gap between theory and practice has been successful.

We cannot thank our reviewers enough for having been so professional and effective in reiterating to contributors the need to provide managerial applications of their research. As is now obvious, the majority of the articles include a section on managerial implications of research. We wish to reiterate once again our sincere thanks to JGBAT reviewers for having induced contributors to answer the "so what?" question that every *Journal of Global Business and Technology* article is required to address.

Thank you for your interest in the journal and we are looking forward to receiving your submissions. For submissions guidelines and requirements, please refer to the Manuscript Guidelines at the end of this publication.

N. Delener, Ph.D., Editor-in-Chief
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HOW TRANSFORMATION FROM TRADITIONAL TO PARTICIPATORY LEARNING AND TEACHING PEDAGOGY HELPS BUILD CONFIDENCE AND COMMUNICATION SKILLS IN INTERNATIONAL STUDENTS – A REFLECTIVE ANALYSIS

Anna Sekhar

ABSTRACT

While 85% of young Australians have a secondary school qualification, the Department of Jobs and Small Business forecast that approximately 90% of jobs created in 2022 would require higher qualifications. Enhancing student participation in tertiary learning, to improve their confidence and communication besides employability is the focus of this study. Elements such as communication and confidence that emanate out of participation in classroom discussions come to the foreground in this reflective study. Important factors that limit student participation are the inherent cultural shyness and language of international students. Use of language within an intercultural context could either contribute or reinforce barriers to participation in classroom discussions. This paper focuses on international post-graduate students and aims to achieve the dual objective of improved communication and confidence through classroom participation. Aiming to understand how intercultural competence can either enhanced or diminished the researcher uses own teaching and learning practices to transform the teaching and learning pedagogy to be more participatory. Using qualitative research methodology for a sample size of 149 students, this research uses complete observer method to capture the classroom participation of students in a participatory learning environment. Spread across 4 trimesters of study period, class size for this study ranges from 11-35 students. Tabular and graphical representations support the observations made. Using student engagement as a primary calibration, this paper expounds how traditional learning and teaching methods are of minimal help in trying to alleviate the inhibition and cultural shyness rampant in international students. This study delineates a few recommendations that are primarily focussing on participatory learning, peer motivation and constructive feedback, all of which help mitigate cultural shyness and language issues. The research concludes summing up the need to transform from a traditional to a participatory learning and teaching pedagogy and expounds on some gaps in the paper surrounding the use of Artificial Intelligence in higher education.

Keywords: participatory learning, confidence, communication, traditional learning, cognitive elaboration

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INTRODUCTION

Shyness is universal with varying degree of intensity across different cultures (Afshan, Askari, & Manickam, 2015). Studies reveal that the results of diverse tests such as Henderson/Zimbardo Shyness questionnaire[i], Fernandez scale of independent-interdependent self-construal[ii] indicate a high extent of correlation between shyness, introversion and neuroticism. Leading to inhibitions, shyness hinders a *healthy interpersonal relationship* and *professional goal*. This statement seems in tandem with this study by Paulhus, Duncan, and Yik (2002) who confirm a self-reported higher rate of shyness amongst Asian students and the authors concluded that this characteristic had impact on students' classroom participation.

Being in a psychological state of discomfort, shyness impact social contact. Although there is no definitive cause of shyness, studies do attribute that trying to develop a relationship with the opposite gender on a one-to-one basis could contribute heavily to shyness. Finding computer-mediated communication to be easier than a face-to-face mode, this view aligns with cultural reasons as to why some international students display shyness in classrooms (Chu 2008). This also vindicates that in some cultures, showing restraint and self- control displays itself as a social competence. For others, avoidance of the spotlight and cultural shyness seems profound in East Asian cultures (Wang, Hempton, Dugan, & Komives, 2008). Alongside cultural shyness, some literature also criticise the negative impact from embarrassing feedback that could reflect negatively on students' behaviour. From the viewpoint of an international student covered with inherent cultural shyness and inhibition, a negative and a less constructive feedback signals that very phobia of classroom participation and a changed behaviour.

Attempting to delve into participatory learning, it is that collaborative work environment where people work effectively and respectfully in a diverse team. Participatory learning inculcates those qualities of both working in a team and for a common cause. Working with flexibility, learning to compromise, valuing individual contributions are other tenets of participatory learning. This research aims to explore the positive relation that participatory learning holds with confidence and communication. Comparing traditional learning[iii] and teaching pedagogy with participatory learning techniques and spaced learning[iv] (Tech, 2017), this literature review discusses various other findings such as cooperative learning[v], cognitive elaboration[vi] relevant to this study.

A positive emotional state in the form of motivation does help in encouraging international students to break of their shell and actively participate in classroom discussion. The peer support encourages self-initiation promoting effective mutual learning, improved confidence, and communication. Alongside motivationalist approach being one of the probable theoretical perspectives to achieve cooperative learning (Slavin, Cooperative Learning: Theory, Research and Practice, 1995), excerpts from the social interdependence theory[vii] distinctly display the effects of cooperative learning as largely dependent on classroom cohesiveness. This has a profound impact on motivating most of the international students who then interact with increased confidence. As mentioned above with reference to cooperative learning, social interdependence theory also focuses on cooperative learning such that the learning outcomes are positive and achievements, far greater (Johnson & Johnson, 2008). Aiming to promote classroom participation and practice peer-to-peer learning, this paper begins with understanding what is learning like in tertiary education. This study attempts to define both traditional and participatory learning, then draws a comparison between the two learning pedagogies using classroom observations and finally, concludes favouring participatory learning.

LITERATURE REVIEW

Studies indicate how challenging students enhance their learning outcomes (Scager, Akerman, Pilot, & Wubbels, 2017). Given the rapidly changing nature of all disciplines, a successful tertiary education

revolves around students' ability to think critically around complex problems and complex ways about difficult problems (Marra & Palmer, 2004). Literature also suggests that higher education should embrace a customer-oriented approach which within the concept of marketing is a pre-requisite for sustainability (deJager & Wulandari, 2018). Whilst discussing about sustainability, concerns about integrity and academic values comes into picture. To better understand the working of tertiary education, there is an underlying need to delve into and fathom the higher education industry constructs and the kind of approach that can be appropriately applied. Alongside, trying to get a grasp of student satisfaction, demographics such as gender, culture contribute munificently to student learning experiences. Clearly, the diverse learning and teaching pedagogy that international students come from also contributes to classroom participation (deJager & Wulandari, 2018). Thus, with these diverse abilities, it thus boils to the kind of educator, what they stand for and what the educators can do to help increase the psychological safety in students. Focusing on classroom participation, a positive outcome increases the aspirations of students, quality of education and a curriculum that encourages participatory learning (Mtawa, Fongwa, & Wilson-Styrdom, 2021).

This paper attempts to understand some forms of participatory learning before delving into the role of classroom discussion in building confidence and communication. Being the best form of participatory learning, cooperative learning in simple terms is that instructional method where teachers break the classroom into small groups and facilitate an atmosphere for mutual learning (Slavin, Instructions Based on Cooperative Learning, 2011). Recent studies expound a new innovation in learning and teaching pedagogy that supports participatory learning concept through a more focussed model called the 'Block Model', devised by Victoria University, Melbourne (Jackson, J; Tangalakis, 2022). This unique model of learning expects students to enrol into one unit for an intensive study over a period of four weeks. Offering an alternative to the usual three to four units over a period of twelve weeks of teaching, innovation coupled with participatory learning appears to have had a significant impact on students' performance, reducing their failure rate by 40%(Jackson, J; Tangalakis, 2022). This improvement being more profound in international students from non-English speaking backgrounds, better performance of students was an outcome of participatory learning with adequate focus and peer support.

Helping students participate in classroom discussion builds confidence. Choosing challenging situations helps students deepen their understanding of concepts and participate in classroom discussion that certainly enhances confidence and communication. To communicate better in classroom discussion, students could better equip themselves by keeping abreast of the required information. This encourages students to share their insights better leading to a group cohesion/ classroom cohesion, also referred to as a cooperative learning. Alongside, maintaining students' psychological safety gains prominence (Scager, Akerman, Pilot, & Wubbels, 2017). Encouraging student participation rather than stigmatizing them and their thoughts gains importance. The level of motivation relates proportional to the level of cohesiveness prevailing in a classroom.

In his Science and Human Behaviour, Skinner (1953) expounds how stigmatising a student for their work makes the palm of their hands sweat and to kick the cat (Skinner, 1953). Research states that criticising a learner leaves a negative impact and that criticism reflects on their behaviour causing emotional changes from which germinate fear. From the viewpoint of an international student, a negative and a less constructive feedback signals a phobia of classroom participation. To ensure international students do not feel disadvantaged given their differences in culture and language, constructive feedback coupled with peer observation helps. Clearly, with minimal interference from the facilitator, students motivate one another and converse between each other with greater confidence. Thus, a supportive learning environment sets in when students are clear and prepared for the task lying ahead of them (Cohen & Lotan, 2014). Participation in classroom discussion increases the enjoyment of learning holistically in students (Scager, Akerman, Pilot, & Wubbels, 2017).

For achieving a purposeful participatory learning, for students from diverse cultures, choice of language and its use to convey meanings within an intercultural context play a profound part in either reinforcing barriers or promoting intercultural competence (Dunworth, Grimshaw, Iwaniec, & McKinley, 2021). Language therefore plays a pivotal role around intercultural competence and expounds how students perceive culture. With culture being a dynamic process, it emerges through interaction. Clearly, in a participatory learning environment, peer-to-peer discussion amongst diverse cultures helps with the emergent process. Whilst mentioning that shyness and inhibition forms an inherent part of international students predominantly, language helps break this barrier. In sharp contrast, a traditional learning environment could appear less effective. It thus becomes apparent that language used in a classroom environment, acts as a stimulus to help international students come out of their reticence and partake in classroom group discussions.

From an emic perspective, fluency in a language helps students become more participative in classroom discussions and further, use of language in particular either facilitates or debilitates the cultural competence in a classroom environment. As against traditional approach, participatory learning environment that encourages communication between intercultures, a traditional learning environment occludes the achievement of cultural competence in a classroom environment. Good communication and confidence among diverse cultures helps build positivity and enhances employability in the process. It is worth noticing that from an educator's perspective, conflating language capabilities profoundly affects learning, confidence and communication, by creating disconnect among students in a participatory learning environment.

Studies expounds that motivation does help in encouraging international students to come out of their shell and actively participate in classroom discussion. This peer support encourages self-initiation that promotes effective mutual learning, improved confidence and effective communication. To bring about a change in the overall emotional predisposition, a favourable approach seems important, that said, a specific effect often best discovered is the increased classroom participation of students as the study period progresses. The steady progress in classroom participation as outlined in both tabular and graphical representations shown in this research, clarifies the profound role played by participatory learning in enhancing confidence and communication in international students.

With this sole intention to improve teaching quality, the data collected informally using complete observer method show some initial gaps indicating a quiet behaviour from international students; in particular, these signs signal a withdrawal syndrome by students from classroom participation. Rather than breaking away from that shell, some students move away from participating in classroom discussions and mutual learning. Although not aversive, student who abstain from partaking in classroom discussions merely escape from the very tenet of participatory learning. Owing to the past conditioned negative reinforcements, students tend to avoid an aversive condition. Rather than rekindling the past behaviour back into action, motivation, peer-to-peer support and encouragement help, create that positive reinforcement.

Non-participation is showing another quality associated with aversion and avoidance commonly referred to as anxiety. Feeling anxious about classroom participation and participatory learning makes some international students engage either minimally or nothing in classroom discussions. Anxiety is not a cause but is a behaviour and a special case of emotion according to Skinner (1953). Observation shows that when students help and motivate each other, the learning process automatically begins alongside the care and support that emanates in the process, thereby reducing anxiety. The self-initiation process that takes shape leads to better interaction, among international students. Thus, classroom participation helps achieve the dual effect of better learning coupled with enhanced confidence and effective communication skill, which reflects on the positives of participatory learning and teaching. Thus, rather than widening the existing hiatus, participatory learning provides a convincing solution to close the gap.

In sharp contrast, a traditional learning method pictures a student to be a recipient of information and the educator, a repository of knowledge or information. Thus, the shyness and inhibitions resident in international students stems from a disciplined classroom set up. Persistent motivation from the educator accompanied by peer-to-peer motivation drives these taciturn students to the phase of self-initiation as is apparent from the various graphs shown. The increasing participation in classroom group discussion vindicates the importance of transforming from a traditional to a participatory form of learning and teaching and clearly reflects the positive outcome owing to this transformation.

Participatory versus traditional learning- the difference

Participatory Learning in international students

Studies expound how participatory learning helps students develop that critical thinking and creativity. In short there exists an acme of cognitive elaboration when adopting a participatory learning and teaching pedagogy (Missinger, 2013). Alongside active classroom discussion, participatory learning offers a convenient way to move away from the traditional learning and teaching methodology by adopting these four elements[viii] such as:

- Asset based teaching.
- Enabling deliberative processes and collective learning
- Problem posing pedagogy and
- Involvement of students in the construction of knowledge.

Highlighting the interactive methods in a participatory form of learning, educating students takes a completely new form when focusing on the holistic development of students. Literature on participatory form of learning delineate how it enhances critical thinking and helps learners to bring that necessary transformation in their overall learning (Kroll & LaBoskey, 1998). Participatory learning, unlike the traditional form enhances individual students' learning through collaborative techniques[ix], classroom participation by engaging actively in classroom group discussions. Reflecting on the teaching practice, as overt from the table and graphs in the research methodology section, higher-classroom participation rate vindicates the positive outcome from participatory learning and teaching.

Teaching being an interactive process creates an environment where both educators and students carve their mutual expectations of a conducive learning environment with clarity being the epicentre. Thus, rather than a traditional learning environment, an informal participatory learning atmosphere ensures deeper multicultural engagement, where in most cases, learning extends beyond a classroom environment. While domestic students avail the opportunity to understand cross-cultures, international students benefit with ample confidence and their acquired ability to communicate with cross-cultures without much inhibition(Leask, B., Carroll, 2013). An extensive read of the literature in tandem with the data collected for a self-reflection provides convincing answers surrounding the positive role played by participatory learning in enhancing the employability of graduands with adequate confidence and communication.

International students, in most cases come from a traditional learning mould of memorising and examination techniques. In sharp contrast to traditional learning, a more participatory form of education with a spaced learning approach helps students retain the learnt information far more effectively. Displaying stark differences from its traditional learning counterpart, participatory learning guarantees an in-depth knowledge and understanding of the concepts. Clearly, rather than merely acting as a dispenser of knowledge, the facilitator here encourages classroom participation, challenge and collaboration with one another (Akar & Yildirim, 2005). Collectively along with participatory learning, enhancement of learning outcome is limpid. Having grown up more with examinations and recitations, when exposed to a participatory learning pedagogy (Stephen Perse Foundation, 2017), these students find themselves in a more

comfortable position of being able to retain the gathered information much better. As a steady progress, being able to participate in classroom discussions instils that very confidence and communication unlike in a traditional environment where classroom discipline is the norm.

An essential tenet of participatory learning is the ability to support and cooperate with peers from diverse cultures. Although cultural change and acceptance does not come easy, breaking the preconceptions and adapting to new cultures makes students learn more when in a multicultural environment and in a participatory form of learning. Thus, the culture of shyness and reticence rampant in international students rather than becoming monolithic, becomes penetrable making students more competent in their ways of thinking. Using the model of cooperative learning process (Slavin, Cooperative Learning: Theory, Research and Practice, 1995), this research using its primary element called classroom discussion, expounds, how language and understanding of diverse cultures enhances participation capabilities in international students and helps build their confidence and communication skills.

Thus, constructivism is a culture of how learners interact with their peers, experience the subject matter and relate it to the teacher (Windschitl, 1999). The overall learning and teaching calls for a constructivist paradigm where students enjoy being empowered to expand their knowledge through collaboration and interaction. An experiential learning, evaluation and reflection along with self-observation makes students better prepared. As against the above, the traditional learning environment holds more of competitive grading and less classroom participation (Slavin, Cooperative Learning: Theory, Research and Practice, 1995).

Traditional Learning

In contrast to participatory approach, the traditional learning and teaching pedagogy uses more recitation and memorization techniques in their learning process (Stephen Perse Foundation, 2017). A traditional education system also called conventional education seems to be popular in some educational institutions. This vindicates the statement that students coming from a traditional learning background are more comfortable memorizing than thinking critically and participating in classroom discussions for mutual learning. Studies on traditional learning and teaching make it apparent that students reaped rich rewards for all their efforts. Evaluating the use of commercially developed materials, estimates suggests that while textbooks serve as the basis for 75% to 90% of traditional classroom environment, it does create a sense of need to understand the real effectiveness of this system (Stein, Stuen, Carnine, & Douglas, 2001). Literature surrounding traditional learning does reveal that information contained in these textbooks are either incomplete or incorrect leading to misinformation and creating a void in a student's overall learning.

With minimal classroom participation, the educator considered the epitome of myriad knowledge, assumes the same level of understanding from all students (Stephen Perse Foundation, 2017). Although a popular learning and teaching pedagogy, traditional learning and teaching has been a subject to criticism for the fact that there has been a modicum contribution towards helping students develop critical thinking and decision-making capabilities. The inherent weaknesses rampant in textual learning questions that effectiveness of traditional learning and teaching. In short, traditional learning quite distinctly falls short of cognitive elaboration aspect that constitutes the core of participatory learning. Considered a passive medium of communication, clearly with knowledge limited to the contents of the traditional textbook, the reader plays no part in any form of classroom interaction. As earlier mentioned, while the educator stands as a knowledge repository, students reap rich rewards for their ability to memorize and recite the textual contents. This vindicates the reticence of international students to participate in classroom discussions and critical thinking. Shyness and inhibition in these students primarily emanate because of inadequate fluency in language. Language does lay edifice for an effective communication as lack of fluency leads to unclear communication. Thus, while traditional learning focuses more on classroom discipline, classroom

participation in group discussions helps break both cultural and language barriers, thereby assisting in peer-to-peer discussion, enhanced confidence and communication (Dunworth et al., 2021).

Good educational practices deserve a good support (Brooks & Brooks, 1999). Rather than setting standards and developing capacity to enhance student learning, traditional learning lays emphasis on uniformity in learning, that is, all the students get to learn the same material at the same time with minimal scope for construction of knowledge. From these, that inherent shyness and inhibition resident in majority of our international students become overt. Despite these lags, surprisingly, traditional or conventional learning and teaching has carved a name for itself as being one of the most reliable forms of learning (Stephen Perse Foundation, 2017). In the process of transforming to a participatory learning mode, a brief look into constructivist learning methodology reveals that constructivism is where learners actively create, interpret and recognize their knowledge. Succinctly put, active classroom participation exists. This diverse display of understanding confirms the better grasp of students' learning (Windschitl, 1999). Constructivist learning further necessitates the use of peer-to-peer learning, inquiry activities and problem-based learning with teachers encouraging in-classroom participation and discussions to help students demonstrate their understanding in diverse ways (O'Shea, Baker, Allen, Curry-Corcoran, & Allen, 2007) .

Participatory learning versus Traditional learning

In traditional learning, one student's chances of success decrease the chances for another student, in most circumstance, favouritism from an educator is evident. Clearly, a traditional learning calls for that kind of a classroom environment where with the educator being the repository of knowledge, the flow of information stems from scholarly sources (Caroline, 2020). The nickname 'sage-on-the-stage'[x] fits traditional learning and teaching given the nature of its functioning (McInnerney & Roberts, 2009). Although participatory learning, works effectively in building confidence and communication, in those circumstances where memorising and repetitive learning is needed, traditional learning and teaching pedagogy fits the best. With intentions to develop critical thinking skills for employability, a participatory classroom with abundant discussions seems relevant. From the perspective of an educator, quite understandably, teaching across cultures does prove a challenge given the language barriers besides their tacit approach. This said, there appears to be a growing responsibility within educational institutions to equip educators with the necessary skills through intercultural support (Leask, B., Carroll, 2013).

As earlier mentioned, culture plays a profound part in determining behaviour and communication patterns. Understanding these diverse cultures and their associated behaviours does influence classroom participation in a participatory learning environment. As indicated previously, culture calibrates the extent of reticence in international students. With international students coming from a different learning and teaching pedagogy, differing expectations inevitably result in intercultural incompatibility. Diversities in culture accompanied by diversities in learning behaviours signals differing communication and confidence prevalent among students. Effort from educators in the form of inclusive learning environment exposes students from multivariate cultures to multivariate challenges and perspectives shared by their peers through participatory learning. These lead to the objectives of this research that revolve around motivation, peer support to enhance self-initiation, confidence and communication.

RESEARCH GAPS

Based on the literature review above, the following gaps seem overt. This research aims to fathom and address these identified gaps using classroom discussions. This would provide a dual solution to both harnessing and enhancing confidence and communication skills in international students. Some of these unexplored areas include:

1) Is shyness cultural or are there any other unexplored determining factors?

2) Insufficient information on those challenges that deter communication skills in international students.
3) Gaps surrounding whether confidence and communication are a hand in glove.

RESEARCH OBJECTIVES

Research objectives gain further prominence when explained using the diagram shown below. This diagram designed exclusively for the purpose of this research explains that when there is a cohesive group of students, peer motivation results in better classroom participation by international students. Enhanced motivation enhances confidence and communication skills leading to better learning outcomes. This provides a fitting solution to one of the research gaps whether confidence and communication go hand in hand. Clearly, as is evident from the above, the main objectives of this research include understanding:

1) What role does a cohesive classroom environment play?
2) The role of enhanced motivation in building confidence and communication
3) How does self-initiation lead to greater confidence and communication?
4) What constitutes better learning outcome?
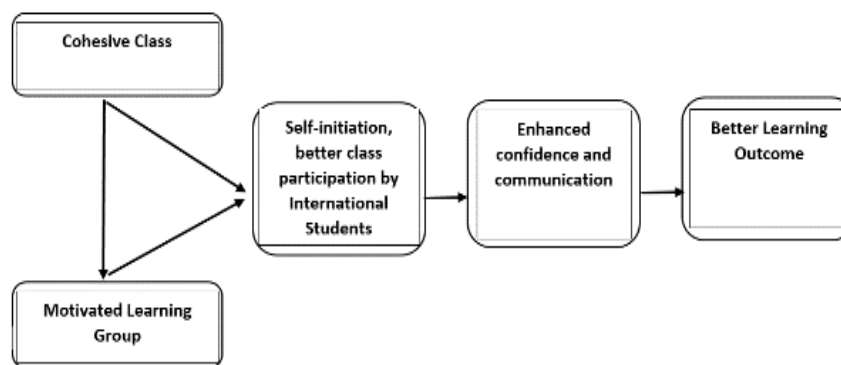
Figure 1. Learning outcome in a cohesive classroom environment
Source: The Author

Delving further:

1) Cohesive classroom: A cohesive classroom is the key for a productive classroom interaction (Slavin, Cooperative Learning: Theory, Research and Practice, 1995). It promotes mutual learning through peer support and constructive feedback from the educators. Group discussions in classroom become instrumental in creating that cohesive classroom environment unlike in the case of a traditional classroom atmosphere with strict in-classroom norms.

2) Motivation: Motivation seems important to increase student participation in classroom discussions. Helping their peers along with encouragement aides the mutual learning process and the. Constructive feedback / motivation work best to help the otherwise shy international students to break away from the shell. Participatory learning through a motivational approach result in a more holistic academic achievement.

3) Self- initiation, enhanced confidence and communication: Cohesiveness and motivation according to literature enhances caring and a sense of responsibility among students. This promotes the attitude of helping one another to achieve better results, which in turn leads to motivating shy

students to participate in classroom discussions. Such a motivation and peer support enhance learning along with better confidence and improved communication. Self-initiated learning leads to increased opportunities for confidence and effective communication. Cohesive classroom environment plays a pivotal part in encouraging self-initiation and confidence in those tacit students.

4) Better learning outcomes: In a participatory learning and teaching environment, students share ideas, encourage one another to participate in classroom discussions. Through a team environment and group discussions, Slavin (1998) expounds the collective responsibility exhibited by the students to encourage participation in one another along with instilling communication skills that brings about a positive transformation in the overall learning process.

METHODOLOGY

Qualitative research methodology: Complete Observer method in detail

Attempting to delineate the positive relation between confidence, communication and classroom participation, this research focussed on observational evaluation of international students undertaking the Master of Business Administration (MBA) programme. Aiming to address the research gaps already mentioned, the primary intent of this study clearly leaned towards a self-reflection of how a transformation in the teaching pedagogy enhances confidence and communication in international students. Making observations over 5 trimesters of teaching, a change in teaching style displayed a positive change. A positive relationship between participatory learning, classroom discussion, confidence and communication became overt.

Adopting a simple observation type called the complete observer method[xi]; this approach focused on observing students during their classroom group discussion time. Attempting to do away with any Hawthorne effect[xii] and possible discrepancies, students were unaware of these observations made. Reluctance to partake in group discussion was a common observation for the first few weeks. That said, concurring with one of the research objectives surrounding enhanced motivation for increased confidence and communication, interaction among international students showed signs of increase as weeks progressed. Clearly, with this being a complete observation with no participation from the educator, this complete observer method helped manifest that in a participatory learning, student, as individuals, seek outcomes that are both beneficial to themselves and to their peers in classroom. In sharp contrast, while competitive learning makes students work against each other, in a traditional learning environment, where students recite and/or memorise the concepts. Addressing one of the research objectives surrounding the role played by a cohesive classroom environment, a cohesive learning environment allows students to work together to maximise the benefits from learning mutually (Johnson, Johnson, & Smith, 2015).

The diagram below created for the purpose of this study, expounds the observations made in the complete observer method. The symbiotic and intricate relationship between participatory learning, partaking in classroom discussion, confidence and communication gains prominence. Displaying how these different entities are inextricably interrelated, not fulfilling the previous characteristic would prevent the achievement of the succeeding characteristic; a lag in any of these impacts the overall learning outcome. Complete observer method helped understand how:

- a cohesive classroom environment brings an overall development in students.
- motivation from peers builds confidence and communication leading to a better learning outcome.
- Motivation without any influence from the educator allows for self-initiation to participate in group discussions.
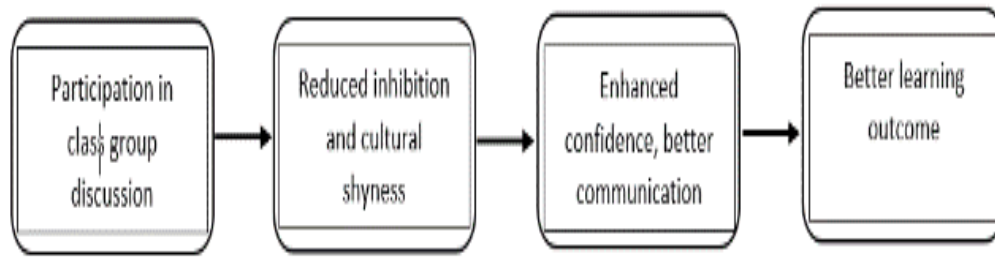
Figure 2. Participatory Learning, Confidence and Communication – a symbiotic relationship
Source: The Author

Trying to address the research objectives using the complete observer method, observations favour transforming into a participatory learning method to increase the involvement of students in classroom group discussion. Enhanced motivation aides in removing the inherent shyness. With the support and motivation from their peers in particular, increased confidence helps build effective communication; a mutually beneficial learning and a cognitive elaboration happens in the process. Motivation and cohesive classroom environment through class groups bring self-initiation and that changes students' confidence and communication skills. These address the research questions on how confidence and communication work in tandem than being siloed. Cultural shyness and inhibition rampant in traditional form of learning transforms to confidence and communication through participative learning making these graduands more employable. Answering this research question on insufficient information regarding challenges that deter good communication skills, it is evident that an ethnocentric curriculum design offers least help. With learning and teaching across cultures being complex, some minor holistic adjustments help make powerful changes in the overall confidence and communication capabilities of students.

With the educator being a pure observer in the complete observer method, this qualitative research approach asserts that peer-to-peer conversation, critical thinking, attitude to partake in class discussions profoundly influence learning outcome along with interpersonal skills. Quiet observations without influence of the educator also explains the rising ability of students to converse mellifluously among themselves within a classroom environment. The following triangle[xiii] (Gallwey, n.d.) below provides a fitting description to the above:
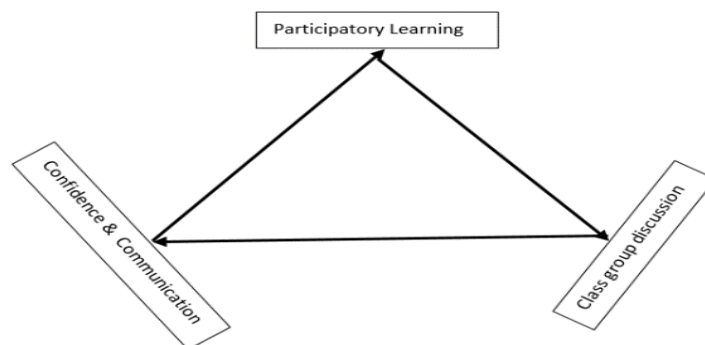
Figure 3: Participatory Learning Triangle
Source: The Author

A robust relationship between classroom discussion, confidence and communication, makes transition to participatory learning a necessity. Highlighting the intricate relationship between the elements: 1) classroom group discussion, 2) confidence and 3) communication, clearly, the outcome seen at every stage addresses the research questions mentioned earlier. The entities above mentioned also offer convincing answers to the research objectives surrounding enhanced motivation and cohesive classroom environment. Improved performance that follows displays a student's persona to either ossify or further develop confidence and communication by shedding their reticence. Moving away from the traditional learning and teaching pedagogy does invoke changes in students' learning outcomes.

FINDINGS: PRE-COVID AND POST COVID

Pre-Covid Findings

The following findings were overt from the observations using the complete observer method. The weekly classroom group discussions showed robustness; it became apparent that students' positivity was on the rise alongside confidence and communication. Motivational learning and cohesiveness became profound within each class where every student encouraged one another to partake in classroom discussions. Progressively, the inhibition and cultural shyness rampant in international students showed signs of fading away. These observations that were meant to be reflective for the purpose of improving teaching quality vindicated the positive impact created by participatory and inclusive teaching style. Vividly, alongside shyness, teaching pedagogy and reticence in students seemed to go hand in hand. As stated in the research objectives, motivation, cohesive learning environment pleasantly manifested into enhanced confidence and communication among students.

Other findings include a positive result for class sizes with smaller numbers along with a profound impact on larger class sizes. Students' participation, their confidence and communication showed convincing results in smaller class sizes. Their increase in confidence came about more quickly than for students in larger classroom sizes. Students in smaller classroom numbers exhibited that self-initiation and effective communications skills faster compared to their peers in large-sized classroom. Vividly, participatory learning and teaching technique along with peer-to-peer support and motivation appeared to work effectively on students in small-sized classes. Evidently, motivation made self-initiation quicker in smaller class sizes and together they played its part in building confidence and communication skills in students.

Comparison of communication across different classes – a succinct explanation

The table shown below compares the level of communication across five different classes. As is evident, the level of class participation from each student shows a gradual increase throughout the trimester. Being more of a reflection for improvement in learning and teaching, a sample of 5 different classes were chosen with qualitative research methodology as the research method. Findings from these informal observations revealed an interesting picture. Students who were spread across different trimesters of a 12-week study period over a year, belonged to classes of size ranging between 11-35 students per class. Observation was done for a period of 10 weeks. As weeks progressed, a robust increase in class participation became overt. Clearly, participatory learning proved a success among students who felt supported in a cohesive environment. Participatory learning also meant a mutual encouragement between students in all classroom discussions. A quick look at a simple table explains the above description.

Table 1. Communication across different classes – a comparison

No of students in the classroom	class 1: Tri 2 2019 (F2F) participation Per student	class 2: Tri 3 2019 (F2F) Participation per student	class 3: Tri 3 2019 (F2F) Participation per student	class 4: Tri 1 2020 (F2F, online) Participation per student	class 5: Tri 2 2020 (online) Participation per student	Total no of weeks students Observed
1	8	5	7	8	8	10
2	7	0	6	3	9	10
3	7	2	6	0	6	10
4	8	6	7	10	4	10
5	0	6	0	9	8	10
6	3	7	8	6	1	10
7	7	5	7	2	6	10
8	8	6	6	4	7	10
9	8	7	4	8	9	10
10	2	5	7	9	7	10
11	6	5	6	10	8	10
12	0	6	0	8	9	10
13	2	4	0	7	9	10
14	0	7	0	6	8	10
15	0	6	0	5	9	10
16	0	3	0	10	8	10
17	7	5	0	7	2	10
18	0	1	0	10	8	10
19	7	3	0	6	8	10
20	9	7	0	6	9	10
21	3	5	0	8	9	10
22	6	3	0	8	3	10
23	0	6	0	6	7	10
24	9	6	0	10	0	10
25	1	7	0	10	4	10
26	3	7	0	6	9	10
27	0	7	0	8	4	10
28	7	4	0	8	0	10
29	8	6	0	7	3	10
30	6	6	0	0	7	10
31	0	4	0	0	4	10
32	0	6	0	0	5	10
33	7	2	0	0	1	10
34	1	2	0	0	6	10
35	9	4	0	0	1	10

Grand Total	149	171	64	205	206	10

The table above shows classes with an average of thirty-five students except for Class 3, a small group of 11 students. The results of an informal observation of students partaking in classroom discussions for over 10 weeks of study period reveals some interesting results. Handling five classes with a range of 11 - 35 students, this observation revealed that over the 10-week period, progressively, the number of students participating in classroom discussions showed a continuous increase. Beginning with a moderate achievement of classroom participation, while some students showed high participation levels, some displayed lower levels, as evident from the table. That said, an organic improvement in classroom participation levels over time seems overt which effectively summarizes the effectiveness of a participatory learning pedagogy. When represented graphically as shown below, while classes 1 and 2 showed an organic progress in classroom participation, class 3 with a small group of students showed a very cohesive learning. A very distinct improvement seemed visible in classes 4 and 5. These two classes handled in the first and second trimesters of study in the year 2020 showed profound participation as evident from the area chart shown.

The informal data collected aimed for improvement in teaching with no intention for research purposes. The complete observer method of data collection used in this study, meant to transform teaching to become more participatory. The ultimate purpose behind this change meant improving confidence and communication skill in international postgraduate students and better employability. Along with, the idea of reduced reticence appears limpid through participatory learning.
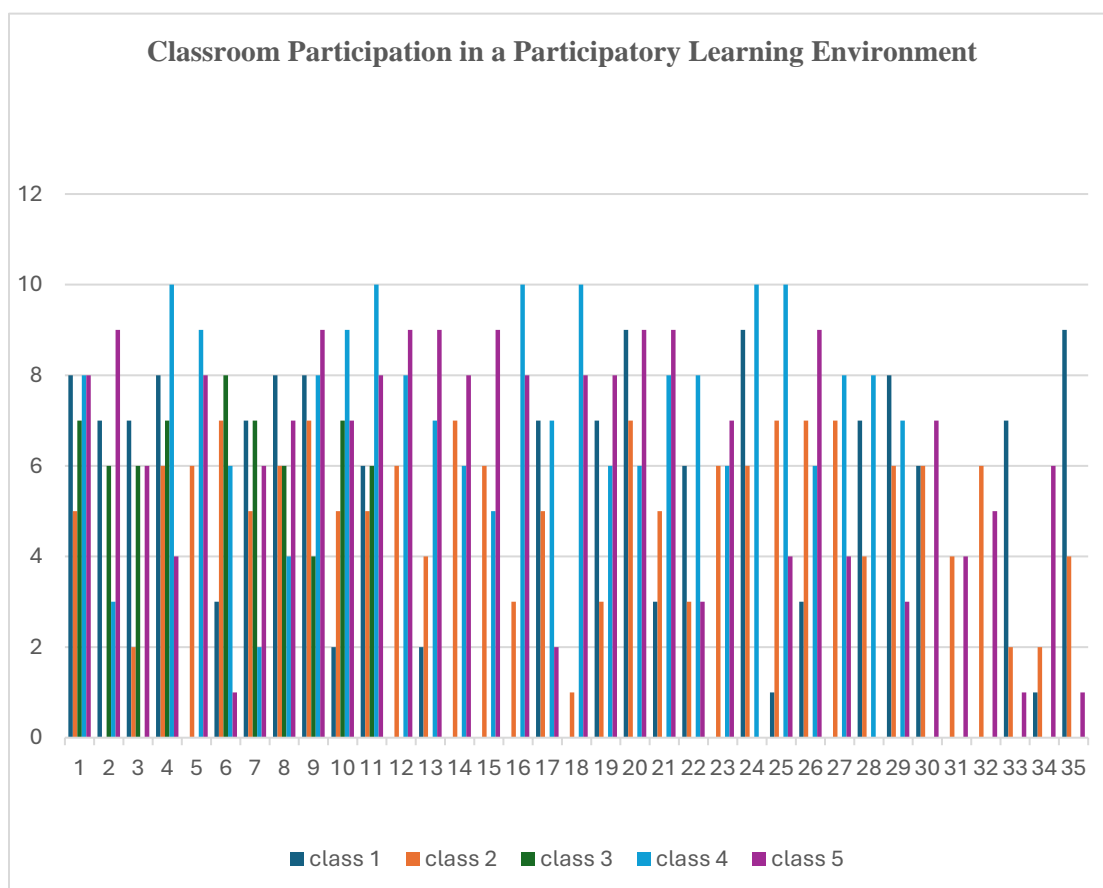
Figure 4. Classroom Participation in a Participatory Learning Environment
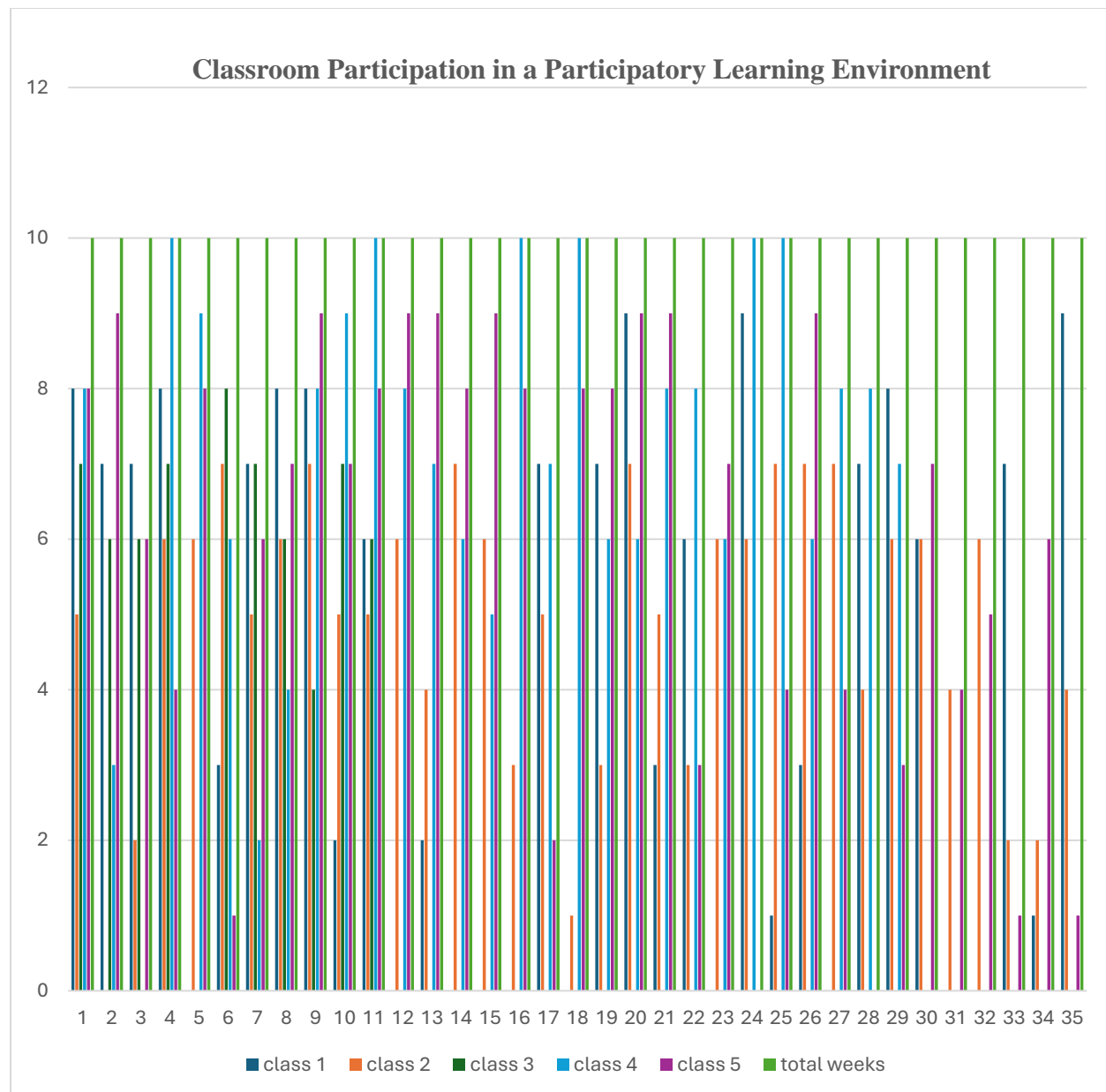
Figure 5. Classroom Participation in a Participatory Learning Environment

The column graph below explains the above description. The vertical axis denotes the total number of weeks (10 weeks) and the classes observed are shown as mentioned in the legend. While classes 1 and 2 showed a progressive improvement in classroom participation, class 3 with a small size of 11 students displayed an interesting revelation of a good classroom participation and an easy peer-to-peer motivation owing to their small class number. Participation in classroom discussions shows commendable improvement in classes 4 and 5, with students' participation evident in almost all the ten weeks of observation.

The above graph is a clear depiction of increasing confidence and a greater urge to communicate because of peer-to-peer motivation and participatory learning and teaching pedagogy.

Post Covid Findings

The 2020 student rankings of universities display a dismal picture of very low teaching quality and student engagement (Jackson, J; Tangalakis, 2022). Whilst comparing tertiary education and employability, Understandably, the Australian Tertiary education continues to struggle to meet the growing demands of Australian workforce. A seamless array of options presents itself to meet both students and employers' needs. With the onset of this medical pandemic, the hiatus between students and their employer requirements has greatly widened thereby creating a need for a reformation in the learning and teaching pedagogy(Noonan, P., Pilcher, 2018). A revolution in the overall learning and teaching pedagogy shows a switch to a hybrid teaching mode predominantly although face-to-face teaching is slowly gaining momentum. While online teaching seems to carve a name for creating disengagement and distance between students and their lecturers, innovations in teaching have offered a viable solution. Developed by Victoria University Melbourne, this innovation in learning and teaching pedagogy called *Block Classroom Model*[xiv], stands out in terms of imparting resilience, confidence and communication skills to international students during these uncertain times.

That said, by student engagement, a participatory approach confirms a positive impact on student participation. Satisfying outcomes seen using complete observer methodology reveals an interesting result as shown in the table and in the graphs. A steady progress by students in the online learning environment to partake in classroom group discussions seemed evident. Using participatory learning and teaching pedagogy in the online mode showed the same or even a better level of effectiveness. Self-initialization was on the rise with increased motivation and confidence to offer oneself for discussion given online learning mode. Classroom participation displayed a clear increase with students feeling more comfortable and confident to instigate a healthy discussion despite it being an online learning environment. Evidently, classroom participation in the above sample has shown a fair rise in virtual teaching and learning mode as against face-to-face (F2F)[xv]. As mentioned in the earlier pages, virtual teaching and learning environment have created an atmosphere where students are being their natural self during classroom participation. Quiet observations have vindicated that with little Hawthorne effect the innate conversational ability becomes stronger. While such pandemics likely cause emotional disruptions and breed uncertainty (Mendy, Stewart, & VanAkin, 2020), the positive side is the confidence it instils in students to communicate better.

RECOMMENDATIONS

Laying great emphasis on improving communication skills and confidence in international students, the following recommendations expound the research outcome of this study. Based on the extensive literature review and the various informal observations done through the complete observer method, this study recommends the following namely:

- A participatory learning and teaching pedagogy with a cohesive study environment: This helps students build confidence and communication skills both in a face-to-face and online learning environment.
- Peer support: Receiving support and motivation from their peers' help build the necessary confidence. Assisting in building a symbiotic learning environment, peer-assisted learning promotes self-initiation to partake in class group discussion that enhances critical-thinking ability in students. A look at the graph shown earlier vindicate the positive role played by classroom discussions in building strong interpersonal skills in international students. A student coming from a traditional learning environment, therefore stands to benefit when partaking in classroom discussion activities by alleviating the inherent shyness rampant.
- Constructive feedback: While negative feedback can impede the very confidence levels in international students, it also creates a phobia impeding smooth classroom discussions. A supportive, cohesive learning with constructive feedback encourages a clearer understanding of the

learning outcome and the assessment tasks that lie ahead. Further, constructive feedback makes participatory learning easier and enjoyable holistically besides mitigating any impediment surrounding language and culture.

CONCLUSION AND FURTHER SCOPE OF THIS RESEARCH

Summarising the importance of a participatory learning for enhanced classroom participation, this reflective paper analyses how increased motivation and self-initialization to partake in classroom discussions enhances confidence in students and increases effective communication especially in international students. This study also makes it apparent that the mode of delivery that is, be it face-to-face or in a classroom environment is immaterial for classroom participation. Although this paper has made devout attempts to stress on the importance of classroom participation, some gaps still exist. This study with its informal observations delineates the positive impact that classroom group discussions, peer-assisted learning and constructive feedback have on improving the students' performances. That said, this paper does not delve into any improvised learning and teaching pedagogies including the use of artificial intelligence in tertiary education. Clearly, artificial intelligence would change the very nature of learning and giving feedback to students; a sequel study on this would further magnify the scope of this research.

While many tertiary institutions have successfully transformed to include participatory learning as their pedagogy, there are other traditional institutions bringing this transformation seamlessly. Plenty recommendations exist about teaching, that said, some studies on cooperative learning expound the hiatus between application of theory and research to actual instructional methods (Johnson, Johnson, & Smith, 2015). Having a participatory classroom does present itself as a difficult caricature given the varying perseverance levels of international students besides the rigorous commitment from the facilitator. Creating a congenial environment to build that experiential repertoire which students bring along is more important and constructive than ignoring the views presented by the students; this aggravates their reluctance to cognitive elaboration holistically (Brooks & Brooks, 1999). The ability of the educator to revolutionise new learning and teaching pedagogy to suit the evolving needs of students munificently becomes profound. This motivates students for a mutual learning process as against the traditional system that is more of a competitive approach[xvi] than participatory.

In a participatory learning environment, a cohesive classroom ensures cooperative learning such that students partake in small group discussions in classroom and are motivated to do so by their peers. Involving actively in a constructive learning, students in a participatory learning process assuredly have a better grasp of some complicated concepts through a shared attempt to understand. Through these discussions in small groups, students strive for a continuous improvement, but that said, if students from a traditional learning background are competitive and more individualistic, then the whole concept of participatory learning becomes less effective (Johnson, Johnson, & Smith, 1998).

Clearly, rather than nurturing a learning and teaching pedagogy that helps students strive for a growth mind set, focussing on achieving high grades does not seem to adequately help in achieving the desired results. Rather than focussing on rewards and punishments that lead to fear of failure, focussing more on a constructivist approach through a social cohesive perspective[xvii] increases the quality of group interactions, confidence and ensures effective communication especially in international students (Slavin, Cooperative Learning: Theory, Research and Practice, 1995). Thus, this reflective paper using complete observer method concludes stating that participatory learning enhances confidence and communication. Results from various thematic analysis expounds the ontology of higher education with an entrepreneurial activity and employability as its epicentre (Rees, 2021).

As a reflection to improving learning and teaching further, this study aims to understand how transforming to a participatory learning and teaching pedagogy, the confidence and effective communication instilled help prepare students for different levels of leadership. That said, further improvements such as adding new perspectives that enrich learning and teaching pedagogy would enrich the quality of this research. More emphasis on the role of artificial intelligence in higher education especially with international students would enhance the scope of this research.

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[i] This is a scale to measure chronic shyness (Henderson & Zimbardo, 2001)

[ii] Independent self-construal is the extent to which people construe the self as being able to connect to other people. Those who calibrate high in interdependent self-construal, focus strongly on their relationship with others, and are concerned with ways in which they can benefit from their social group (Fernandez, Paez, & Gonzalez, 2005).

[iiiii] A traditional learning environment has classroom norms besides the educator is considered a repository ok knowledge. Students are least participative, but that said, many educational institutions still follow this traditional form of learning.

[iv] Spaced learning is where information is learnt by splitting the timeframe into shorter intervals and repeating this multiple times for a better retention of information.

[v] A modern learning and teaching method where the educator divides the classroom into groups and facilitates an atmosphere for mutual learning.

[vi] Cognitive elaboration is the process of processing information by thinking critically, active learning and developing schemas.

[vii] Social interdependence Theory is a good example of interaction among theory, research and practice. This theory states that the way goals are structured determines how individuals react. With over 750 research studies, on the merits of cooperative, competitive, individualistic efforts and conditions under which each is appropriate, these studies have validated, modified, refined and extended the theory. Social interdependence theory is widely applied especially in education (Johnson D. W., 2003)

[viii] As it is beyond the scope of this research, these elements are not studied. This paper tries to just mention them.

[ix] Collaborative learning, in simple terms occurs where there is a joint learning by students to achieve better learning outcomes.

[x] The professor regarded as a storehouse of knowledge transmits the same to the students. Students are expected to take notes, simply memorize that information and reproduce the same in an examination even without thinking about the information gathered (King, 2013).

[xi] Complete observer is one of the four types of observational research, where the observer is completely detached. The observer /researcher remains hardly noticed by the participants thereby minimising the Hawthorne effect (Sauro, 2015).

[xii] Hawthorne effect is the inclination of the people of an experimental study to change or improve their behaviour because of being chosen for study. Simply stated, people modify their behaviour simply because of being observed (Kenton, 2019).

[xiii] Although ideas have been taken from the stated source, this triangle has been created with entities pertinent to this research.

[xiv] Block Classroom Model, originally invented by Victoria University Melbourne, is where a student enrols into one subject and does an intensive study of that unit for four weeks. Thus, over a span of 12 weeks, students complete three subjects but studies them individually. This helps students to focus better and complete their studies with better results.

[xv] F2F is the short and abbreviated version for face-to-face learning where students assemble in a classroom and the lecturer or instructor would deliver the contents to those students in a classroom environment.

[xvi] In competitive learning, individuals work against each other to achieve a goal that either one or only a few will be able to attain. There is no motivation here to help each other because students prefer to work alone and want to compete against one another to be better than their counterparts. Competitive learning benefits one and deprives the others; further, achievements of self and failure of their counterparts are celebrated. Unlike in cooperative learning where the entire learning process is mutually beneficial and rewards are joint, here in competitive learning, rewards are limited and are based on a ranking system of best to worst (Johnson, Johnson, & Smith, 1998)

[xvii] A socially cohesive perspective holds that effects of cooperative learning surrounds the cohesiveness of the classroom. This simply means that students will engage in a task and help one another learn because they want everyone to succeed. Applying this perspective to our research, motivating each other to participate in classroom discussions guarantees a confident set of students with better communication skills.

PORTUGUESE STUDENTS' PERCEPTIONS OF THE FLIPPED CLASSROOM: A CASE STUDY IN DIDACTICS OF MATHEMATICS IN HIGHER EDUCATION

Hugo Menino, Susana Reis, and Ana Oliveira

ABSTRACT

This paper describes the experience of using a flipped classroom methodology in Portuguese higher education in the scope of the curricular unit of Didactics of Mathematics of the basic training for teachers and educators. The study was based on the research question: "What do higher education students think about the Didactics of Mathematics learning using the flipped classroom method?". The study was carried out with 39 students. The methodology used was a quantitative paradigm, namely the questionnaire, answered by 34 students, designed according to the relevant categories of the study of the flipped classroom pedagogical model. Results suggest that students enjoyed the flipped classroom model. As favourable arguments, students mentioned their engagement and learning, increased motivation, self-regulation of learning processes, and the development of critical thinking. This way, in the flipped classroom models, highlights go to the individualized and collaborative learning and the creation of spaces and contexts for the development of student-centred activities that involve more complex, challenging activities that are closer to the actual professional practice of future teachers. This paper makes an important contribution to understanding students' perceptions of flipped classroom, which can be an important indicator for planning (future) curricular units and teaching practice.

Keywords: Flipped classroom model, basic training for teachers and educators, didactics of mathematics, educational technology, higher education

INTRODUCTION

Hugo Menino *has a PhD in Teacher Training from University of Extremadura (Spain) and has been a higher education professor since 2000. Currently, he is a Coordinator Professor at the Polytechnic Institute of Leiria and Integrated Researcher at the Centre for Research in Education and Innovation (CI&DEI), having participated in several R&D projects funded by FCT (Foundation for Science and Technology) and European projects. He has extensive experience in international projects in the field of development education, teacher training and ddidactics of mathematics.*
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This training experience focused on adopting the flipped classroom methodology, a pedagogical model created by the Chemistry teachers, Jonathan Bergmann and Aaron Sams, in 2007 (Horn & Staker, 2015). The adopted model was the implementation model, designed for higher education, proposed by Limaymanta et al., (2021). This study aimed to describe the potential of the use of this model for learning, in higher education, by using a set of indicators that arose from the review of relevant work in this field. It is worth mentioning that despite the extensive international research on this subject, in Portugal, research on the flipped classroom model in higher education is still scarce as shown, for instance, by the bibliometric analysis made by Linling and Abdullah (2021).

Considered an active methodology that focuses on the active role of the student and the teacher as a facilitator, the flipped classroom model allows teachers to optimize learning time by removing education practices from in-class moments and focusing mostly on collaborative learning activities involving advanced processes (Kong, 2014; Bhagat, et al., 2016; Foldnes, 2016). This way, by distancing itself from the traditional classroom model, the flipped classroom model establishes that the basic concepts are introduced before the class, when students work autonomously, therefore allowing teachers to use their in-class time to guide students through active, practical, and meaningful activities (Bergmann & Sams, 2012). Fung et al. (2021) report greater effectiveness of the flipped classroom methodology in terms of students' academic results when activities include discussion, interaction, teacher feedback and collaborative group work.

While in traditional education the classroom is the place where teachers convey information to students and the students perform their assignments after the class to see if they understood the topic, in the flipped classroom the classroom becomes an active learning place, where there are questions, discussions and practical activities and where teachers work on students' needs and difficulties instead of teaching basic subject knowledge (Valente, 2014).

The Flipped Learning Network (Hamdan et al., 2013) established the four essential pillars of the flipped classroom: i) flexible environment, ii) learning culture, iii) intentional content, and iv) professional educator. The flexible environment comes from the need to change the classroom to facilitate different styles of learning and working methods of students, such as group work, working in pairs, or autonomous work. Student learning times and evaluation types should also be flexible.

As to the learning culture, there is a change in how students see teachers, as teachers become those who are actively engaged in student learning and evaluation. When it comes to intentional content, the teacher is responsible for assessing which content they need to use while teaching directly and which content the students will deepen by themselves, while guaranteeing those learning goals are achieved and students' needs and interests are met. Lastly, educators must be professional, as they are responsible for assessing which strategies and resources better suit autonomous study while managing autonomous study and in-class time, therefore enhancing interactions, discussions and the analysis of difficulties. Feedback is an essential part of this process because it allows for continuously improving student learning (Hamdan et al., 2013). Through the dynamics of flipped classrooms, the teacher closely monitors the student's work and provides them with immediate feedback on their performance, supporting the implementation of a constructivist approach to teaching and learning, with active and involved students (Cevikbas & Kaiser, 2020).

Based on the results of bibliometric analysis and the background review, Limaymanta et al., (2021), present a framework to implement a flipped classroom in higher education. For this, they analysed: (a) papers by more productive authors; (b) results from the keywords co-occurrence network; (c) papers with more citations in the Web of Science and Scopus databases; (d) seminal studies by Bergmann and Sams;

and € flipped classroom studies in the context of covid-19. The framework has five components (fig. 1): (a) planning; (b) induction session; (c) pre-class activities; (d) in-class activities; and € post-class activities.
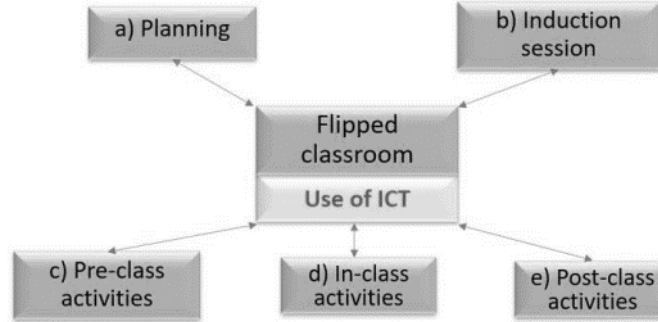
Fig. 1 – Descriptive framework to implement a flipped classroom in higher education (Limaymanta, Apaza-Tapia, Vidal, & Gregorio-Chaviano, 2021)

In this model, information and communication technologies (ICTs) are used to disseminate work materials but are also a form of collaborative work. The authors argue that the course must be carefully planned by the teacher and that an induction session is essential to present the methodology in detail and clarify work methods and teacher and student roles. When implementing the flipped classroom method, there are tasks with different features and intentions that are performed in three moments (before, during and after the class).

As to the impacts of the use of the flipped classroom in higher education, the literature states that there is a significant number of gains in terms of learning, especially when it comes to the development of advanced skills, such as communication and collaboration (Bergmann & Sams, 2012; Clark, 2015), problem-solving, time management, self-regulation of learning (Akçayir & Akçayir, 2018; Cilliers & Pylman, 2020; Sosa Díaz et al., 2021), and critical thinking (Zainuddin & Perera, 2019). A recent study by Liu and Zhang (2022) showed that the advanced performance and skills of higher education students, such as critical thinking and willingness to solve problems, were significantly better when they attended a flipped classroom when compared to traditional classrooms.

Moreover, the studies of Alamri (2019), Martínez-Jiménez and Ruiz-Jiménez (2020) or Salimiet al. (2022) highlighted that, in higher education, student satisfaction and learning increased when a flipped classroom methodology was used. They also stated that there is also a closer, more spontaneous relationship between students and teachers. In general, students' perception of the flipped classroom is widely positive (Bergmann & Sams, 2012; Cilliers & Pylman, 2020). They show a positive attitude regarding the effects of this type of class on motivation, engagement, learning, and collaborative work (Rasmussen et al., 2021). The successful implementation of this methodology is an opportunity to boost students' mathematical thinking and understanding, using differentiated teaching in interactive and flexible environments (Cevikbas & Kaiser, 2020).

The differentiating aspects of flipped classroom, compared to a traditional methodology, make it considered innovative. The adoption of innovative practices, whatever the area and context, requires awareness, interest and ownership. If we take the example of areas such as business and management, the study by Koubaa and EpKoubaa (2012) is quite significant. The authors state that the sense of innovation can help the person to understand the problem, find the solution and differentiate themselves from the rest, as well as seek as much information as possible to propose new alternatives, different from the others.

Considering the implementation of the flipped classroom methodology specifically in the maths classroom, Yang et al. (2021), in a literature review that included 82 articles, found benefits of the flipped

classroom in terms of student learning, confidence and improved attitudes towards learning and the development of problem-solving skills. Lopes and Soares (2018) implemented the flipped classroom methodology in a financial mathematics course, obtaining positive results on students' achievement overall.

Cevikbas and Kaiser (2023) emphasize that the flipped classroom contributes significantly to the psychological and affective development of students, with the development of positive attitudes and feelings towards mathematics, which include pleasure, enthusiasm, motivation, and interest in learning. Furthermore, the authors report contributions to pedagogical and academic development, with a positive impact on student performance in mathematics (increase in students' exam/test grades after flipped classroom interventions), learning progress, active involvement, and work collaborative. However, Fung et al. (2021) previously argued that, although the flipped classroom is an effective alternative teaching and learning strategy, the evidence is still not strong enough to conclude whether this methodology is better than the traditional approach in terms of students' academic performance and perception (Fung et al., 2021). Also, Güler et al. (2023) reinforce this idea, highlighting that although several studies argue that the flipped classroom methodology is effective in improving performance in mathematics, the results are not consistent. At this level, the authors concluded that the effectiveness of the flipped classroom varies depending on the level of education, being effective at all levels but more significant in fundamental education, which can be justified by the mathematical content covered. Class size also seems to have an impact on the effectiveness of the flipped classroom: performance seems to be better in groups with a smaller number of students (Güler et al., 2023).

The following sections present the methodological questions (which explain the scope of the study), the research question, the data collection and analysis process, the results, the discussion and the conclusions.

METHODOLOGY

Research Question

This study aims to describe a teaching experience using the flipped classroom methodology, in the scope of the training of teachers, in Portugal. The research question for this research was: "What do higher education students think about the Didactics of Mathematics learning using the flipped classroom method?".

Curricular Unit Planning

The flipped classroom experience presented herein was conducted in the scope of Portuguese higher education in a curricular unit (CU) of Didactics of Mathematics, a subject of the 5th semester of the Basic Education Degree. The CU had a duration of 30 in-class hours, organized into 2-hour classes over 15 weeks. Classes were taught on the same weekday, by the same teacher, during the winter semester of 2021. Classes were given to two classes, a group of 20 students and another group of 19 students. The framework proposed by Limaymanta et al. (2021) for higher education was used to conceptualize the work.

CU activities were fully planned and scheduled, including the selection and creation of materials to be used and the elaboration of work scripts for each class before the beginning of classes (*Planning*).

At the beginning of the semester, the methodology to be used in the CU, as well as the planning and timeframes, were presented to the students. Work stages for each weekly class, including pre-class, in-class and post-class work, were described in detail, and there were examples of the type of resources that would be provided and the type of activities that would be proposed. This was especially relevant because

the flipped classroom methodology implies an appropriation of the changes in student and teacher roles (Kong, 2014; Bhagat et al., 2016; Foldnes, 2016). Moreover, it was important to emphasize the relevance of autonomous work, particularly pre-class work, based on provided resources (*Induction session*).

Each week, the dynamics were based on three core moments:

i) *Autonomous work, before class* – multiple varied resources, such as educational texts, research papers, videos, and pedagogical proposals, were provided weekly for students to read, analyse and take in the fundamental theoretical aspects of each theme being studied (*Pre-class activities*).

ii) *Group work, during class* – in each class, after a summary of class content and goals, provided by the teacher, students started the analysis and discussion of the educational questions presented in the class script, where, via problems, they deepened the aspects that they had analysed before the class. This was group work that included discussions about contextualized educational episodes, the creation of assignments and resources for the classroom, oral presentations and simulations (*In-class activities*).

iii) *Individual work, after class* – after each class, students were told to make a summary of the contents that were addressed. In addition, virtual tools, such as *Kahoot!*, were used to perform assignments online, which helped track student progress (*Post-class activities*).

Data collection instrument

This study aims to describe a teaching experience using the flipped classroom methodology, in the scope of the training of teachers, in Portugal. The research question for this research was: "What do higher education students think about the Didactics of Mathematics learning using the flipped classroom method?". The methodology used was essentially quantitative, and the instrument was the questionnaire. The questionnaire was designed to gather data concerning relevant categories of the study of the pedagogical flipped classroom model systematized in the studies of Akçayir and Akçayir (2018) and Cilliers and Pylman (2020) and validated by experts. Answers were collected in terms of the degree of agreement with the affirmations presented, using a 5-point Likert scale (from 1 = strongly disagree to 5= strongly agree). The questionnaire was divided into six sections that matched the following categories: 1 – *active engagement and learning*; 2 – *satisfaction*; 3 – *collaboration and communication*; 4 – *motivation*; 5 – *self-regulation*; 6 – *critical thinking*. The instrument Cronbach's alpha was 0.872, which indicates good reliability. The questionnaire also included an open field where the respondents were invited to leave comments with their global assessment of the teaching experience. These answers were then analysed as to their content, which allowed them to give a qualitative look that complemented the quantitative analysis. The questionnaire was performed via Google Docs and its completion was voluntary and anonymous. It was completed by students who attended the classes in their last week of classes. The response rate was 87% (34 students).

RESULTS

In this section, there is a description and discussion of the results that were obtained after the application of the instrument described above.

Active engagement and learning

The first analysis category focuses on multiple aspects related to student engagement in the classroom and their learning. Results for this category are presented in table 1.

Table 1. Results for the *active engagement and learning* category.

	Results (%)				
	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
Resources provided in the CU helped my learning.	0	0	0	44.1	55.9
Topic and resource diversity prepared me for an effective participation in discussions.	0	0	8.8	53.0	38.2
I was encouraged to read more and deepen the autonomous study of topics discussed in classes.	0	0	11.8	35.3	52.9
With the flipped classroom methodology, this CU provided useful learning experiences.	0	0	2.9	38.2	58.9
Learning at this CU was high quality.	0	0	8.8	47.1	44.1
The flipped classroom methodology helped me learn more than what I would have learned in a traditional classroom.	0	2.9	8.8	35.3	52.9

The items concerning the utility of materials and resources provided in the CU for learning show high agreement percentages, which might indicate that materials provided before classes, for autonomous study, were perceived as useful and adequate by students. Students said that they agreed or strongly agreed that the materials provided helped them with their learning, which reinforces the importance of pre-class activities. In addition, 91.2% of students said that they agreed or strongly agreed that the diversity of topics was important for them to feel able to effectively participate in the discussions in the classroom. Most students (88.2%) agreed or strongly agreed that the used methodology enhanced the deepening of study topics when they studied autonomously. In terms of learning, 91.7% of students believed that the flipped classroom methodology provided them with useful learning experiences, and 91.2% agreed or strongly agreed that learning in the CU was high-quality learning.

In addition, the questionnaire asked students to comparatively evaluate the flipped classroom methodology and the traditional classroom in terms of learning. Most students (88.2%) agreed or strongly agreed that the flipped classroom methodology helped them learn more than the traditional classroom. There were also 2.9% of students who disagreed and 8.8% of undecided students.

In the open field of the questionnaire, multiple students have highlighted the advantages of the flipped classroom methodology related to engagement and learning. The following comment shows those dimensions:

I think this classroom model left students more at ease and more confident to participate in classes. It also helped with the learning process, because the teacher created several moments where we analysed practical examples so that we could apply that in the future as teachers. In my opinion, this experience was totally different from the traditional model, which interested me immensely, because I felt engaged in assignments and highly predisposed to perform them.

Satisfaction

One of the goals of this study is to learn students' satisfaction levels with the flipped classroom experience. Table 2 shows the results for this category.

Table 2. Results for the *satisfaction* category.

	Results (%)				
	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
The CU was challenging positively.	0	2.9	8.8	35.3	53.0
CU activities met my expectations in terms of expected learning.	0	2.9	20.6	26.5	50.0
Proposed activities showed the relationship and usefulness of learning in terms of future professional performance.	0	0	5.9	35.3	58.8
The teacher seemed to be interested in the levels of engagement, learning and understanding of students, in the scope of addressed matters.	0	0	5.9	23.5	70.6
I enjoyed the methodology used in classes (flipped classroom).	0	2.9	14.7	38.2	44.2
As a result of my experience with this CU, I would like to attend other CUs with the flipped classroom methodology.	0	8.8	11.8	41.2	38.2

According to the results, researchers can say that students have a positive opinion about the methodology that was used (84.2% of students stated that they enjoyed the methodology that was used in the classroom). There were 2.9% of students disagreed with this affirmation and 14.7% were undecided. Aligned with the previous result, 79.4% of the students said they would like to attend other CUs where the flipped classroom model was used.

Nonetheless, in the questionnaire, there was one student who said that despite being satisfied with the flipped classroom methodology, he/she thought that sometimes it would have been easier if the concepts had been explained by the teacher. This perspective highlights the resistance of some students to self-regulation and autonomous study, which will be discussed below. This student stated:

> *I enjoyed the fact that we (students) could explore the activities and study autonomously using the resources that were provided by the teacher, however, I feel that I am still highly attached to the traditional teaching method because sometimes I felt like some concepts would have been easier to understand if they would have been introduced and explained by the teacher.*

It is worth mentioning the high degree of student satisfaction concerning proposed activities, in their relationship with future professional careers, and also concerning the teacher and their attention to student engagement and learning. In fact, 94.1% of students said that they agreed or strongly agreed that the proposed activities showed the relationship and usefulness of learning to their professional performance. The same percentage of students said that they agreed or strongly agreed that the teacher was interested in the student's level of engagement, learning and understanding of the matters that were addressed.

Collaboration and communication

One of the features of the flipped classroom is to allow for more opportunities to interact with the teacher and with the other students (Bergmann & Sams, 2012; Clark, 2015). In this sense, the questionnaire

included five items to describe students' perception of collaboration and communication dynamics in a flipped classroom pedagogical model. These results are shown in Table 3.

Table 3. Results for the *collaboration and communication* category.

	Results (%)				
	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
When compared with other CUs, I believe this CU has promoted interaction.	0	0	14.7	23.5	61.8
The CU encouraged joint work between peers before, during and after classes.	0	5.9	14.7	47.0	32.4
In-class discussions helped me understand other points of view.	0	0	2.9	44.1	53.0
The questions brought by the students and their feedback were valued and considered in discussions.	0	0	2.9	38.2	58.9
I learned by working in groups and discussing ideas with the teacher and my colleagues.	0	0	5.9	38.2	55.9

This was the only CU in the course where the flipped classroom model was used and 85.3% of students agreed or strongly agreed that this promoted interaction when compared to the other CUs. According to 79.4% of students, the methodology used in this CU encouraged joint work before, during and after the classes. This interaction was seen as positive because students confirmed that the discussions in the classroom helped them understand other points of view (97.1%), that the questions that were raised were valued and taken into account in the classroom (97.1%) and that such discussions and joint work between students and teachers were learning opportunities (94.1%).

Motivation

The fourth category that was analysed was motivation, the results of which are shown in Table 4.

Table 4. Results for the *motivation* category.

	Results (%)				
	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
I felt excited about the methodology used in classes.	0	0	17.6	47.1	35.3
I felt motivated to learn the content of this CU.	0	2.9	5.9	50.0	41.2

As to this category, students were asked to express their degree of agreement with the affirmation; "I felt excited with the methodology used in classes." None of the students disagreed. There were 82.4% of students agreed or strongly agreed and 17.6% of students were undecided. In addition, 91.2% of students stated that they have felt motivated to learn the content planned for this CU. Only 2.9% disagreed with the affirmation that they felt motivated, and 5.9% were undecided regarding such affirmation.

These results are in accordance with previous studies that show the potential of the flipped classroom methodology in the motivation of higher education students (Akçayir & Alçayir, 2018). The

following student affirmation, left in the open field of the questionnaire, shows the potential of the flipped classroom methodology in the motivation of higher education students:

> *I believe that this model made classes more interesting. I felt highly motivated, in the sense that, when concepts were addressed, we already had an idea, making it possible to reflect on the topics and participate in classes more confidently.*

Self-regulation of learning

One of the goals and perhaps the greatest challenge of the flipped classroom methodology is self-regulation. Table 5 shows the results for this category.

Table 5. Results for the *self-regulation* category.

	Results (%)				
	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
I felt responsible for my self-learning.	0	0	5.9	44.1	50.0
This methodology was an opportunity to manage autonomous study processes.	0	0	5.9	55.9	38.2
I have learned autonomously from the study materials provided.	0	0	14.7	55.9	29.4
I invested a significant amount of effort in researching and studying different topics to boost my learning.	0	2.9	26.5	44.1	26.5
I was able to organize and manage my study with the flipped classroom model.	0	0	32.4	52.9	14.7

In general, students showed high degrees of agreement with all affirmations, showing the advantages of the flipped classroom methodology in the development of self-regulated learning processes. Almost all students said they felt responsible for their learning (94.1%) and that this methodology was an opportunity to manage autonomous study processes (94.1%). In addition, 85.3% of students agreed or strongly agreed that they learned autonomously from the materials that were provided. The following comment that a student left in the open field of the questionnaire illustrated the advantages of the methodology used in multiple dimensions of the self-regulation of learning:

> *This active flipped classroom methodology allowed me to learn and not just memorize the contents. The fact that we first read the recommended bibliography and then applied it, allowed me to better systematize my ideas. I am a person who needs to organize my thoughts constantly, to summarize them (via schemes, tables, etc.) and, in that sense, this method requires a higher degree of autonomous work and personal management. The fact that the materials are provided timely and the scripts meet the bibliography has helped me keep focus and not struggle to systematize my ideas autonomously. I summarized the ideas throughout the semester and, when I re-read them, I realized that I knew most of the content that was taught, because I had already researched, read and applied them in the classroom. This was my favourite CU of this semester.*

Most students (70.6%) said that they have invested a significant degree of effort in researching and autonomously studying the different topics. However, 26.5% of students stated that they were undecided about the affirmation, and 2.9% showed their disagreement, which means that this need for effort in terms of autonomous work was not perceived in the same way by all students.

In the open field of the questionnaire, one of the students mentioned the tensions between the volume of autonomous work estimated by the teacher and the volume of autonomous work they consider reasonable, by stating:

> *I believe the volume of autonomous work was incredibly high. There were many materials to analyse because there were new topics to deepen every week. Considering that we had another 6 CUs in the semester, it was extremely difficult to manage time to meet the teacher's expectations.*

Despite this opinion, there was one student who mentioned that extra work but highlighted the importance of these classes for the development of self-regulation processes, opening horizons and showing another perspective of teaching and learning, which is essential in a training course for teachers. They stated that:

> *I had never attended a flipped classroom methodology. I find it extremely enriching because it motivates students to search for answers and not expect the teacher to do so. It requires extra work, but it gives us another perspective on education, which is quite interesting.*

Lastly, for this category, researchers have questioned students as to their ability to organize and manage their study with the flipped classroom model. Most students (67.6%) stated that they were able to do it. However, despite nobody answered that they disagreed, there was a relevant percentage of students (32.4%) who were undecided, which shows that this management might not have been easy for some of them. Researchers' interpretation is supported by some of the comments to the questionnaire made by the students, from which researchers selected the following:

> *It became harder to manage time (...) to read all materials carefully and in a focused way to feel that this model has the desired effect.*

Critical thinking

The last category to be analysed was critical thinking, an essential dimension when training teachers. Data for this category is shown in Table 6.

Table 6. Results for the *critical thinking* category.

	Results (%)				
	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
In-class discussions engaged me in critical analysis processes about programme topics.	0	0	5.9	58.8	35.3
The methodology used made me refresh theory due to the educational problems that were raised, making me critically reconfigure pedagogical options.	0	0	14.7	441	41.2
I believe this learning model has developed my critical thinking.	0	0	8.8	53.0	38.2

Almost every student (95.1%) agreed or strongly agreed that discussions in the classroom got them to analyse programme topics critically. A similar percentage (91.2%) agreed or strongly agreed that the pedagogical model used in the classes developed critical thinking. These data are particularly relevant, especially due to the nature of the CU, a Didactics CU where these goals are the core goals. Most students

(85,3%) agreed or strongly agreed that the problems and questions raised in classes, many times from didactic situations that arise in real contexts, led them to refresh the theory, which gained new meanings, leading to transformations in future professionals when it comes to their pedagogical options. It is worth mentioning that there were no students who disagreed with any of the affirmations in this category.

DISCUSSION

The results suggest that students enjoyed the flipped classroom. Most students showed their preference for the flipped classroom as opposed to the traditional classroom in higher education. These results are in accordance with the results obtained by Martínez-Jiménez and Ruiz-Jiménez (2020) and Lopes and Soares (2018), which stated that in a flipped classroom students become more self-directed interested, and motivated than in a traditional classroom.

Also, students said they would like to attend other CUs where the flipped classroom model was used. This evidence is supported by previous studies that suggest that students enjoy the flipped classroom methodology and that it positively impacts learning results (Bergmann & Sams, 2012; Cevikbas & Kaiser, 2020; Cilliers & Pylman, 2020).

The collaboration and communication dimension were deeply valued by students, who reinforced the importance of flipped classroom planning, especially focused on assignments centred on applied, complex problems, performed in groups (Bhagat et al., 2016; Foldnes, 2016). Cevikbas and Kaiser (2020) also emphasised in their study that the methodology helped to increase the level of communication and interaction between students and with the teacher, with more effective communication and the construction of knowledge based on interaction and collaboration.

In addition to the methodology used, researchers believe that the reduced dimension of classes (Cilliers & Pylman, 2020) might have been determinant for these results, as it allows for an atmosphere that enables group work in the classroom and close contact and interaction with the teacher, therefore creating opportunities for productive questioning and immediate response for questions raised by students.

Most students stated that they have felt motivated to learn the content planned for this CU. The results are in accordance with previous studies that show the potential of the flipped classroom methodology in the motivation of higher education students (Akçayir & Alçayir, 2018; Cevikbas & Kaiser, 2020; Lopes & Soares, 2018).

Students seemed to feel that the flipped classroom requires more effort than the traditional classroom, which matches the study of Cilliers and Pylman (2020). The authors also mentioned that students did not prepare the class beforehand and tended to resist to this methodology because they struggled to contribute to in-class activities. The inversion of responsibilities and roles may not be perceived by students and may create tensions that can persist over time (Alamri, 2019). In addition, problems may arise in work groups, as some students may react negatively when they realize some group members have not prepared the class, while those who did not prepare for the class may feel put aside or simply agree with their group members, which will limit class effectiveness (Cilliers & Pylman, 2020). Lopes and Soares (2018) argue that changing roles in the teaching and learning process implies that students must manage their time and develop their autonomy, determination and responsibility.

Zainuddin and Perera (2019) and Liu and Zhang (2022) highlighted that the flipped classroom, which is based on highly complex learning experiences that are experienced collaboratively, stimulates the development of critical thinking and the ability to solve problems creatively. Most students agreed or strongly agreed that the problems and questions raised in classes, led them to refresh the theory, which

gained new meanings, leading to transformations in future professionals when it comes to their pedagogical options, a dimension that is in accordance with the results of Kong (2014).

Almost all students showed a high level of satisfaction with the flipped classroom and pointed out some favourable arguments for the use of this methodology, namely student engagement and learning, increased motivation, self-regulation of learning processes, and the development of critical thinking. In pedagogical terms, students have recognized the importance of the quality and diversity of the materials that support the autonomous study, the role of group work and rich discussions among peers and with the teacher, which are all aspects that support student motivation and engagement and the quality of their learning.

CONCLUSIONS

The goal of this study was to describe what a group of 34 higher education students thought about the use of the flipped classroom in the context of Didactics of Mathematics learning.

Researchers would like to highlight the importance of the creation of spaces and contexts for activities in the flipped classroom, which are student-centred and involve more complex, challenging activities that are closer to the real professional contexts of future teachers. This is seen by students as an advantage, due to the skills gained that allow them to solve problems related to their professional activity. In addition, despite being challenging in terms of organization time management and the individual study of contents (which is seen as a limitation by some students), autonomous work is seen by most students as an opportunity to develop their learning strategies, which will be determinant for them to respond to future professional challenges. Ultimately, this methodology puts into action two dimensions that are intertwined: the individualized learning of each student from their autonomous study and the collaborative learning that happens mostly in the classroom in the scope of group work and discussions.

Although the evidence of this study is strongly aligned with international studies about the use of the flipped classroom model in higher education, the use of this model in Portuguese higher education must be further researched, in different contexts, due to the limited research conducted in Portugal in this field. One of the limitations of this study is the fact that it was conducted with a reduced number of students and in the scope of a specific curricular unit of a training course for teachers in a Portuguese institution. So, the results of this study cannot be applied to other contexts. Despite the study being focused on students' perspectives about the flipped classroom, it is important to get other perspectives, namely higher education teachers' perspectives, which opens a clear window for future research.

This paper, despite the limitations identified, constitutes a small contribution to the study of the implementation of the flipped classroom methodology in the context of mathematics, in Portuguese higher education. Knowing students' perceptions about the impact of using this methodology on the involvement and self-regulation of their learning, on their satisfaction and motivation and the promotion of communication, collaboration and critical thinking, is a fundamental aspect in the preparation of teaching practice and the constant improvement of teaching effectiveness.

This work allows us to reflect on the nature of maths work in a teacher training context, from which a set of recommendations emerges. We believe that the three moments on which the methodology was based were decisive for the positive perceptions of the future teachers. It is therefore suggested that similar work be carried out:

- the definition of autonomous work by the students, before the lesson, with the provision of varied resources that would allow the different styles and previous knowledge of the students to be taken into account, supporting them from a theoretical point of view;

- the promotion of group work during the lesson, with the definition of clear objectives and the support of work-orientated guides that fostered autonomy, collaboration and the construction of knowledge;
- the suggestion of individual work which, on the one hand, allowed students to consolidate their knowledge and, on the other, the teacher to give them feedback so that they could readjust their next activities;
- the inclusion of tasks with technological support, to be carried out online;
- the definition of tasks that promote transversal skills such as communication and collaboration, competences valued by the students involved;
- decentralisation of the teacher's role, promoting interaction between students and teacher.

In the future, it would be very interesting to give continuity and depth to this study, extending the classroom experience through a larger research sample and comparing the results over the years, with the possibility of improving practices in subsequent years. This study, despite its limitations, brings together important contributions and recommendations for the context. As Ashrafi and Kabir (2023) mention in their study, analysing the perceived value, perceived risk and resilience to innovation allows us to understand the practical implications for potential decision-makers.

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EXPLORING E-PORTFOLIOS: ILLUMINATING ACCOUNTS OF THE PEDAGOGICAL INNOVATION TRAINING PROGRAMME AT THE POLYTECHNIC INSTITUTE OF VISEU

Susana Amante

ABSTRACT

Every educational institution strives for pedagogical excellence, driven by the goal of providing the most effective and impactful learning experiences to its students. This is no different at the Polytechnic Institute of Viseu (IPV) and other Polytechnic Institutes participating in a Pedagogical Innovation Training Programme developed within a consortium committed to enriching educational methodologies and tools. There is evidence that innovative pedagogical methodologies lead to enhanced student engagement, foster meaningful interactions, promote critical thinking and problem-solving skills, and ultimately better academic achievement. This study focuses on the training course on pedagogical innovation offered to the teaching staff from IPV and vocational schoolteachers from the region, by examining their reflective portfolios. We aim at illuminating the impact and efficacy of the initiative in fostering active methodologies and innovative pedagogical tools, employing qualitative analysis to uncover the nuanced perceptions of the IPV participants in the six editions of the programme (2021-2023). The findings reveal that they value active methodologies, intercultural and multidisciplinary collaboration, and the integration of industry-aligned skills development, even if we encounter accounts of challenges faced during the implementation process of the training course. Ultimately, this study contributes to assessing the initiative's impact and underscores the pivotal role of innovative teaching methodologies in striving for educational excellence. In light of the findings, policy recommendations include encouraging continued investment in pedagogical innovation training programmes, supporting interdisciplinary collaboration, fostering industry alignment, and addressing implementation challenges to ensure the effectiveness of such initiatives.

INTRODUCTION

In a time known for rapid technological progress, the demand to ensure equitable access to digital resources and quality education has attained unprecedented prominence. The pandemic situation that was experienced in 2020 and 2021 as a result of the need for the whole society, namely Higher Education

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Institutions (HEIs), to transform their *modus operandi*, in a short period of time, and create resources adapted to virtual environments, has greatly exacerbated this situation (Hass, Laverie & Cours Anderson, 2020; Chhabra & Ambreen, 2021; Winch et al., 2021; Nani & Ndlovu, 2022; Konstantinou, Nachbagauer, & Wehnes, 2023).

Even before, as postulated by Antunes (2012, p. 451), "the Bologna Process (BP), the Education & Training 2010 programme (E&T 2010) and the Copenhagen Process (CP) have gradually been highlighted as being the carriers of dramatic changes." At the time, there was a growing recognition that traditional knowledge transfer from teachers to students was inadequate. A notable shift was needed towards a more engaging, participatory approach emphasising learning outcomes (ibidem). This shift aimed to better prepare students for the complex challenges of the modern world. Active pedagogy started to emerge as a transformative force, revolutionising the way students learnt, and empowering them through facilitation, problem-solving exercises, simulations, co-creation, and real-world application of knowledge. Socialisation, externalisation, combination, and internalisation, encapsulated in the SECI model (Songkram & Chootongchai, 2020), delineate the four pivotal modes of knowledge conversion essential for fostering innovation. Therefore, rather than rote memorisation and passive learning methodologies, in a one-size-fits-all approach, students were encouraged to take an active role in their learning process. They were urged to share their individual experiences, emotions, and tacit knowledge, to develop their critical thinking, creativity, leadership, adaptability and, among others, effective communication skills. These skills are more than ever essential attributes for success in today's interconnected and globalised world.

This transition to active methodologies went hand in hand with a change in the role of the teaching staff. According to Kurvits, Laanpere, Väljataga, and Robtsenkov (2019, p. 177), "The modification of the existing teaching practices is one of the greatest pedagogical challenges today, and teachers need support in this process of changing their approach to teaching." Some of them have, thus, searched for training on pedagogical innovation, and they have become designers of learning experiences and facilitators. This, in turn, has required careful planning, adequate classroom resources, integration of technology, and government and institutional policies for implementation to be truly functional.

According to Lambriex et al. (2020), the cultivation of a culture of innovation has emerged as a pivotal factor significantly influencing innovative practices within educational organisations. Despite its recognised significance, a scarcity of comprehensive studies on this topic of pedagogical innovation persists, as noted by Fuad et al. (2022). This article contributes positively to, addressing this gap, offer some insights that can guide the design and implementation of forthcoming teacher training programmes that aim at nurturing pedagogical innovation, thereby elevating educational practices. The discussion of the specific initiative to be described below represents a noteworthy step in fortifying this endeavour. In this study, we extend the knowledge of novel approaches and tools that contribute to active pedagogies and that bring academia closer to the needs of the labour market while, at the same time, enhancing students' motivation and skills (Amante & Fernandes, 2023). We will focus particularly on the programme entitled Demola Portugal Initiative (2021-2023), held at the Polytechnic Institute of Viseu (IPV) and other Portuguese Polytechnic Institutions, and attempt to answer two questions: 1) which methods and tools were introduced by the programme, namely through one of its projects, Aprendizagem com base em processos de cocriação [Learning based on co-creation processes] (ref. no. POCH-04-5267-FSE-000818)?, a training course on pedagogical innovation for teaching staff, and 2) what is the participants' perception of the tools and approaches learnt. In trying to answer these research questions, we will start with some theoretical considerations on the importance of bringing innovative pedagogical methodologies and tools to the classroom or other learning environments; next, in a second section, we will provide the readers with a framework that will help them visualise the Initiative and, afterwards, we will delve into data analysis, by describing a) the methodology and sample selected, and b) examining some of the assertions extracted from the final e-portfolio each teacher/professor produced as a participant of the programme, that is, as a trainee and facilitator. Finally, this article will summarise the main conclusions of this study, looking ahead and

extrapolating this active methodology as a potential scenario that can influence educational practices across various levels and geographic boundaries.

THE GROWING IMPORTANCE OF ACTIVE LEARNING AND INNOVATIVE PEDAGOGICAL TOOLS IN HEI: SOME THEORETICAL CONSIDERATIONS

Introduced in the nineties, Active Learning methodologies aim at giving responsibility to the student of his/her own meaningful learning, engaging him/her in meaningful learning challenges that require higher-order thinking such as analysis, synthesis and evaluation. (Mercat, 2022, p. 161)

Active learning methodologies have been present in education for a long time. Even before the nineties, Piaget and Vygotsky had already laid the foundation for the principles underlying active learning, by highlighting the importance of hands-on learning experiences and the influence of interpersonal interaction on cognitive development. The roots of active learning, thus, cannot be pinpointed to a specific decade, once these methodologies have been evolving over time (Chinn & Iordanou, 2023).

In Higher Education Institutions (HEIs), this paradigm shift in teaching methodologies is even more prevalent and, for this to happen, there has been a very important role played by innovation intermediaries. These intermediaries facilitate and accelerate innovation, by bridging gaps in knowledge and resources and connecting academia with various local organisations, and with experts and other stakeholders, who act as catalysts in the innovation ecosystem. Most often, they provide training, expedite knowledge exchange, and enhance collaboration, among so many other benefits, aligned with specific Sustainable Development Goals, and summarised by Koria et al. (2022, p. 2) below:

These innovation intermediaries traditionally support knowledge diffusion, technology transfer, brokering, innovation management, intermediation services and systems and networks (...). They also support the aims of the Sustainable Development Goal (SDG#17), as multi-stakeholder partnerships are an important vehicle for sharing both global and local knowledge, expertise, technologies, and resources to systemically support human development (...). Through the combined OI–UIC focus, the innovation intermediaries help to foster innovation (SDG#9), decent work and economic growth (SDG#8), as well as access to quality education (SDG#4). They support combining global, local, internal and external knowledge (...), and open, flexible and collaborative modes of working that support partnership-forming practices (...). Engaging universities enables systemic approaches to societal challenges through shared value within these partnerships (...).

As we will make clear in the next section, drawing upon insights and feedback from intermediaries, experts representing partner entities or other stakeholders is very important to ensure best practice. The intermediaries help HEIs integrate innovative pedagogical tools related to general innovation and entrepreneurship that foster collaboration, enable engagement and help co-create tangible value (Rodrigues & Mourato, 2023). These tools can encompass a wide spectrum of technologies, from virtual reality (VR) and augmented reality (AR) to gamification and interactive simulations, to quote just a few. Besides this, videoconferencing, email messaging and discussion threads on different social media channels, the use of polls and remote collaboration platforms, such as Miro and Canva for example, and multimedia sharing, all these tools facilitate interaction and knowledge exchange among students, teachers/facilitators, other experts and stakeholders. By immersing students in experiential learning environments, using some of the tools above, HEIs enhance engagement, critical thinking, and practical application of knowledge (Bertran et al., 2022).

In fact, research has stressed the importance of the application of knowledge in real-world scenarios. This can involve contributing to local communities, connecting students' learning experiences to their immediate surroundings, that is through Place-based learning, or by opting for a broader approach, Project-based learning, implemented in various contexts, often across multiple disciplines, in an attempt to create a tangible product or presentation that demonstrates how a challenge could be solved. Herodotou et al. (2019, p. 2) explain that "Place-based learning derives learning opportunities from local community settings, which help students connect abstract concepts from the classroom and textbooks with practical challenges encountered in their own localities." As mentioned before, project-based learning is not necessarily tied to a specific geographic location and, as Amante et al. (2021, p. 220) point out when referring to a project held in Portugal, Poland and Turkey, with participants from different fields, the most important thing is that "… students are actively involved in the learning process, sharing knowledge while trying to answer authentic questions and problems derived from real-world contexts and, ultimately, putting together a final product that addresses the core challenge."

Even if these approaches are not the same, they both emphasise active and experiential learning. Through immersion in real-world challenges, sometimes posed by community partners, authentic learning has been working as a powerful educational approach. It bridges the gap between theoretical knowledge and practice, transforming the traditional classroom and even going beyond it to dynamic environments where students actively engage with genuine problem-solving scenarios. Bauman further elaborates on this, particularly focusing on the teaching of strategic management, but the trend described below can also be applied to societal challenges:

… a recent trend in teaching strategic management is to give students' authentic experience to help them understand the challenges of a business environment (Domke-Damonte, Keels, and Black 2013). Students are partnered with local businesses and complete a project that benefits all the participants. Students, thereby, gain experience in a real-life business situation, in which they have to develop a strategy and present it to businesses owners and/or their classmates.
(Bauman, 2018, p. 214)

As these real-world scenarios mirror life itself, this active learning approach enables students to identify problems, interact and collaborate in complex environments, to devise effective solutions from multiple perspectives. This goes in line with what Fullan describes as "new pedagogy", as Kurvits, Laanpere, Väljataga, and Robtsenkov (2019, p. 178) observe:

According to the concept of "new pedagogy" suggested by Fullan (…), pedagogical innovation is defined through changing partnerships between teachers and students in which the learning process becomes a collaborative way of discovering, creating and using knowledge in a ubiquitous technological context. The main learning outcomes of new pedagogy are the student's ability to learn and develop continuously while persevering through the challenges that he/she comes across during real-life situations.

Among the many innovative pedagogical approaches that have emerged as transformative methodologies and have reshaped the learning landscape, design thinking comes as highly impactful, as it is a human-centred approach to problem-solving that encourages students to empathise with the perspective of the end-users or stakeholders in order to understand their needs, desires and pain points. Then, they define and reframe the problem to ensure that a focused and meaningful solution is achieved; they ideate, that is, brainstorm unconventional ideas; they transform their selected ideas into prototypes (e.g., mock-ups and other physical models or less tangible products, such as the description of future scenarios); and, finally, they test and refine those solutions following a process of feedback and iteration. However, Avsec and Savec (2022, p. 3) remind us that "[w]hen performing design thinking, educators should focus on practising and receiving feedback from experts in the field"; otherwise, the whole process may fail, and the outcomes may not meet expectations.

This collaboration with "experts in the field" mirrors the real-world nature of many professional environments, as students have to learn to work in a team, communicate effectively, make informed decisions under sometimes uncertain conditions, delegate tasks, and leverage diverse skill sets, namely soft skills, so needed for success in the workplace.

In this next section, let us get to know Demola Global, the intermediaries between academia and community partner entities, who work as "the 'engines' of innovation, playing a significant role through setting up hubs, facilitating learning, orchestrating knowledge-intensive services, and brokering activities to enable commercialisation, engagement, and value creation" (Koria et al., 2022, p. 3).

A GLIMPSE OF THE DEMOLA PORTUGAL INITIATIVE AND THE METHODS AND TOOLS USED

Since 2008, Demola has maintained the foundations of their business model, which are the creation of networks and the exchange of value through the solution of problems: first local, then regional and now global. (...) In addition to continuing with business projects connected with students, they have launched pilots for the attention of students around the world to address global problems.
(Koria et al., 2022, p. 7)

Established in 2008, as part of the "Creative Tampere 2006-2011" initiative, Demola went from significant regional success to swiftly garnering global expansion due to the support of the Tampere municipality and three co-located universities, in an endeavour undertaken and greatly facilitated by the Nokia Research Centre and the Hermia Group (Amante & Fernandes, 2022; Catalá-Perez et al., 2020).
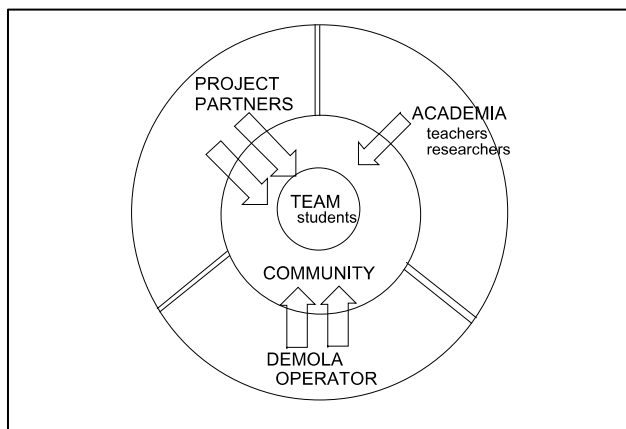
Figure 1. Demola partners (Source: Kilamo et al., 2011, p. 308)

Nowadays, Demola Global is a renowned innovation platform that operates internationally at the nexus of academia, industry and society, as shown in Fig. 1, encouraging cross-cultural collaboration and problem-solving, in 18 countries, with over 50 Demola Alliance Partner universities worldwide (Demola Global, 2023a).

Within the Portuguese context, the Demola Portugal Initiative was launched in 2021 and it involved a consortium of Portuguese Polytechnic Institutions that ran two concurrent projects, Aprendizagem com Base em Processos de Cocriação [Learning based on Co-creation Processes] and Link Me Up – 1000 Ideias [1000 Ideas]. The first one was a training course on pedagogical innovation, held at 14 Portuguese Polytechnic Institutes, and directed towards their teaching staff and vocational school teachers from each of the 14 regions. The second project was held in 13 Polytechnic Institutes, and it intended for intercultural and multidisciplinary teams to collaborate on real-world challenges posed by diverse organisations from

the community, in an attempt to develop more than 1000 ideas, while equipping students with problem-solving skills, cultivating an entrepreneurial mindset and allowing them to be prepared for the dynamic demands of the labour market (Fernandes & Amante, 2022). Simply put, these two projects were interdependent since one trained the teaching staff, providing them with innovative pedagogical tools, to become facilitators of the teams of students, that is, it prepared the implementation.

The Demola Portugal Initiative lasted from 2021 to 2023 and at each Polytechnic Institute it implied the training of eight of its Professors and two other vocational school teachers from the region per semester, making up an approximate number of 960 teaching staff, because in Leiria and Coimbra the number of teams doubled in each of the six batches, and at IPV one of the participants gave up and in the sixth batch there were 11 trainees/facilitators rather than 10.

The training was intensive and took place synchronously every week, on Mondays for some Polytechnic Institutes and for the remaining ones – namely IPV – on Tuesdays. On top of the scheduled full days of training, the process also included execution clinics, in which trainers worked alongside the participants, answering questions, and providing a variety of support based on their demand, and there was also asynchronous time allocated, in a total of 344 hours per batch.

Forging a pathway towards educational excellence, this initiative used several educational tools, such as a) mind maps, that is, visual representations of ideas connected through branches and used to brainstorm and organise thoughts, plan projects and summarise information; b) PESTLE analyses, used to gain a comprehensive understanding of external – Political, Economic, Social, Technological, Legal and Environmental – factors that inform strategic planning and decision-making aligned with the goals and values set; c) affinity diagrams, used to group related data generated during brainstorming sessions or research, after collaboratively identifying common themes and patterns; d) 'How might we…' questions, used to encourage a shift from viewing a challenge as a problem to seeing it as an opportunity, since these open-ended inquiries invite students to consider multiple perspectives and enable divergent thinking; e) megatrends discussion, which implies anticipating future challenges and opportunities by analysing long-term, transformative shifts that impact societies; f) value proposition canvas, used to guide students in designing solutions that cater to specific user needs and provide meaningful value; g) other design thinking related tools, such as persona creation and prototyping, among others.

The participants in the training course learnt how to use these tools and then, became facilitators of their teams of students, helping them complete the tasks, by explaining the steps involved in using each tool and creating a supportive environment for exploration, creativity, and collaboration. Providing feedback on their work and encouraging them to refine their ideas was an integral part of the iterative process that fostered the students' growth and improved their problem-solving skills and creative thinking abilities. A final report was asked at the end of the process so that students could reflect on their insights gained and their experiences because reflection reinforces learning and promotes metacognition. The teaching staff also had to reflect on the training course and on their role as facilitators in a digital portfolio. In the next subsection, we will focus on the teachers' learning journey, documented in those e-portfolios so that we can understand the participants' perception of the tools and approaches learnt.

THE USE OF E-PORTFOLIOS TO ASSESS THE PARTICIPANTS' PERCEPTIONS OF THE DEMOLA METHODOLOGY AND TOOLS

Portfolios have widely been used to showcase the work, growth, skills and accomplishments of an individual or of a group over a specific period of time. Besides this, they serve as a reflective tool in various fields and contexts, namely for educational purposes, professional development, and creative endeavours,

and they also encourage critical (self-)assessment. According to Amante (2021, p. 102), portfolios are useful for students to "… reflect on where they started, their learning progress, outcomes and what remains to be learned and applied. It is also an instrument that the students can keep and resort to whenever they need." The same holds true for the teaching staff that participated in the training course designed and conducted by Demola, and that were prompted to reflect on their learning journey, by including samples of work that demonstrate the trainees' learning of methods and tools, the skills acquired and the impact they made as facilitators. In the instructions that Demola gave the trainees, the trainers also suggested treating this tool as memorabilia, by identifying aspects, moments, or phases that were significant during the process, capturing not only the technical skills but also the personal and emotional aspects of their experience.

METHODOLOGY, PARTICIPANTS AND DATA ANALYSIS

At the Polytechnic Institute of Viseu, sixty participants from different fields, mainly in their forties, females, and holders of a PhD, delivered their e-portfolios and completed the training course within the project entitled "Aprendizagem com Base em Processos de Cocriação [Learning based on Co-creation Processes]" throughout the six batches that ran from 2021 to 2023 (cf. Table 1).

Table 1: Demographic overview (N=60)

Variable	Percent	Variable	Percent
Data collection round		**Education**	
Jul-21	16.67%	Bachelor's degree	11.67%
Jan-22	16.67%	Master's degree	8.33%
Jul-22	33.33%	Doctorate degree	80%
Jan-23	16.67%		
Jul-23	16.67%		
Gender		**Age range**	
Female	66.67%	Under 30	0%
Male	33.33%	30-39	16.67%
Other	0%	40-49	61.66%
		50-59	16.67%
		60 and above	5%

Bearing in mind those e-portfolios, the researcher identified, extracted and categorised relevant text segments. The objective was to unveil the participants' nuanced perceptions of the tools and approaches they acquired through the training programme, also placing significant emphasis on understanding their experiences throughout the implementation phase. Thus, this study follows qualitative research methodology (Gelo, Braakmann & Benetka, 2008), particularly content analysis (Vaismoradi, Turunen & Bondas, 2013), to reveal the thoughts, insights and experiences reported by the participants. Given that the perspective of participants from the first and second editions of the Initiative was briefly discussed in a prior study conducted by Amante and Fernandes (2023), we will now prioritise the most representative extracts from the reflections of participants[4] in the latest batches of the programme, to gain a comprehensive understanding of their perceptions, observations, and transformative journey, as mentioned. This strategic

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[4] *It should be noted that we will use the initials of participants, most of the time in alternating order throughout the analysis, to maintain confidentiality and uphold participant anonymity. This precautionary measure aims to protect the privacy of individuals involved in this study while facilitating an unbiased examination of their reflections.*

prioritisation becomes particularly pronounced due to the recurring prominence of specific categories. These include efficient time management, handling of uncertainty, utilisation of ICT tools, opportunities for internationalisation, networking, skill diversification, and fostering effective communication and interaction within interdisciplinary and multicultural teams.

These categories encapsulate the key dimensions and focal points that define the Demola values and approach, as seen in Fig. 2, and that are achieved through the integration of tools designed to foster curiosity, creativity, strategic thinking and solution-oriented perspectives, open communication and intercomprehension, responsibility but also the awareness that failure and imperfection lead to adaptability, continuous improvement, and growth. In fact, at the heart of Demola Global lies the dynamic interplay between all these principles and the tools that underscore a pedagogical commitment to experiential learning, innovation, and holistic skill development among all programme participants, as we will make clear in the next few pages.
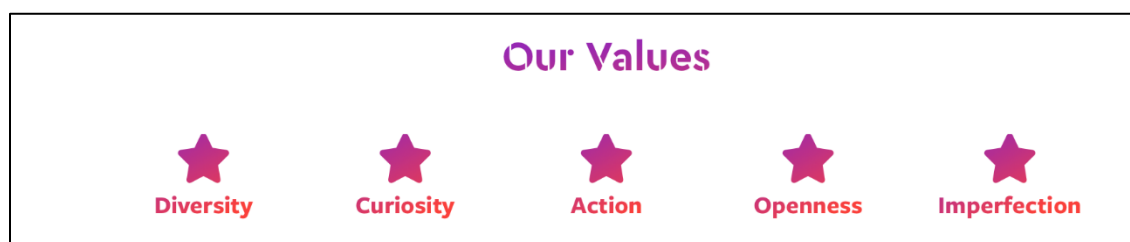
Figure 2. *The set of core values that Demola Global establishes to guide its approach.*
(Source: Demola Global, 2023b)

A LOOK AT THE RESULTS AND DISCUSSION

In most e-portfolios, the participants valued the **ICT platforms** put in place by Demola, but some disclosed very limited familiarity with and lack of time to explore the tools, a difficulty also felt by their teams. In fact, **managing time** was a challenge in itself, because the training was intensive and time-consuming, and the facilitation process demanded from them even more dedicated time and attention since they were expected to answer questions, provide feedback and ensure that the team members were on the right track. For instance, a professor who was a trainee in the 5th batch brilliantly summarised the process, providing a critical analysis of the intricacies involved and potential areas for improvement:

Starting with the end, the course 'Aprendizagem com base em processos de cocriação' was very positive and appreciated by the (...) facilitator. (...) The DEMOLA methodology of co-creation is very interesting and well structured, making it possible to dissect problems/systems/organizations, envisioning key issues, namely: which are the most relevant agents; trends in characterizing the current situation; insights into what is bad/less good (making the counterpoint to 'what should be'); signs (strong or weak) of change that are already happening; ideas that can seriously leverage/stimulate change. Of course, there is always the 'bitter' taste – the lack of dessert (?) – of not emerging more final solutions – making it happen – but that is also not what is intended...! Paradoxically (?), although the deadlines of the tasks (excessive number for the time available) succeed each other, with no time to properly prepare or digest the tasks already performed, many of the online and face-to-face sessions gave the feeling of being productive, perhaps to drag themselves in time. There is doubt as to whether this is natural in the process and one of the variables that make the success of the DEMOLA methodology and the co-creation process. (B.P.A., 5th batch, sic)

This critical appraisal finds resonance among other trainee participants in the training course, who, for instance, complained that "My team always felt that they had little time to do things with the quality that they deserved, and so they always felt that everything was badly done and without foundation" (P.R.F.,

4th batch, sic). Time management always implies acknowledging and accommodating the diverse levels of enthusiasm and commitment, as well as time-related expectations and predispositions of team members and grappling with unforeseen disruptions. Some participants regarded the lack of time and the students' varying availability and engagement levels as obstacles that hinder the successful completion of this type of projects:

On the other hand, I must point out something that was difficult to manage: the synchronization of meetings and the orientation for collective tasks. The typical learning model in Portugal is essentially individual, where each student plans their own activities. Since it is a project that implies carrying out different tasks, but from a more collective perspective, it was difficult to get people together and discuss as a group. I don't think, however, that this difficulty is a limitation of this pedagogical model, I think that the Portuguese model is not yet built for this kind of collaboration. (L.M., 6th batch, sic)

Other trainees/facilitators were aware that it was something to be addressed proactively, and they attempted to **find strategies and be flexible** to mitigate any bottlenecks and pitfalls, harnessing the collective strengths of the team:

It wasn't always easy to find time compatibility for weekly meetings. But this context also presented itself as a parallel challenge, which was magnificently overcome with the five sharing meetings with the expert, (...) in five different weeks. And because willpower is highly transformative, we were all able to take advantage of this sharing by the specialist, the students, the partner entity, and myself, scheduling compatible times for all. They were very enriching meetings, highly valued by the students, who considered them an asset for their development. (C.E., 5th batch, sic)

The commitment to proactive problem-solving and flexibility, as exemplified by this and other trainees and facilitators who recognised and addressed the same challenges, aligns with the values of Demola Global, mentioned in the section above. This ethos is actually the Demola methodology itself and it leads to another common thread that could be found in most e-portfolios: the **need to manage uncertainty**. Most reported that being a facilitator, that is, being a "guide on the side", is completely different from being a "sage on the stage" in a classroom. By embracing these projects, they had to adapt to unexpected situations, because they were not in control over the content delivery and the direction of the learning process. Actually, in this type of projects, the students are seen as talents, they take ownership of their learning and, guided by a facilitator in interaction with experts, they question, explore, discover, and co-construct knowledge. On this matter, we are told:

One of the most difficult things about the facilitation process is the habit that we have to "command" all the process of projects where we have a defined goal. The facilitation process is different because I had to let the students make their own path. The collaboration with the partner company was difficult since companies are usually very busy and do not have a lot of time to participate in co-creation projects. Nevertheless, the company participated in the definition of the challenge and accompanied, when possible, the evolution of the project. After the ending of the training course, I feel that I am much more prepared than I was in the beginning of the process and sometimes I feel I should start it again. I will surely take this training into account in the preparation of my next course in order to give students a more active role in the learning process.

I think the training will help me to better conduct my project teams in the future. I have learned new tools for collaborative work such as the use of Miro board and Canva and they will be very important in the future. (E.B., 6th batch, sic)

As we notice above and as we can find in some more testimonials below, the fact that the students are placed at the centre of the learning process, rather than having the teaching staff as the sole conveyors

of knowledge, can actually yield significant benefits for student engagement and learning outcomes, but for the IPV participants in the programme it also introduced a level of uncertainty, because they were required to relinquish some control and allow students to take the lead in their own learning journeys. Professors and vocational school teachers became facilitators who depended on sometimes uncooperative partner entities and on the students' willingness to take advantage of this type of projects. That is why active learning methods and tools play such a crucial role in facilitating this approach. One of the trainees puts it metaphorically:

A kind of plunge into the unknown: it seems to me to be a good image for the way I felt at the beginning of this process. Starting challenge, partner, student team, online sessions and bootcamps, facilitator and co-creation processes were the pieces to integrate for a path with meaning. How would this integration take place? I had no idea! This principle of uncertainty was a little scary. After all, the coordinates of traditional trainings did not seem to apply in this new journey. It would be necessary to learn new methods of navigation and trust the winds. (S.J., 5th batch, sic)

And in another e-portfolio, we read:

In the initial stages I had a little weird feeling what am I getting myself into, what is this whole process   going   to   be   like?   That's   what   was   in   my   mind. I must admit that in the initial phase of the process it was a little bit bumpy. (...)

We used the tools provided by Demola for the interaction process and facilitation with the students (Demola chat, email, Mic, etc). I requested that they create a group on Whatsapp for the team. In the initial phase my contact was not included, I did not push for that either, to let them have autonomy. (L.P., 3rd batch, sic)

In fact, besides the **tools that were part of the training**, there were several teachers/trainees that advocated for the **adoption of more widely used apps**, such as WhatsApp, during facilitation, because this instant messaging platform allows users to quickly send messages, multimedia content, and make voice or video calls: "Between me and the students/partner entity/co-facilitator, in addition to the aforementioned channels, we also used email and WhatsApp, mainly because the partner entity also preferred to use these contacts" (C.E., 5th batch, sic). WhatsApp enabled real-time communication and collaboration among team members and, in many cases, as seen, with facilitators, experts and company representatives, but it could also be used to send reminders about upcoming assignments and their deadlines:

In addition to these weekly meetings, the team had a WhatsApp group and the Demola chat (...), where several messages were exchanged and shares were made about the topic being studied. Tasks and activities that each element of the group should fulfill were also defined and it was decided which team member would submit the weekly task on the platform. (D.A.S., 5th batch, sic)

All the e-portfolios **extensively address the tasks and tools** with a substantial degree of detail. The participating teaching staff were very enthusiastic about them, and it was another common theme, as observed below:

Our facilitators knew how to do it masterfully! Everything I learned and was able to pass on to the students was enormous. I also understood how this program is so well organized, with all the materials available weekly in Training materials, smoothing the process, that in bootcamps we are allowed to experience in advance all the steps that we would facilitate with the students, for later, with the work they develop in team and insert in Demola Atlas, namely: Stakeholder/User Group Identification (long list), Selected target groups (short list), Empathy maps (& Synthesis), Design Insights, Present Report, Future Questions (What if...? & How might we...?), Signals, Future stakeholder personas, Signals (a continuing

task), Future Solution Ideas, Low-fidelity prototyping (optional – not developed with students), Signals (a continuing task), Final Report. (C.E., 5th batch, sic)

The detailed list of sequential tasks, which started with personal mind mapping, not mentioned in the extract above, serves as a set of tools that were discussed and tested in the training sessions to effectively tackle the real-case challenges. The inclusion of various tasks such as empathy maps and low-fidelity prototyping, for instance, contribute to a comprehensive problem-solving approach. Many more participants go on to highlight their positive experience, underscoring the utility of these tasks developed on Miro boards, Canva, and other collaborative platforms, such as Atlas, which proved to be highly advantageous, even if they seemed not to be very user-friendly for some at first:

… Atlas that was used from the beginning with "Team building", "Membership acceptance", "Contract signing". Then we continued with "Tasks" submission, "Team member evaluations" and "Access to team results". It was not very intuitive at first, but with all the patience of the facilitator, we were able to learn more about the platform and be more comfortable with it. It turned out to be a very useful tool. (B.S., 5th batch, sic)

Miro is not, at first glance, the most intuitive tool. It requires some exploration time before we feel comfortable using it. Perhaps for this reason, the team of students (and myself) resisted, at first, using it as a work tool. But, as the students realized that it was a tool that allowed everyone to have access to everyone's work, giving, in real time, a global vision of the work that was being developed, we started to use it as the main working tool between meetings.

It is certainly a tool that I will encourage my students to use in group work. It could be very useful in the group's internal communication, as well as in my non-face-to-face communication with each of the working groups. (S.J., 5th batch, sic)

I had my first experiences using MIRO, CANVA and DEMOLA platform. The first one was very helpful to joint our team's notes and transform them into next steps by voting on ideas, grouping insights by themes and trends, and crafting workflows and project documentation. The CANVA helped to present in a very beautiful and trendy design our information, as well as working together and at the same time, no matter where we were located. In the same way, the Chat from DEMOLA was a simple and intuitive communication tool, which made it easy for us to stay in touch. (A.L., 5th batch, sic)

The programme aimed at providing the teaching staff with innovative pedagogical tools, so it comes as no surprise that most e-portfolios focus on **tools and tasks**. Miro, a collaborative virtual whiteboard that seamlessly captures and organises digital sticky notes on an expansive canvas, is always praised as a dynamic tool that provides a digital, fluid, and accessible workspace for real-time collaborative ideation. It is recurringly considered effective in supporting various aspects of project management. Canva is another tool that is lauded for its contribution to creating visually appealing and trendy designs for presenting information. As highlighted in Salim, Saad, and Nor's "Comparative Study of Low-Cost Tools to Create Effective Educational Infographics Content", Canva emerges as the tool that "provides major advantages in terms of enhancing the infographics design" (2021, p. 27), and this recognition becomes manifest in the portfolios under discussion. Also commended by every single training participant is the Demola Platform, especially its chat feature, which facilitates straightforward communication, enhancing teamwork and productivity. Although we do not intend to be redundant, we believe that some more examples can only attest to the success of the initiative. As a note, let us clarify that we are choosing just some of the more pertinent quotations from a universe of 60 portfolio reflections, all addressing various aspects of the tools and their impact on the creative process:

No less important were the tools I learned to work with. In terms of technological tools, I would highlight the miro platform (...). Regarding the more theoretical tools, I loved working with the empathy maps that taught me to look at people in a different way; I really liked the task related to the future persona and future ideas. Finally, I would like to highlight the signals task that, although not a tool in itself, was a working model that helped us to observe our challenge by analysing what was already being implemented and that went in the same direction of our objectives. (P.R.F., 4th batch, sic)

Throughout this phase the method was Design research. Different tools were explored that allowed a broad knowledge about the theme of the challenge (academic articles; Demola reports; observation) and others facilitated a more directed and oriented knowledge (identification of stakeholders – long and short list, interviews, empathy maps, design insights...). (B.A.A., 4th batch, sic)

As a teacher, Demola's methodology was particularly useful. The combination between empathy, insights and knowledge provides new ways of thinking and dealing with problem-solving. Therefore, this training provided valuable tools with which it was possible to build insights in every domain, and even improve teaching activities.

For students, this project had a significant impact, since for them it was the first time too, they got involved in a co-creation project, dealing with the outside world and dialoguing with companies and associations. All this has elicited on them critical thinking, entrepreneurship, self- motivation, information literacy, other digital skills and creativity. (R.S., 3rd batch)

Due to constraints on time available for delving into these design methods, the creative process was driven by a dynamic interplay of self-directed exploration undertaken collaboratively by the teaching staff Figure 3 – The five stages included in the divergent and convergent phases that make the joined model of the Design Thinking and Double Diamond processes, as presented by Suoheimo and K. Määttä (2024, p. 86). and their student teams. This proactive engagement encompassed anticipating scenarios, conducting insightful interviews, and employing direct observation. The multifaceted approach extended to the identification of user pains and gains skillfully mapped onto empathy frameworks. Additionally, the teams filled in 'persona' forms, speculated on what users see, feel, think or do, and worked on some form of prototyping – usually opting for low-fidelity, rather than high-fidelity prototyping – with simple sketches to convey an idea and get validation. The methodic progression of the creative process adhered to a deliberate framework, mirroring the Double Diamond Structure. The process transitioned from divergent thinking, where a multitude of possibilities were generated and explored, to convergent thinking, refining and narrowing down these different options into a more focused outcome. This dual-phase approach
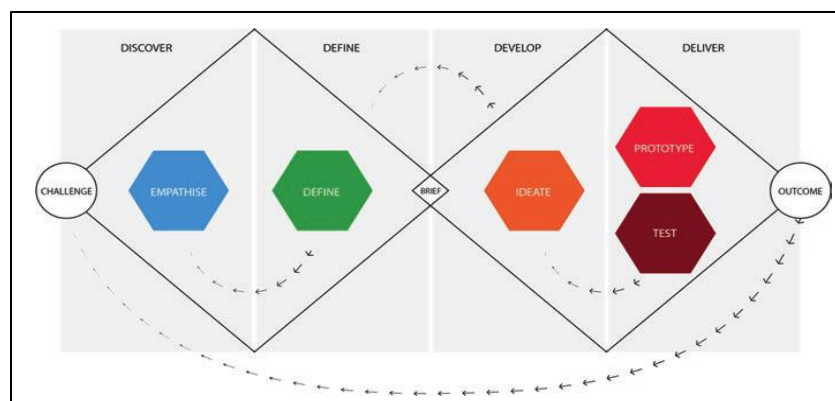
Figure 3 – The five stages included in the divergent and convergent phases that make the joined model of the Design Thinking and Double Diamond processes, as presented by Suoheimo and K. Määttä (2024, p. 86).

facilitates a robust and effective design methodology, as put by Mantelet, Segonds and Jean (2018) and, among many other scholars, as illustrated by Suoheimo and K. Määttä (2024), in Fig. 3.

The tasks and tools are indeed acknowledged as relevant by all participants, namely the students. On the left side, we find a graphical representation of some of the tasks accomplished by one of the teams of students participating in the 5th batch and sketched by them. It can be regarded as the project roadmap, as it provides us with a visual design that allows us to understand the project's progression and key events at a glance. Fig. 4, shown here, was not directly extracted from the facilitator's e-portfolio, but from the original source – the students' final report – to ensure the quality of the content, but she resorted to it as part of her reflection.
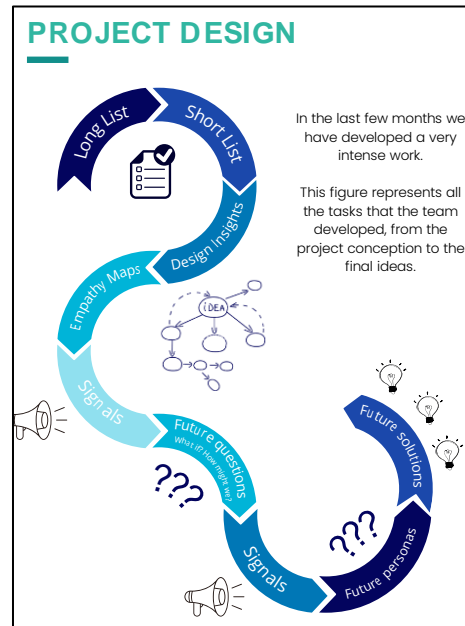
Figure 4 - Team tasks (Source: D.A.S. students' final report, also extracted and used in her e-portfolio)

Besides the tools and tasks, there is a range of benefits that contribute to the participants' personal and professional growth/excellence, such as the perks of **internationalisation** because of the training and bootcamps where there were colleagues from different Polytechnic Institutes, as well as Finnish, Hungarian and Brazilian trainers; valuable **networking opportunities** and **skill diversification**, as the following account, among so many that report the same, makes clear:

I learned about new tools, such as Atlas, miro, empathy maps, PESTEL, insights, week signals, about the co-creation process, about the facilitation process, about teamwork. I learned about the importance of exploring, reflecting and thinking with other people, in different contexts, pedagogical, social and cultural, of different nationalities, such as with the facilitators, the workers of the partner entity, the colleagues in the different formations and meetings, but particularly in the internationalization immersion carried out in the six fantastic bootcamps with the presence of the four polytechnics involved and the facilitators, both Portuguese and Finnish, that allowed me to have this vision that I now have of what it is to participate in a bootcamp. (C.E., 5th batch, sic)

The fact that the Demola Portugal Initiative offered synchronous and asynchronous training sessions, workshops/meetings with experts and the representatives of partner entities, as a platform for experiential learning, is regarded as beneficial by the participants, but **face-to-face bootcamps** are

highlighted as the key because of collective skill development and the sharing of best practices: "In my opinion, the presential sessions – bootcamps – were much more interesting for facilitators. There it was possible to learn strategies and tools for group working" (G.F., 6th batch, sic). This sentiment resonates across other portfolios, where the acknowledgement of the digital realm's vast opportunities is balanced with an appreciation of our fundamental need for in-person interactions as social beings. Numerous portfolios highlight the bootcamps as the pinnacle of their training journey. During these face-to-face and/or online sessions, the teaching staff, representing diverse fields of expertise and hailing from various Polytechnic Institutes in Portugal – and even from Finland (and one from Hungary) where the trainers came from – engaged in testing co-creation tools and approaches. As claimed by S.J., from the 5th batch:

The future is already there, at the end of the avenue. Starting from current reality to project the future seemed to me to be a very interesting exercise. The opportunity (particularly in bootcamps, but also in online sessions) to do the analytical exercise of speculation that the What if... and How might we... questions, was very relevant to deepen the idea that more important than to arrive at immediate solutions is to co-create thought, developing hypotheses. (...) Technology allows us this marvel of having training in Portugal, from Finland. The online sessions were fundamental to sustain, both with theoretical foundations and with knowledge of techniques and tools, my facilitation practice. (S.J., 5th batch)

The tools referenced by S.J. proved instrumental for all teams in redirecting their focus from fixed solutions to the exploration of opportunities, embracing setbacks as integral components of the learning process. Through the incorporation of methods such as affinity mapping, the 'What if…?' and 'How might we…?' design approaches, whose advantages are addressed and analysed by scholars such as Siemon, Becker and Robra-Bissantz (2018) and Vignoli et al. (2022), teams cultivated a mindset conducive to creativity and innovation.

Nevertheless, the pursuit of innovation is not without its challenges. A succinct reflection capturing some common concerns found across various e-portfolios revolves around dissatisfaction regarding partner entities. It was observed, in different instances, that **partner entities tended to overlook or dismiss** most – if not all – of the **ideas** presented by students:

One of the least positive aspects was the relationship with the partner company. Despite always being interested in helping us, company representatives didn't have much time available to meet with the team. When we asked them how the team could help with their ideas and contributions, the solutions they were looking for were different from those the team was able to provide. The organization's problems were quite practical, while the ideas developed by the team were more theoretical. (D.A.S., 5th batch)

This recurring theme highlights a crucial aspect of the collaborative process, indicating potential challenges in the implementation and recognition of student-generated ideas within external entities. This goes hand in hand with what Amante (2023) mentions when she addresses the common difficulties on the part of organisations to capitalise on the possibilities arising from ideas generated by students. Actually, the translation of their ideas into real-world organisational practices is frequently met with resistance, most often because the students do not have time to mature their ideas, or the skills needed. That is why most trainees/facilitators recognise the **significance of interdisciplinary and intercultural teams**, as this extract exemplifies:

This methodology is similar to the Learin's Creatin project that we implemented in IPV funded by FCT but it introduces the possible concept of an interdisciplinary team of students working in close collaboration with a company. Both methodologies require high dedication and autonomous work from students for which they are not trained/prepared. In our case, we follow the concept of interdisciplinarity of the students obtaining good results, therefore I propose to become mandatory to have an interdisciplinary team integrating at least (when possible) one foreign student. (O.S., 2nd batch, sic)

Diverse teams, comprising students from different cultural backgrounds, bring forth a wealth of perspectives, experiences, and insights that collectively enrich a project's outcome. One of the trainees/facilitators points out another advantage: "The fact of having an international student Chinese forced me to overcome one of my weaknesses the language barrier" (G.D., 1st batch, sic), an aspect similarly emphasised by other participants. This initiative stressed the need for the teaching staff to **invest in the learning of foreign languages, particularly English**, for effective communication to take place, but despite the challenges encountered, fruitful collaboration was feasible:

Although initially fearful, due to my lack of expertise in the English language, I felt increasingly excited and confident, thanks to the feeling of understanding and inclusion present, that led me to invest not only in the development of the project idea I had, but also in English language training. (C.E., 5th batch)

The quotations above indicate that the teaching staff hold **a positive view regarding the "Aprendizagem com base em processos de cocriação" training** and believe it leads to a significant enhancement in teaching quality. Many more examples could be added, but let us conclude this section with a final excerpt that eloquently captures the main ideas of this study:

This (long!) journey, often felt with discomfort, due to the low predictability and control (...), allowed the development/improvement of skills and learning.

From defining the challenge, to aligning to the partner's needs, to recruiting and building the team, to people, tools, through the training and facilitation process, the discoveries, insights, opinions, scenarios... it was indeed a period of great investment and with harvested fruits. I feel grateful for having embraced this challenge, for having withstood adversity, for the welcome and support of all involved, and above all, for all the moments when enthusiasm was visible in the twinkling of eyes and waving of hands! (B.A.A., 4th batch)

CONCLUSIONS

As the digital landscape evolves and academia evolves with it, programmes like the Demola Portugal Initiative stand at the forefront of pedagogical innovation and student empowerment in Portugal. They pioneer active methodologies, innovative pedagogical tools, and holistic learning experiences, aligning strongly with the needs of the contemporary labour market. By bridging gaps, promoting collaboration, and embracing innovative pedagogies, they inspire a dynamic learning environment. This environment nurtures critical thinking, fosters practical skills, and equips students for academic success and future professional endeavours. Moreover, this approach extends beyond classroom walls and textbook knowledge. It incorporates experiential learning in real-world contexts, often alongside intercultural peers in multidisciplinary teams, further enriching the educational experience.

These insights stem from the considerations in this study, which delved into the perspectives of teaching staff from the Polytechnic Institute of Viseu and 12 vocational school teachers from the region, engaged in the six editions of the Demola Portugal Initiative. The analysis of their e-portfolios revealed common themes. Findings indicate that participants are embracing this paradigm shift and valuing their role as facilitators. They feel compelled to invest in ongoing professional development to act as architects of a new era in education. In their portfolios, almost all IPV members and vocational school teachers expressed this compelling drive to periodically engage in training. This includes immersive bootcamps, face-to-face workshops, and other events to prepare them to use novel pedagogical tools, ensuring alignment with educational innovation and evolving pedagogical methodologies.

This initiative (2021-2023) not only provided the teaching staff with tools to strive for pedagogical excellence, but it also empowered students to actively shape their own destinies. Therefore, it can be asserted that familiarising oneself with programmes such as the Demola Portugal Initiative may hold implications for transforming and improving teaching quality across various educational levels and contexts. Actually, this initiative serves as a model that can inspire similar endeavours globally, akin to the one previously described by Catalá-Perez et al. (2020) in Spain. It bears the potential for ramifications that extend beyond its immediate scope, with far-reaching consequences to the advancement of teaching methodologies and the overall educational quality. The Demola Portugal Initiative has the capacity to leave a lasting imprint on other national and international educational settings.

In conclusion, our study highlights the significance of programmes like the Demola Portugal Initiative in fostering pedagogical innovation and improving educational standards. However, it is crucial to acknowledge the existence of certain inherent limitations. Notably, some participants in the programme exhibited some resistance, a topic deserving attention. This resistance may arise from various factors, such as time constraints or reluctance from collaborating organisations and students. Addressing these concerns surrounding initial setbacks or uncertainties regarding the effectiveness of proposed changes is essential. Effective communication, providing a rationale for change, offering support, and highlighting the benefits of pedagogical innovation can all play crucial roles in mitigating resistance, as evidenced by testimonials. In addition to these acknowledged limitations, it is essential to recognise that our findings, while insightful, are constrained within the regional context of Viseu. Hence, caution must be exercised in extrapolating these results beyond this specific setting. Moreover, to comprehensively assess the initiative's impact on the pedagogical practices of professors at the Polytechnic Institute of Viseu, future research directions should focus on exploring changes implemented at an institutional level. This entails examining whether the Polytechnic Institute of Viseu is currently integrating challenge-based approaches, co-creation methods, and exploring platforms and tools that facilitate active pedagogies. Such an in-depth investigation would offer nuanced insights into how the initiative has influenced and potentially transformed the pedagogical approaches adopted by IPV professors. Furthermore, it would contribute significantly to the broader discourse on pedagogical innovation in Higher Education. By delving into institutional changes and practices, future research can provide valuable insights that inform policy decisions and educational practices beyond the confines of our current study.

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INTERNATIONAL GASTRONOMIC FAIR–PROJECT-BASED LEARNING TO DEVELOP LINGUISTIC SKILLS IN TOURISM RELATED COURSES

Berta José Fernandes Costa and Maria Natália Pérez Santos

ABSTRACT

Project-Based Learning (PBL) is an educational approach that has been embraced in various disciplines, including tourism education. This article explores the role of PBL in enhancing tourism education in a higher education context. The study sought to determine the impact of PBL methods on students' knowledge acquisition, retention, practical skills development, and teamwork. The research was conducted with a class with 16 students, in a management and restaurant industry course at a polytechnic institute in Portugal. Results were collected by means of questionnaire disclosed among the students subsequently to the event organised. Findings indicate that students, by engaging in PBL, exhibited a deeper understanding of the course material, improved their ability to transfer knowledge to real-world scenarios, and developed important collaboration, communication, and critical thinking skills. It is then concluded that PBL is an effective approach to enhancing tourism education in a higher education context. It encourages students to actively participate in their learning and provides them with skills, knowledge, and experience that better prepare them for careers in the tourism industry. The research aims to demonstrate how PBL can be a valuable tool for tourism educators. By actively engaging students in project-based learning, educators can equip them with the necessary skills, knowledge, and practical experience to excel in their future careers within the tourism industry. Ultimately, this study seeks to contribute to a deeper understanding of PBL's potential in enhancing foreign language teaching within tourism-related university courses, promoting language proficiency and preparing students for success in the global tourism landscape.

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INTRODUCTION

The global tourism industry thrives on cultural exchange, making it crucial for employees to understand different cultures and languages (Costa et al. 2020). Tourism-related courses naturally integrate foreign language learning to equip students with the skills to bridge communication gaps and enhance the experiences of international visitors. In recent years, project-based learning (PBL) has emerged as a powerful approach to language acquisition, boosting motivation and fostering practical language skills for the tourism industry (Santos & Costa, 2024).

This article explores the potential of PBL in enhancing foreign language teaching in tourism-related courses, through a review of literature and case studies, it examines the advantages of PBL in foreign language teaching, outlines the challenges of implementing PBL in foreign language teaching and offers practical solutions to overcome these challenges. Ultimately, it aims to provide a greater understanding of how PBL can be used as a tool for enhancing foreign language teaching in tourism-related courses, and promoting language proficiency among students by presenting the results of a questionnaire disclosed among a class of management and restaurant industry students of the Polytechnic of Leiria.

While foreign language learning is a cornerstone of tourism education, equipping students for the global tourism landscape requires innovative teaching methods. Project-Based Learning stands out as a promising approach, yet existing research often examines its effectiveness in general language learning or within different academic disciplines.

This study distinguishes itself by investigating PBL's impact specifically within tourism-related foreign language courses. Here, the focus goes beyond general language proficiency. The research explores the industry's specific needs, exploring how PBL can foster the essential communication and cultural awareness skills required of future tourism professionals.

This targeted approach has the potential to make significant contributions to the literature on PBL and foreign language teaching. Firstly, it can provide empirical evidence for tourism educators seeking to improve their methods, demonstrating the effectiveness of PBL in enhancing foreign language learning specifically for tourism careers. Secondly, it can offer valuable insights into best practices for implementing PBL within these courses, serving as a practical guide for other educators.
Most importantly, by demonstrating how PBL fosters practical skills and cultural awareness alongside language proficiency, the research can contribute to closing the skills gap between tourism education and industry needs. This exploration can further stimulate research on PBL in tourism education, encouraging the development of different PBL project designs, assessment of learning outcomes in various tourism specializations, and comparisons with other teaching methods in this context.

Ultimately, this study aims to expand the existing knowledge on PBL and foreign language teaching by showcasing its effectiveness and practical application within the unique field of tourism education. In order to accomplish these goals, the following research questions were formulated: RQ1: How does Project-Based Learning impact students' knowledge acquisition in tourism-related university courses?; RQ2: How does PBL influence practical skills development in these courses?; RQ3: How does PBL foster teamwork and collaboration among students?; RQ4: How does PBL contribute to the development of critical thinking and problem-solving skills among students?

PROJECT BASED LEARNING LITERATURE REVIEW

Project-based learning has been widely used in educational settings across various disciplines, including foreign language teaching (FLT). Research has shown that PBL is an effective approach to enhance FLT in tourism-related courses. This literature review aims to synthesize the most significant findings of prior research on the effectiveness of PBL in FLT in tourism-related courses.
Project-based learning is an innovative approach to pedagogy that has gained popularity in recent years. It involves students in independent and authentic projects that help them acquire the knowledge and skills required to solve real-world problems. As such, PBL has been recognized as an ideal tool for enhancing foreign language teaching (FLT) in tourism-related courses due to its capacity to develop the language skills, socio-cultural competence, critical thinking, and creativity of students in the tourism industry.

The literature review indicates that PBL has been widely implemented in FLT contexts to enhance the communicative language skills of students effectively. For instance, Li and Li's (2019) research investigated the effectiveness of PBL in enhancing the English proficiency of vocational college students majoring in hotel management. The study revealed that PBL helped students to improve their pronunciation, vocabulary, and syntax, and facilitated their communicative competence, soft skills and critical thinking skills, and increased their motivation to learn English.

PBL is an innovative and student-centered teaching and learning approach that offers numerous benefits to both students and educators. Various studies have found that PBL helps to enhance the acquisition of foreign language, in particular, by exposing students to authentic communicative tasks that require them to use the target languages in real-life scenarios (AlMekhlafi & Nagaratnam, 2011; Chen & Lan, 2016; Moursund & Bielefeldt, 2015). PBL enhances students' motivation to learn, which has been recognized as an essential factor that impacts language learning. Through PBL, students are provided with the opportunity to collaborate with their peers, communicate effectively, and think critically and creatively about how to solve the problems they encounter while completing a project. This cooperative approach fosters a positive classroom environment, which not only supports language learning but also encourages the development of soft skills such as teamwork, leadership, and communication.

In addition to the advantages of PBL, studies also identify several challenges in implementing this approach in FLT. Lack of experience, time constraints, and inadequate resources are among the challenges that educators face when incorporating PBL into FLT. Some educators may have difficulty identifying suitable projects that align with the course objectives and are feasible in the given time and resource constraints (AlMekhlafi & Nagaratnam, 2011). Others may struggle to effectively evaluate and provide feedback to students on their PBL performance while ensuring that learning objectives are met (Chen & Lan, 2016).

Despite these challenges, several studies offer practical solutions to overcome them. In terms of identifying suitable projects, AlMekhlafi & Nagaratnam (2011) suggest starting with simple, meaningful, and realistic projects and gradually increasing the complexity of the tasks. To align language learning with course objectives, PBL tasks should include well-defined goals and require learners to apply the language rules in the context of the project. They also suggest involving students in the project design process to enhance their interest and motivation in completing the task. Moreover, including language professionals in the projects can also aid in providing feedback and evaluation of language acquisition.

Sánchez-Gómez et al. (2017) conducted a PBL course that aimed to enhance the English language skills of Spanish tourism students. The PBL project focused on creating a virtual travel agency, and the study shows that this approach led to an improvement in students' English skills, intercultural competence, and project management skills. The authors suggested that PBL can provide an ideal strategy for FLT in

tourism-related courses. Moreover, Li & Chen (2019) examined the impact of PBL on the development of students' language proficiency and intercultural competence in a Mandarin Chinese course for American undergraduate tourism students. The study shows that PBL activities enabled students to improve their Chinese language proficiency, critical thinking, intercultural communication skills and understanding of Chinese culture and tourism. Similarly, in a study conducted by Cortina-Villar et al. (2019), PBL was used as a teaching method to enhance English communicative abilities and critical thinking skills of hospitality management students in Spain. The study shows that PBL leads to an increase in students' motivation to learn English and in their communication and collaboration skills. Lyu & Zhang (2020), refer to PBL as a strategy used in a college English course for tourism students in China to explore different destinations and develop tourism products. The study found that PBL facilitated students' language skills, creative thinking, cross-cultural communication, and experiential learning. Furthermore, the study revealed that PBL projects increased students' motivation and engagement in learning. Furthermore, the study revealed that PBL projects increased students' motivation and engagement in learning.

Finally, a study by Casero-Ripollés et al. (2020) explored the use of PBL to enhance foreign language competencies in tourism marketing courses. The study revealed that PBL projects helped students to develop their foreign language skills, adaptability, cross-cultural understanding, decision-making, problem-solving and interpersonal skills.

Together, these studies provide additional evidence supporting the use of PBL as a tool for enhancing foreign language teaching in tourism-related courses. They also identify various benefits and challenges associated with the approach and propose possible solutions for successful PBL implementation.

PROJECT BASED LEARNING IMPLEMENTATION

Implementing a PBL project ought to follow the following steps: consider the content, which should be carefully chosen so that it meets the students' needs and attract their attention. It should be relevant, resort to engaging strategies so that it activates students' prior knowledge. These strategies main purpose is to stimulate students' ambition to know more about the content under study (Çalik & Şahin, 2022; Esmaeili & Alipour,2023; Özden & Doğan, 2023; Tosun & Demir, 2023), and to develop an overarching question that students will explore throughout the project. This question should be relevant, engaging, and help guide the entire project.

According to Çalik & Şahin, (2022) and Esmaeili & Alipour (2023) the following set of actions should be considered when implementing a PBL activity: plan the project, ie, design the project with clear objectives, learning outcomes, and assessment criteria, by including specific tasks or activities that will help students achieve the learning objectives initially proposed. Create a schedule: establish a timeline and pacing for the project to ensure that students have enough time to complete all steps of the project while meeting learning objectives. Monitor student progress: regularly monitor and assess student performance throughout the development of the project, and provide feedback to help them improve. Encourage student inquiry: as PBL projects should start with students asking questions about a problem, questions like *What is the nature of the problem they are trying to solve? What are some potential solutions?* could be used as the starting point. Consider available materials and resources: ensure that students have access to the materials and resources needed to complete the different tasks. Consider what materials are available, where they are located in the room, and how students can access them.

Present the project to a public/audience (other students, relatives, teachers, community members), as it enhances students' hard work and delight while conducting the project.

Start small: begin by implementing small, well-planned PBL projects to help build students' confidence and increase engagement before tackling larger, more complex projects.

By following these steps, project-based learning can be successfully implemented in the classroom. It is important to remember that PBL is a student-centered approach that requires guidance and support from the teachers throughout the project.

The International Gastronomic Fair, which is the PBL project under analysis in this study, will be detailed in the following section.

METHODOLOGY

The Curricular Units (CU) of the degree in Restaurant and Catering Management integrated in the activity detailed in this paper is ministered in the second semester of the first year of the course. In an attempt to offer students the opportunity to combine practices and interact different knowledge and skills in a single pedagogical activity, its genesis materializes in the 2021/2022 academic year. Involving, in a first edition, three CUs – Spanish for Catering II, English for the Restaurant Industry II, within the scope of Foreign Languages (FL) and the CU Introduction to Catering and Restaurants. From the second edition onwards, in the 2022/2023 academic year another foreign language was included, namely, the CU Foreign Language II – German II.

In this sense and with the aim of promoting multidisciplinarity, interdisciplinarity and transversality between the four CUs, three in a foreign language for specific purposes and a practical CU, Introduction to Catering and Restaurants, it was proposed to students the organization of an *International Gastronomic Fair*, open to the academic community, in which a gastronomic experience was prepared and presented. This demonstration included dishes from different parts of the globe (in this case, from Spanish, German, and English-speaking countries). At the same time, in order to develop digital skills, students also had the opportunity to promote and advertise the event using internal communication channels and different digital resources.

The event itself was developed considering a range of diverse but interconnected skills, which were addressed on the CUs already mentioned to develop the skills expected for a professional in the area of restaurant and catering. This activity aimed at simulating practice (cooking practice), encouraging teamwork and critical reflection, while allowing students to learn about the gastronomic diversity and richness of the countries involved, acquire specific lexicon, and develop their oral and written linguistic skills in a foreign language, research and selection of information, as well as develop expertise regarding the process of planning and organizing a gastronomic event.

In the activity and considering one of the premises of PBL, the students were placed at the centre of the learning process, as the protagonists, placing the teacher in a position of facilitator and advisor, as well as a spectator of the process development.

The activity was developed in different phases, with the starting point being the selection of the dishes to be prepared and presented, followed by the research on these same dishes, planning, organization, and promotion of the event. Another phase involved the preparation of the dishes and advertising of the event, its execution and evaluation. In each phase, students were invited to prepare sequential tasks, culminating in the *International Gastronomic Fair* open to the entire academic community.

The first phase, prior to the selection of the dishes to be prepared and presented, working groups were formed, three students per group, which matched with the various curricular units organization. In the early stages of this phase, the organization and dissemination process, the working group defined the objectives and prepared the activity script for subsequent presentation in the different foreign languages chosen by the students (English, Spanish or German). Posters, leaflets, and a menu were also considered as elements for promoting and advertising the dishes and the gastronomic event.

On the second phase, research and processing of information on the dishes assigned to each working group were carried out and were mainly based on online bibliographical research, in different foreign languages.

The following phase, the third, was dedicated to the preparation of dishes in the context of simulated practice in the Introduction to Catering and Restaurants CU, simultaneously to the planning, organization and dissemination of the gastronomic event within the scope of the remaining Foreign Language CUs.

The next phase comprised the execution of the event – the *II International Gastronomic Fair* with tastings for visitors, with the penultimate phase being the creation of a teaser to present the result of the event.

The last phase was dedicated to evaluating the students in all the tasks carried out over the thirteen weeks of the semester: the script, the oral presentation of the dishes, the dishes themselves, their preparation, the posters, the leaflets and the menu created, as well as the teaser produced-were assessed in accordance with what was defined in each curricular unit at the beginning of the semester. At the end of the semester, a questionnaire that had previously been validated and in part already applied in the area of tourism, was implemented, with the purpose of allowing students to reflect on the activity developed and to evaluate the learning experience.

PARTICIPANTS AND CONTEXT

The *II International Gastronomy Fair* was an event organized by first-year students of the Restaurant Management and Catering course, of a polytechnic education institution, in Portugal, in the second semester of the 2022-23 academic year, in which four curricular units participated (Spanish for Catering II, English for the Restaurant Industry II, German II, and Introduction to Catering and Restaurants), with a total of 14 students (out of 15). The participant students are mainly of the male sex (57%), with ages comprehended between 17 and 20. 48% of these students enrolled in the curricular units English for the Restaurant Industry II and Spanish for the Catering II, and just 4% are studying German II.

DATA ANALYSIS AND DISCUSSION

After analyzing and processing the data sample, the results of the questionnaire show that more than 70% of the students already knew the dishes to be prepared at the event, and only obtained more details (ingredients, cooking methods) through online research (42%), through friends, colleagues and family (33%), and a minority in class (17%). Although the students did not have detailed knowledge on the dishes, 36% had already cooked at least one of them.

With regard to the project-based learning and the theoretical-practical structure of the event, 64% of the students stated that the interdisciplinary approach and the different phases throughout the project were an added value and a challenge to get "hands on" and present a gastronomic event to the entire academic community.

Regarding the development of language skills in the different foreign languages, English, German or Spanish, 18% of the students stated that they had developed foreign languages oral expression. 15% considered to have developed written expression, pointing out that this activity was beneficial for developing their language skills, particularly the oral expression (17%) and the written expression (14%). 8% also acknowledged that it was beneficial for acquiring specific vocabulary.
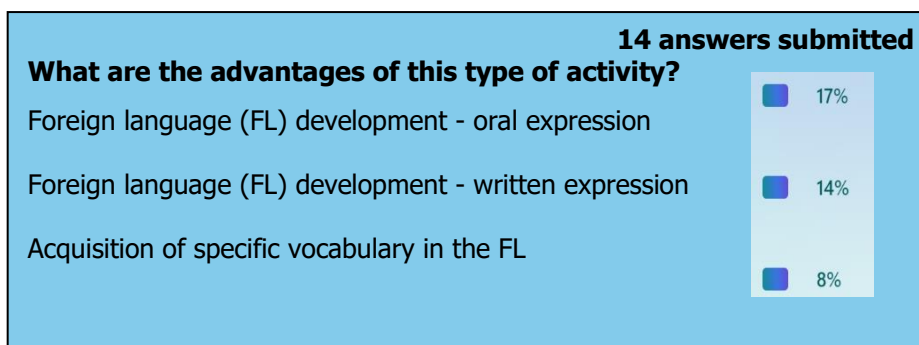
14 answers submitted

What are the advantages of this type of activity?

Foreign language (FL) development - oral expression   ■ 17%

Foreign language (FL) development - written expression   ■ 14%

Acquisition of specific vocabulary in the FL

■ 8%

Figure 1. – Advantages of the International Gastronomic Fair.

The students were also asked to choose the option that best expressed their degree of agreement (Likert scale) with a range of statements related to the development of oral and written communication skills; the importance of foreign languages as an essential communication tool for a catering professional; the methodology adopted; student commitment and motivation, and the integration of students into the labor market, among others. Regarding the development of oral communication skills, 29% of students totally agree that they have developed oral communication skills, more than a third, 36%, agrees, and the remaining 35% neither agree nor disagree. As for written communication, 14% of students totally agree, 57% agree and 29% neither agree nor disagree that they have developed foreign languages written expression.

Regarding the importance of foreign languages as an essential tool for communication in the catering sector and as a future catering professional, when acknowledging this importance, 43% totally agree, 50% agree, and 7% neither agree nor disagree, with almost the majority of students recognizing the importance of the role of foreign languages in the area.

■ totally disagree   ■ disagree   ■ neither agree nor disagree   ■ agree   ■ totally agree

14 answers submitted

I recognise the importance of foreign languages as essential communication tools in this profession.

7%   50%   43%
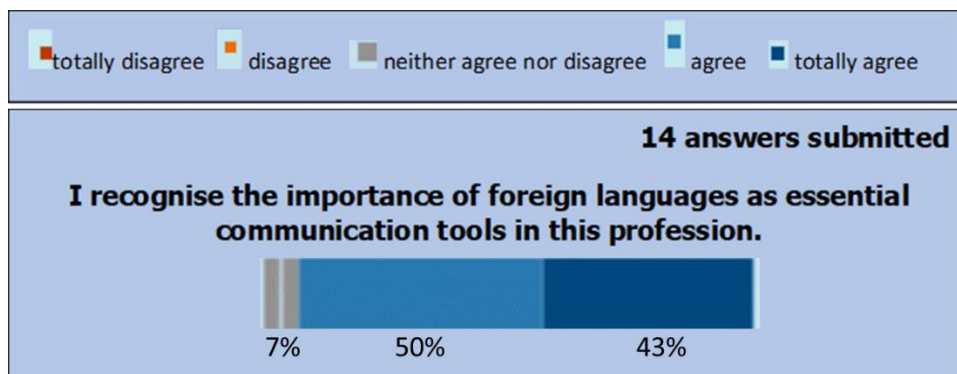
Figure 2 - Importance of foreign languages as an essential tool for communication

Project-based learning, the methodology adopted for the gastronomic event, proved to be efficient and effective, as more than half of the students (54%) agreed and more than a third (36%) totally agreed that the methodology adopted contributed to the whole learning process and to the preparation and execution of the final product, with only a minority disagreeing (7%). The methodology used resulted on the students' greater commitment, motivating them throughout the project, with students stating that the work model used in this activity was very motivating (36%). 54% considered that it was motivating, and just a minority (7%) found it not very motivating.
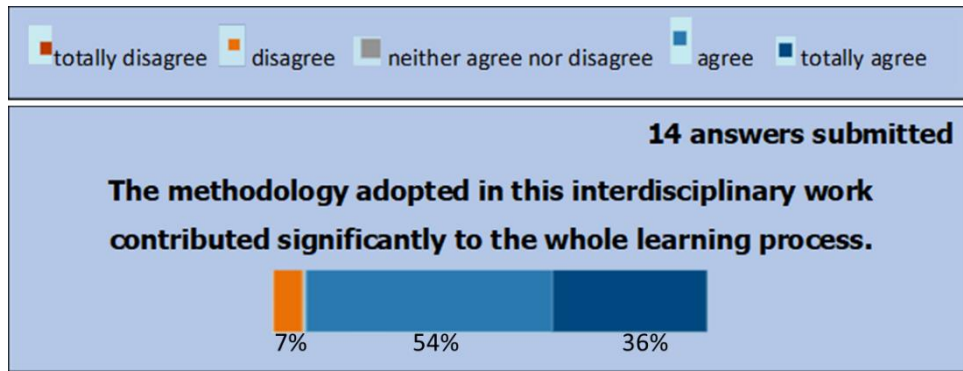
Figure 3 – Methodology adopted for the event.

As for the skills developed and/or acquired through this project-based learning with regard to entering the world of work, the results show that 64% agree, and 22% totally agree that learning through challenges, presenting problems and solving them, and events, has allowed them to feel more prepared for the world of work, and consequently have the perception of having more accessible access to the labor market, increasing their employability, with 43% agreeing, 29% totally agreeing, and only a minority not having an opinion, as stated by Figures 4 and 5.
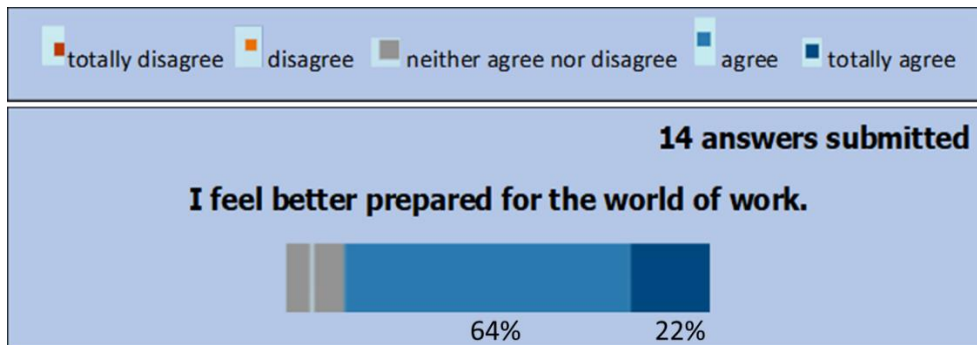
Figure 4 - Preparation for the world of work.
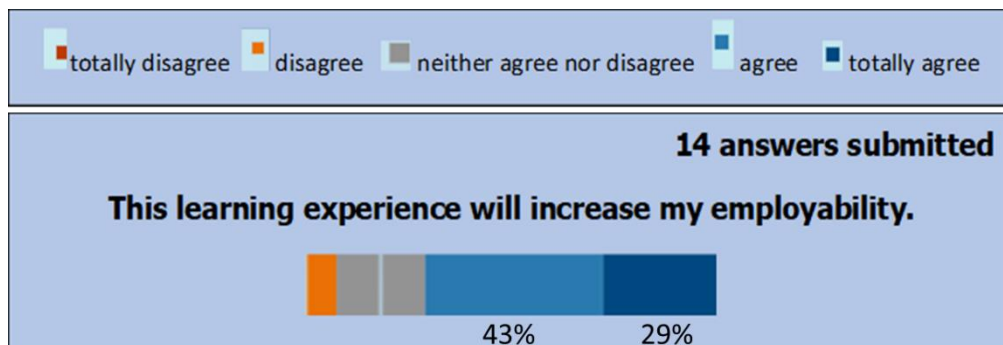
Figure 5 – Employability

CONCLUSION

Project-based learning stands out as a teaching/learning strategy that addresses the needs of both educators and learners in teaching and learning a foreign language efficiently and effectively, and at the same time promotes knowledge transfer in compliance with skills, by engaging students into their learning process, which can be broadly motivating and more encouraging as it allows their creativity to be enhanced.

The *II International Gastronomic Fair* allowed students to come into contact with dishes, ingredients, and food preparation methods from different countries. One of the key contributions of this event was the opportunity to develop foreign language written and oral communication skills, as well as acquiring specific vocabulary of the restaurant industry and catering area. Students also acknowledge that learning a foreign language is fundamental to a professional who works in the aforementioned area. It was also highlighted by these students that the methodology adopted of putting into practice this fair assisted the preparation and execution of the final product. Results additionally indicate that learning through challenges, presenting problems and solving them, allows them to feel more prepared for the world of work, increasing the potential of employability.

Based on the results presented and discussed above, it is possible to conclude that PBL guarantees great and beneficial outcomes on the students' academic accomplishments. Although there are various challenges and obstacles to overcome, the advantages of implementing such a methodology outweigh those obstacles.

Despite these interesting results, this study has also some limitations, particularly the number of students who took part in the study (these were the current number of students enrolled in the curricular units which participated in the project). A higher number of students could contribute to the generalization of the results.

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POLIEMPREENDE-AN ANALYSIS OF THE EFFICIENCY MEASURES IN 13 PORTUGUESE HIGHER EDUCATION INSTITUTIONS

Fernando Teixeira and Olinda Sequeira

ABSTRACT

This paper discusses the significance of entrepreneurship in higher education institutions and presents a case study of 13 Polytechnic higher education institutions in Portugal. Over the past 3 years, these 13 institutions have received European funding to promote and develop activities related to entrepreneurship within their institution. Among the various actions funded, there is one that is particularly important called Poliempreende, which involves a business plan competition in each of the institutions, culminating in a national competition. Up until now, the efficiency of each of these institutions in relation to Poliempreende has never been analysed. Bearing in mind that productivity is influenced by technical efficiency, this paper aims to analyse the productivity of these institutions. This paper presents a study on the individual performance of these institutions. This analysis is crucial for less efficient institutions to benchmark against completely efficient ones. To conduct this analysis, we apply the non-parametric Data Envelopment Analysis method, which is solved through linear programming. Our findings indicate that while some institutions are completely efficient, others have significantly lower efficiency levels. Therefore, institutions that received the same amount of European funding should observe the efficient institutions and conduct benchmarking. As far as public policies are concerned, it would be desirable to have ongoing projects to encourage the development of partnerships between institutions and with businesses, incentives for the creation of incubators and start-ups and greater diversification of financing instruments for entrepreneurs.

Keywords: Entrepreneurship, Productivity, Efficiency, Poliempreende, Data Envelopment Analysis (DEA)

INTRODUCTION

Poliempreende is an entrepreneurship education programme implemented in polytechnic higher education institutions. Discussing entrepreneurship means discussing innovation. Talking about entrepreneurship is talking about growth, creativity (Thalassinos & Zampeta, 2012) and innovation (Markatou & Stournaras, 2013). Entrepreneurship education is the initial and perhaps the crucial step

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towards instilling a culture of innovation in society (Gianiodis et Meek, 2020). For 3 years (2021 to 2023), 13 higher education institutions (HEIs) formed a consortium and applied for European funds to promote and develop entrepreneurship. Promoting an entrepreneurial culture in the European Union is a top priority, which is why significant funds are allocated to entrepreneurship education. Education is not the only factor, but it explains a very important part of the country's economic growth rate. That is why education is and will continue to be a very valuable investment and today there is no doubt that education for entrepreneurship plays a relevant role. Portugal is ranked among the top 10 countries in the European Union (EU) for knowledge creation. However, when it comes to transforming this knowledge into patents, timely technology transfer, anticipating innovation, and creating and expanding innovative companies, our economy is considered to have moderate innovation, which is far below the EU average (European Commission, 2022). The absence of an entrepreneurial culture hinders the transformation of knowledge into economic and cultural goods, creating a significant gap that impedes innovation and productivity in the economy (Motoki, et al., 2022). Entrepreneurship is the key to converting research into innovation, which is essential for transferring research results to the economy. This is why we need an entrepreneurial culture, and this culture is fostered through entrepreneurship education – offering a mix of experiential learning, training and, most importantly, a change in mindset. All 13 institutions were already developing a joint project called Poliempreende. However, it is important to analyse the productivity results of each of these 13 institutions. No study has ever analysed the productivity achieved by each institution using Poliempreende. This article presents an innovative approach. Technical efficiency is used as an indicator to understand the results, enabling analysis of the productivity achieved by each institution. This is important for benchmarking, so that less productive institutions can learn from more productive ones. During the European funding period from 2021 to 2023, all 13 institutions conducted identical activities. This ensures accurate data sources, enabling the application of the Data Envelopment Analysis (DEA) methodology. The DEA method, which involves mathematical programming, is widely used to measure the level of inefficiency of institutions. This method is one of the most commonly used for analysing efficiency levels. It allows for the construction of a non-parametric piecewise surface over the data, known as the efficiency frontier, and calculates efficiency measures relative to this frontier. The remainder of the paper is organised as follows: section 2 presents the importance of entrepreneurship in HEIs. Section 3 introduces the concept of Poliempreende and section 4 explains the methodology. Section 5 presents the results. Section 6 presents our conclusions.

ENTREPRENEURSHIP IN HIGHER EDUCATION INSTITUTIONS

Entrepreneurship can be defined as a process of building mentality and skills aimed at creating employment opportunities and economic development (Hessels & Naudé, 2019 and Nel & Goldman, 2017). Lin et al (2008) add that entrepreneurial capacity is a driver of innovation. This innovation is triggered by the process of entrepreneurship and learning. Vaicekauskaite & Valackiene (2018) state that in recent years, empirical evidence confirms that education plays a significant role in promoting entrepreneurship and boosting an entrepreneurial spirit. Fourier (2008) and Saeed et al. (2018) consider that entrepreneurial intention is essential for entrepreneurship. Wardana et al. (2020) found evidence that entrepreneurship education can have an impact on entrepreneurial behaviour and the entrepreneurial mindset. Colombo & Piva (2020) state that university education is essential for students to develop skills that encourage the choice of entrepreneurship as a career.

Hahn et al. (2020) suggest that HEIs offer their students courses/modules in the area of entrepreneurship with the aim of stimulating their entrepreneurial spirit and acquiring skills in entrepreneurial activities. The authors found that students learn entrepreneurial skills, regardless of whether the courses/modules are mandatory or optional. In the case of students attending compulsory

courses/modules, the acquisition of this knowledge depends on their perception of their parents' interaction with entrepreneurship. According to Wardana et al. (2020), HEIs should change their curriculum in the area of entrepreneurship and, if possible, some of this training should be taught by professionals in the sector and in a business environment. Higher education institutions must also support students in the production of new products by providing financial and technical assistance. Vaicekauskaite & Valackiene (2018) state that HEIs have played a crucial role in promoting motivation for business-oriented entrepreneurship. Saeed et al. (2018) supports these conclusions by stating in their study the importance of the university environment in fostering entrepreneurial behaviour. Audretsch (2014) confirms in his research the evolution of the role of HEIs in society, namely by introducing the concept of entrepreneurial university into his analysis. This university profile arises as a response to the need for HEIs to transfer knowledge to society. This study also highlights the importance of these institutions in boosting knowledge-based startups.

Matt & Schaeffer (2018) found that the introduction of entrepreneurship in academia promotes strategic opportunities for universities. According to these authors, academic entrepreneurship does not end with the creation of high-tech start-ups by faculty members. The analysis carried out suggests that there are several types of entrepreneurial activity, regardless of whether new companies are created. Others such as Trierweiller et al. (2021) note that HEIs are increasingly focusing on their third mission, which includes the dissemination of knowledge through the commercialisation of patents and the maintenance of relationships with companies and other institutions. Governments encourage relationships between these partners, because this approach focuses on technological innovation and changes the relationship between those who produce knowledge and those who apply it. The sharing of knowledge generated by Higher Education Institutions (HEIs) promotes regional development by spreading knowledge, fostering the creation of startups, producing more qualified human resources, and generating innovative ideas. Boldureanu et al. (2020) suggest that entrepreneurship education and the analysis of successful business cases is an important reason to encourage students to create their own business and improve their entrepreneurial spirit. The authors add that teaching entrepreneurship enables students to understand the importance of creating new jobs while maintaining high incomes. Sciarelli et al. (2021) note that HEIs have been encouraged to contribute to the creation of a local entrepreneurial ecosystem and participate in economic growth. Sánchez (2013) states that entrepreneurship education ecosystems focus on motivations, skills in knowledge, management, experience and networks. Matt & Schaeffer (2018) analysed the University of Strasbourg and found that this institution has built an entrepreneurial ecosystem. The objectives of this solution include supporting academic entrepreneurship and maximizing results for the university and the surrounding society. The development of this ecosystem involved three phases: the creation and restructuring of the incubator, accelerator and partnerships with investors; the ongoing coordination and cooperation between the actors that make up the ecosystem; the dissemination of an entrepreneurial culture and dynamics. Fuster et al. (2019) find that HEIs play a strategic role in regional economic growth, through the establishment and support of university spin-offs. These spin-offs are essential partners in the university entrepreneurial ecosystem, as they consolidate the transfer of knowledge to companies outside this ecosystem. Graham (2014) notes that there are venture capital firms associated with the funding of new technologies emerging from applied research carried out within universities. Allahar, & Sookram, (2019) concluded that building a good university business ecosystem is a long-term project. The authors note that the maturation of this ecosystem poses several challenges, including limited financial and human resources, lack of committed leadership, underdeveloped business culture, and resistance to incubating companies at HEIs in developing countries. Odei & Novak (2023) showed that funding, patents and returns have a strong influence on the creation of spin-offs in universities.

POLIEMPREENDE – A CASE STUDY

The Poliempreende Competition is an initiative that involves higher education institutions (HEIs) in Portugal. The twentieth national competition will be held in 2024. The Poliempreende Competition aims

to promote entrepreneurship in academia. Its specific objectives are to stimulate the entrepreneurial spirit in the academic community and its regions of influence, develop entrepreneurial skills through courses/modules, disseminate and promote innovation and its protection, and create new innovative and sustainable companies. The Poliempreende Competition is aimed at students, graduates and faculty from the HEIs within the consortium. Teams with faculty members must have an equal number of students and/or graduates compared to the number of faculty members.

The Regional Poliempreende Competition includes entrepreneurship workshops, as well as regional and national competitions Entrepreneurship workshops offer training activities and support for students to generate ideas (E-workshops) and develop business plans (E2 workshops). For the Regional Poliempreende Competition in each HEI, participating teams are required to submit a document that introduces the team and presents their Business Plan. The Business Plan should consist of a descriptive report and a financial section, following the IAPMEI model. Projects submitted to the competition must be aimed at implementation and cannot have won prizes in other competitions or be judged in competitions of the same type. They can include transformation solutions for operating companies, and team members cannot be involved in more than one project in the same edition. Each of the HEIs will bring together a panel of judges to assess and rank the business plans. The winning team of the Regional Poliempreende Competition in each of the HEIs, will represent their HEI in the National Poliempreende Competition. The National Poliempreende Competition will be coordinated annually by a different HEI.

The projects selected for the National Poliempreende Competition are evaluated and ranked by a national jury according to the following criteria: degree of business innovation; market, environment and marketing strategy; feasibility of operations; socioeconomic impact; financial plan; team and presentation to the jury. In both the Regional Competition and the National Competition, cash prizes will be awarded to the first three classified.

METHODOLOGY

Efficiency is a topic that has attracted a lot of research in recent decades (Vaninsky, 2006, Barros & Antunes 2011, 2014). The research has focused on frontier analysis which includes several measurement techniques divided into mathematical linear programming and econometric approaches. The aim of this paper was to explore the concepts of efficiency and productivity in HEIs applying frontier models. This makes it possible to compare the performance across categories and the determination of the ability of members of each category to keep up with best practice in their own category.

The production of any good or service is a process of transforming a set of inputs into a set of outputs (Sumanth,1998). The productivity of a production unit is the ratio of its output to its input. If the unit uses multiple inputs to produce multiple outputs, the outputs in the numerator must be aggregated in some economically meaningful way as the inputs in the denominator and efficiency is a comparison between observed and optimal values of its outputs and inputs (Sequeira et al., 2023).

In these two comparisons the optimum is defined in terms of production possibilities and efficiency is technical. The term productivity was probably first used by the French mathematician Quesnay (1766) in the *Journal de l'Agriculture* over two centuries ago. Although the concept of productivity has been around for a long time, a surprising number of people who make decisions every day about how to improve plant efficiency cannot answer the simple question of what productivity is (Chew, 1988). The terms productivity and efficiency are often used to assess the performance of organisations in converting inputs into outputs. In fact, they are often confused and considered to be interchangeable. The term productivity is often misunderstood but productivity and efficiency are not the same thing. Efficiency can be defined as the ratio of output actually produced to the standard output prescribed, whereas a classic measure of

productivity is the ratio of output produced per unit of input used (Lovell, 1992). Increased efficiency does not necessarily lead to increased productivity. Increased efficiency is a necessary but not a sufficient condition for productivity improvement.

Why measure efficiency and productivity (Lovell, 1992)? They serve as success indicators and performance measures for evaluating production units. Additionally, measuring efficiency and productivity allows us to explore hypotheses about the sources of differentials, by separating their effects from those of the production environment. Identifying the sources is crucial for designing effective public and private policies to improve performance. The idea of efficiency as a measure of performance was first developed by Edgeworth (Samuels 1992) and Pareto (1927), and its practical application was documented in Shephard's book (1953). According to Greene (1997), producers are considered efficient if they have maximized output while minimizing input costs. The concepts of economic efficiency and frontier functions are closely related, with efficiency being measured through the use of a frontier function. Farrell (1957) introduced two concepts that allowed for the measurement of efficiency by considering different inputs. The production function is the simplest and most common way to describe an organisation's technology. An organization, given its existing technology, produces outputs from different combinations of inputs, all of which are represented in the set of possible outputs. According to Greene (2000), a function is a relationship between inputs and outputs observed at a specific point in time. The frontier production function defines the maximum output that can be produced with a fixed number of inputs in the output approach. In the input approach, the output is fixed, and the observed input is compared with the minimum input required to produce the output. If an organization is classified as technically efficient (TE), it means that it is operating at the frontier. Those outside the frontier are technically inefficient (Sequeira et al., 2023). To estimate the frontier function, two methods can be used: a parametric and a non-parametric method, as stated by Murillo (2004).

• Non-parametric method: The functional form of the efficient frontier is not predefined. The functional form is calculated empirically from observations.
• Parametric method: The functional form of the efficient frontier is pre-established or imposed a priori.

The main difference between these estimation techniques is whether they assume a functional form or not. The non-parametric approach, which is associated with the Data Envelopment Analysis method, does not require a pre-established functional form. Instead, it uses a linear programming model to construct production frontiers based on observations and calculate relative efficiency indices. Villa and Losano (2020) note that technical efficiency is measured on a scale of 0 to 1. The study identified identical inputs and outputs for all institutions and established an appropriate level of aggregation, which is necessary for applying the DEA method. The technical efficiency of 13 higher education institutions was calculated using the DEA method proposed by Charnes et al. (1981). Each of these institutions represents a decision-making unit (DMU) when using the DEA method.

RESULTS

As previously mentioned, each of the 13 polytechnics will be treated as a Decision-Making Unit (DMU) because of their institutional autonomy. Linear programming will be used to determine the efficiency frontier of each DMU, which is assumed to be deterministic. The problem can be solved in fractional form (Charnes et al., 1981). Sequeira et al. (2023) state that if there is a homogeneous set of N DMUs with observations for M inputs and S outputs, the information for the jth firm is represented by the column vectors xj and yj. The input matrix MxN, X, and the output matrix SxN, Y, represent the total observations for all N DMUs. The objective for each DMU is to obtain a measure of the fraction of all outputs over all inputs. This is achieved by using a vector of output weights, w, and a vector of input

weights, z, both of size Sx1 and Mx1 respectively. The optimal weights are calculated by solving a mathematical programming problem.

$$Max_{w_r z_i} H_0 = \frac{\sum_r^S w_r y_{ro}}{\sum_i^m z_i x_{io}} \qquad (1.1)$$

$$\text{subject to:} \frac{\sum_r^S w_r y_{rj}}{\sum_i^m z_i x_{ij}} \leq 1 \qquad\qquad j = 1, \dots, N \qquad (1.2)$$

$$w_r, z_i > 0 \quad r = 1, \dots, S \quad i = 1, \dots, m \qquad (1.3)$$

Considering:
y = outputs; x = inputs; and w, z = weightings

The presented problem assumes an input orientation and constant returns to scale (CRS) (Paradi et al., 2018). It considers 13 DMUs, namely the Polytechnics of Beja, Bragança, Castelo Branco, Cávado and Ave, Coimbra, Guarda, Leiria, Portalegre, Porto, Santarém, Tomar, Viana do Castelo and Viseu. All 13 polytechnics have received European funding over the last 3 years to promote an entrepreneurial culture in teaching practice. The performance of each of these DMUs will be assessed, as mentioned above, by calculating the TE for each institution. This is possible because all these institutions follow the same procedure, as described in point 3. Table 1 presents the data for the two inputs used by each DMU and the two outputs also achieved by each DMU.

Table 1 - output matrix (Y) and input matrix (X) data

DMU	HEIs	Output 1 - Number of business ideas competing	Output 2 - Number of students wishing to create their own job/company	Input 1- Number of training actions of business ideas developmen	Input 2-Number of participants in visits to companies
DMU1	Beja	12	161	22	127
DMU2	Bragança	328	24	27	362
DMU3	Castelo Branco	70	43	10	213
DMU4	Cávado e Ave	74	74	23	290
DMU5	Coimbra	63	83	18	111
DMU6	Guarda	23	46	48	254
DMU7	Leiria	70	168	161	730
DMU8	Portalegre	17	114	45	128
DMU9	Porto	22	118	71	545
DMU10	Santarém	121	98	7	462
DMU11	Tomar	19	79	14	334
DMU12	Viana do Castelo	14	52	20	270
DMU13	Viseu	36	88	20	205

The data pertains to the years 2021, 2022, and 2023, as reported by each institution on a platform created for this purpose. The TE levels for each institution were calculated using the linear mathematical problem described in Table 2.

Table 2 - DMU Technical Efficiency Levels (CRS Model)

DMU	HEIs	Technical efficiency per DMU

DMU1	Beja	1.000
DMU2	Bragança	1.000
DMU3	Castelo Branco	0.757
DMU4	Cávado e Ave	0.570
DMU5	Coimbra	1.000
DMU6	Guarda	0.204
DMU7	Leiria	0.244
DMU8	Portalegre	0.752
DMU9	Porto	0.227
DMU10	Santarém	1.000
DMU11	Tomar	0.605
DMU12	Viana do Castelo	0.318
DMU13	Viseu	0.627
Mean TE		0.639

For a DMU to be considered efficient, it must obtain a value of one. As can be seen, the Polytechnics of Beja, Bragança, Coimbra and Santarém are the only efficient DMUs. The remaining institutions have room for improvement to achieve better levels of technical efficiency which will likely impact their productivity. Institutions that have not yet reached the maximum value of technical efficiency should benchmark against those that are fully efficient. Several factors may affect the optimal scale of institutions such as location or technological intensity of the companies collaborating with the 13 polytechnics. In these situations, a DEA model with variable returns to scale (VRS) can be used. To obtain a VRS model, it is only necessary to impose the convexity condition on equation 1 (Coelli et al., 2005). In this case, the effects of Efficient Scale for the 13 institutions do not influence the TE values. The TE values for the 13 DMUs are presented in Table 3 when applying a DEA-VRS model with input orientation.

Table 3 - DMU Technical Efficiency Levels (VRS Model)

DMU	HEIs	Technical efficiency per DMU
DMU1	Beja	1.000
DMU2	Bragança	1.000
DMU3	Castelo Branco	1.000
DMU4	Cávado e Ave	0.634
DMU5	Coimbra	1.000
DMU6	Guarda	0.437
DMU7	Leiria	1.000
DMU8	Portalegre	0.917
DMU9	Porto	0.261
DMU10	Santarém	1.000
DMU11	Tomar	0.803
DMU12	Viana do Castelo	0.649
DMU13	Viseu	0.782
Mean TE		0.806

The VRS model shows improved efficiency for all DMUs that did not exhibit total technical efficiency. As expected, the average TE increased significantly. On average, there is still room for improvement (0.194) to increase improvements, with the Polytechnics of Porto and Guarda presenting very high levels of technical inefficiency, at 0.739 and 0.563 respectively. This means that the inputs observed can be minimized for the total output achieved by these polytechnics.

CONCLUSIONS

The main conclusion is that the average TE of the 13 DMUS can be improved, regardless of whether a DEA-CRS or DEA-VRS model is used. Another important conclusion is that 4 DMUs exhibit a 100% TE in the DEA-CRS indicating that they are using the minimum inputs required to achieve the same total output as other DMUs. This suggests that these DMUs should share their techniques with other DMUs for benchmarking purposes. One of the main objectives of using a DEA model is to allow benchmarking, precisely by indicating the DMUs that are on the efficient production frontier. It is evident that studying the effects of scale is crucial, as they are largely dependent on the environment in which each institution operates. Failure to consider the effects of scale may result in an improvement in technical efficiency for all decision-making units (DMUs) that were not operating on the efficient frontier of production. This means that there are DMUs that are not efficient at scale while others can achieve optimal results with fewer inputs. The focus of this study is to analyse, the technical efficiency of institutions in incorporating the concept of entrepreneurship into academia. The results indicate that the effects are positive. Table 1 shows that several students report feeling more empowered to create their own business. Thus, it can be inferred that programmes like Poliempreende can shape behaviour and foster entrepreneurship, as opposed to students who were only introduced to entrepreneurship practices related to Poliempreende at their respective institutions. After analysing the data from the three-year period, as referred to in this study, questionnaires were used to determine that the students are better prepared for the business world and are interested in creating their own jobs or companies. This is supported by the figures reported in output 2, as shown in Table 1. Based on the statistics, 1148 students who had contact with Poliempreende expressed interest in creating their own job or company. The article also emphasises the significance of measuring institutional performance in terms of technical efficiency and productivity analysis. It presents an opportunity for improvement, particularly for technically inefficient institutions. In future research, it would be valuable to explore the career paths of these students. In order to gain a deeper understanding of the impact of Poliempreende, it is crucial to determine the number of students who have started their own businesses. Finally, providing a different methodology for analysing efficiency and productivity in higher education institutions is the main contribution of this article to the literature. This methodology can adopt several variables, completely different from those used in this study, and analyse them from different perspectives. On the other hand, the literature aimed at higher education institutions provides information on the concept of technical efficiency and how it can contribute to the assessment of the performance of each institution. This allows, and this is the most important thing, learning between institutions with the aim of achieving similar levels of efficiency among all institutions.

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STUDENTS' PERCEPTIONS ON THE IMPLEMENTATION OF INNOVATIVE LEARNING PRACTICES IN HIGHER EDUCATION

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ABSTRACT

Implementing innovative active learning practices in higher education has been seen as crucial for students' academic and professional success in today's world. In this context, Higher Education Institutions (HEIs) are facing new challenges and have to shift the educational paradigm from the traditional teacher-centred towards student-centred learning. There is evidence in the literature that active learning methodologies improve students' learning outcomes and performance. However, there are few studies that have empirically investigated this relationship and that provide a comparison of the effects in different areas of education. The aim of this paper is to explore the students' perceptions of implementing the Problem-Based Learning (PBL) approach as an active learning practice in both the social sciences and engineering education fields. The study was carried out within the context of a Portuguese Polytechnic Higher Education Institution-the Polytechnic University of Coimbra, based on a survey research methodological approach which involved a sample of 97 undergraduate students. Overall, empirical results support the idea that innovative active learning methodologies constitute an effective approach to enhance students' engagement, learning experience, and competences. This positive effect of active learning practices on students' performance is more evident in engineering education compared to social sciences. These findings support the idea that HEIs need to change their teaching-learning environment towards innovative learning practices, more in line with the challenges of the twenty-first century.

Keywords: Innovative learning practices, Problem-based learning, Engineering and social higher education, Student-centred learning; Skills.

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INTRODUCTION AND BACKGROUND

An important challenge facing Higher Education Institutions (HEIs) is to make the required transition from traditional approaches teacher-centred to learner-centred classrooms focused on students' interests, needs, abilities, and learning styles. Implementing active learning methodologies in the classroom's contexts is therefore seen as central to the success of the educational process. These innovative educational practices are expected to boost students' engagement toward the learning process. The future graduate needs to acquire not only the technical skills but also the transversal and human-centred skills and attitudes, such as adaptability, flexibility, interdisciplinary collaboration, teamwork, creativity, communication, critical thinking, and complex problem solving, to be prepared for the demands of the twenty first century labour market (Sukackė et al., 2022; Baldwin, 2007; Leal-Rodríguez and Alborat-Morant, 2019).

Bonwell and Eison (1991, p. 5), in their seminal work Active Learning: Creating Excitement in the Classroom, define active learning as "instructional activities involving students in doing things and thinking about what they are doing". This is a broad concept that includes a wide range of teaching and learning strategies in which students are required to engage actively in the learning process. Active learning stands thus in contrast to traditional learning approaches in which students are passive receivers of knowledge from an expert. Methods that promote active learning focus on developing students' skills and values rather than transmitting knowledge and require that students process content themselves to learn. The learners are engaged in discussions, teamwork, real-world problem solving, decision-making, and cooperative hands-on projects to develop higher order thinking skills such as convergent thinking, creative thinking, and analytical thinking, which are crucial for students to succeed in today's world (McGuinness, 2021; O'Loughlin, 1992; Carr et al., 2015; Petress, 2008).

The role of the teacher in active learning classrooms is therefore substantially different from the traditional methods. Instead of functioning as a transmitter of knowledge or an expert with answers, the teacher assumes the role of a facilitator of learning processes, guiding students on their journeys of self-discovery by offering advice but also allowing the students to work out their own strategies and make their own mistakes (McGuinness, 2021; Neves et al., 2021). In this way, the teacher provides support and tools for the students to do their own research into the topic they need to learn about or the problem they need to solve.

There is robust evidence in the literature that active learning methodologies improve students' learning outcomes and performance (see, for example, Sukackė et al., 2022; Mabley et al., 2020; Li et al., 2019; Freeman et al., 2014; Trullàs et al., 2022). Focusing on engineering education, Sukackė et al. (2022, p. 1), conducting a systematic literature review on the implementation of three active learning methods - problem-based learning (PBL), project-based learning (PjBL), and challenge-based learning (CBL), point out that "implementing active learning methods in engineering education is becoming the new norm and is seen as a prerequisite to prepare future engineers not only for their professional lives, but also to tackle global issues". Leal-Rodríguez and Alborat-Morant, (2019), in turn, from an empirical study comprises a sample of 80 students belonging to the Bachelor´s Degree in Business Administration at a Spanish Business School, show that promoting innovative experimental learning practices constitutes an effective approach to improving students' competences and academic performance. In the same view, Deeley (2010) points out the benefits of experience-based learning, demonstrating that, overall, this learning approach has the potential to lead to students' intellectual and emotional enhancement. Chapman et al. (2016) also demonstrate that innovative learning methods have a positive impact on the class and improve students' performance. Focusing on the humanities and social sciences, Kozanitis and Nenciovici (2022) provide scientific evidence for the overall superiority of active teaching methods for learning achievements in the context of higher education as compared to traditional lecturing. Moreover, Trullàs et al. (2022), based on

a scoping review of available international evidence concerning the effectiveness and usefulness of PBL methodology in undergraduate medical teaching programs, conclude that problem-based learning is an effective approach for medical education. The results demonstrate that through PBL, students not only acquire knowledge but also transversal skills that are essential in medical professionalism.

The positive effect of active learning methodologies on students' performance has already been demonstrated in studies such as Zancul et al. (2017), Fernandes et al. (2014), Alves et al. (2016), and Aidoo et al. (2016). However, despite the recognized huge potential of innovative learning practices for fostering and enhancing learning, its implementation in classroom contexts has been limited. Indeed, several studies highlight that implementing active learning approaches is a challenging and complex process that requires a paradigm shift and involves great effort and time from all HEIs stakeholders, namely leaders, teachers, students, and staff (Membrillo-Hernández et al., 2019; Zancul et al., 2017; Namasivayam et al., 2017).

The present paper aims to contribute to this literature stream by providing new empirical evidence on the role of innovative active learning methods based on the Problem-Based Learning (PBL) approach. PBL emerged during the late 1960s at McMaster University in Hamilton, Canada, in response to the growing demand for active learning practices capable of developing transferable knowledge and skills and promoting students' engagement, primarily in medical and engineering education, and it has since been gaining popularity among educators from different fields around the world (Knowles, 2020; McQuade et al., 2020). As it is widely recognised in the literature, PBL is a student-centred teaching method where learning is organized around real problems, involves groups of students actively working together, the teacher acts to facilitate the learning process rather than to provide knowledge, and promotes students' self-directed learning and collaboration (Noordegraaf-Eelens et al., 2019; Kolmos, 2017; Venturelli and Fiorini, 2001). In particular, the objective of this study is to explore students' perceptions of the PBL methodology´s effectiveness in a real teaching and learning context, namely in terms of students' satisfaction and engagement, learning experience, and competence development. The research question is therefore formulated as follows: "What are students' perceptions of the implementation of innovative learning practices in higher education?". The study employed a survey research methodological approach, and it was carried out within the context of a Portuguese Polytechnic Higher Education Institution – the Polytechnic University of Coimbra (PUC), using a sample of students from two different scientific areas, engineering and social sciences. Although there is evidence in the literature that active learning methodologies improve students' learning outcomes and performance, few studies have empirically addressed this relationship and provided a comparison of the effects in different areas of education.

The remainder of the paper is structured as follows. Section 2 describes the methodology used in this study. Section 3 presents and discusses the results. The last section draws conclusions from the empirical analysis.

METHODOLOGY

Research Design

The present study was conducted based on a survey research methodology, which seems to be the most suitable approach to achieve the purpose of this work, i.e., to contribute to the understanding of the role of innovative active learning models in higher education by exploring the students' perceptions of implementing PBL in the classroom context. Survey research is defined in the literature as "the collection of information from a sample of individuals through their responses to questions" (Check and Schutt, 2012, p. 160). Survey research comprises a variety of data collection techniques, such as questionnaires, interviews, and observation techniques, and it has been a widely used method in both information management and information systems research (Tanner, 2002; Kate et al., 2003).

The survey involved a sample of 97 undergraduate students from the Polytechnic University of Coimbra who experienced the implementation of the PBL methodologyin two different scientific areas: 32 engineering students (bachelor's degree in sustainable cities management) and 65 social sciences students (bachelor's degree in media studies). The PBL methodology was applied in each course separately. Nevertheless, the teams were formed to reflect the greatest possible heterogeneity.

The technique for collecting data was an online questionnaire created on Google Forms, sent to the participants by email, and answered in a classroom context in the last class of the semester. The questionnaire was adapted from the one used in the Link Me Up project (Rodrigues and Mourato, 2023) validated and applied to higher education students. The questionnaire consists of 14 statement-based questions that are scored on a 7-point Likert scale and 2 open-ended questions. A Likert-type scale is a psychometric scale commonly used in survey research, namely in the social sciences. It is used when there is an order in responses and distances between categories are not quantitative. When responding to a Likert questionnaire item, respondents specify their level of agreement or disagreement on a symmetric agree-disagree scale for a sequence of statements. The range of Likert scale captures the intensity of the respondent's attitudes towards a particular question (Aktas Altunay and Ezgi Yilmaz, 2023).

Concerning ethics issues, all participants were informed of the aim of the study and authorized the use of their collected data for research purposes. Participants were also informed that their data would be anonymised and would remain confidential.

Problem-Based Learning (PBL) Implementation in Classroom

In the active learning experiment under study, the students are asked to carry out a problem-based learning process in which they learn about a subject by working in groups to find a solution for a real-world problem. This approach is applied throughout the entire academic semester, with a duration of 15 weeks, as the primary learning and teaching method. Following Eddy and Dan (2016), the PBL implementation in the classroom comprises seven stages, as described in Figure 1.

For the implementation of the PBL process, the class was divided into teams of 4 to 6 students, and each team worked on a topic related to the scientific area of the course proposed by the professor (week 1). Although the students have roughly the same background, the professor tried to ensure that there was some heterogeneity in the teams to enhance the creative process.

Two distinct stages, as proposed by Banathy (1996), may be identified in the PBL process. In the first stage, known as the "Discovery" phase, students should learn as much as possible about the problem under analysis. This stage lasts 4 weeks, and at the end, each team must present a midway report with all the information they have gathered. During this time, students carry out several tasks, which can be divided into two distinct phases: the research phase, and the synthesis phase. During weeks 2 and 3, students present a list of all the stakeholders that can influence, directly or indirectly, or be influenced by their challenge topic. This list is then shortened to three to five stakeholders, on which the students' research will focus. They will also identify potential interviewees, whose knowledge on the topic will complete the information acquired from other sources of information, such as articles, reports, etc. These tasks are represented by stages 2 and 3 in Figure 1. The collected information is compiled on collaborative and visual platforms (visual boards, shared documents, etc.), ensuring access by all team members. In the synthesis phase, which happens during weeks 4 and 5, students are called to fill out empathy maps where each target stakeholder is characterised. This stage of the process allows students to have a macro understanding of the problem under analysis. The results of the "Discovery" phase are summed up in a PESTLE (political, economic, social, technological, legal, and environmental) analysis, which corresponds to stage 4 of Figure 1 (delivered in week 6). The professor assumes the role of facilitator, ensuring guidance and advice.
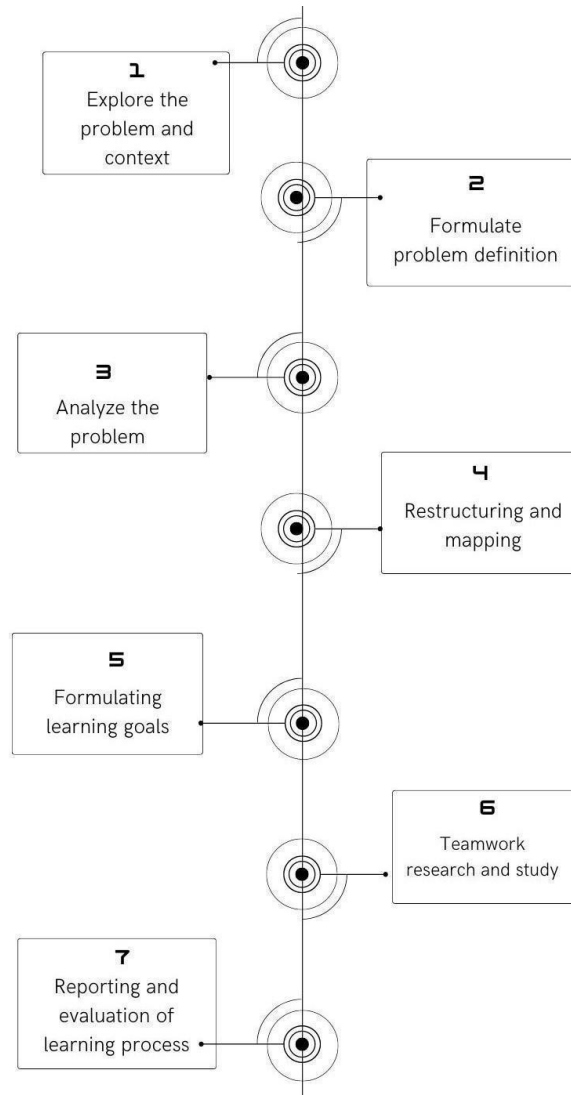
Figure 1. Problem-based learning process (adapted from Eddy and Dan, 2016)

The second stage is the speculative phase of the process, and it is entitled the "Creative" phase (Banathy, 1996). Students carry out speculative work, identifying alternative outcomes to the proposed problem. This stage also lasts 4 weeks, and at the end, each team delivers a report. The transition from the current state of the art to a probable future is supported by several thinking tools that rely on the identification of weak signals, which are singularities that take place all over the place and seem unlikely and/or cause bewilderment (Van Veen and Ortt, 2021). After the identification of those weak signals, students can start to define their speculative design by asking two types of questions: "What if…?", and "How might we…?" (Lahiri et al., 2021). These questions should be provocative and bold and cannot be limited to factual situations, such as political, economic, social, or any other constraints. These two tasks represent stage 5 of Figure 1 and are carried out during weeks 7 and 8 of the process. The speculative questions, together with the proposal of future scenarios are the assignments for week 9 of the PBL methodology and correspond to stage 6 (Figure 1). Based on the outcomes of the previous weeks and the speculative questions, students suggest three scenarios, identifying the winds of change as well as the possible effects of the future vision that they propose. This second stage of the PBL methodology ends with a backcasting simulation, in which students are invited to think about the temporal landmarks for the

implementation of the scenario or solution they will propose (week 10). Finally, each team delivers a future report (week 11), which compiles all the information contained in the midway report as well as all the speculative work carried out in this second stage, highlighting the future scenarios, which are the main outcomes of the PBL process. This last task corresponds to stage 7 of the process (Figure 1). The solutions achieved will also be presented in class in the last week of the semester.

As discussed above, in classroom based PBL, the professor's role is to be a facilitator who supports students through their learning process and whose main mission is to guide and engage the students, monitor the stages, provide advice and material suggestions, and inspire discussions when student teams are working together (Masek, 2016).

RESULTS AND DISCUSSION

This section presents an analysis of the main survey results. The first evidence on the implementation of PBL as an active learning methodology concerns the students' satisfaction level with their participation in this experiment, as illustrated in Figure 2. Results show that most of the students (86%) are satisfied with the implementation of PBL in the classroom. Analysing both education areas separately, the results give evidence that engineering students are the most satisfied. Moreover, no negative perception has been registered, and 75% of students have chosen "satisfied" or "completely satisfied" to evaluate their perception. Considering only the highest grade on the Likert scale, it should be noted that three times more answers (34% against 9%) have been expressed among engineering students.
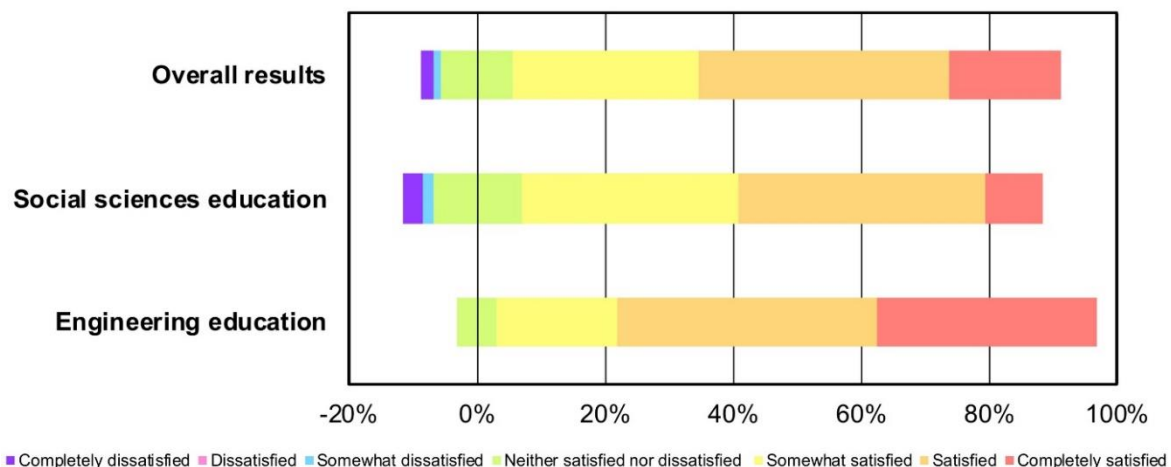

Figure 2. Students' degree of satisfaction

To better understand the satisfaction level expressed by the students, the following questions of the survey addressed different aspects related to students' motivation, engagement, and performance. Specifically, this assessment is achieved through two questions related to class dynamics and class productivity, whose results are illustrated in Figure 3 and Figure 4, respectively. Starting by analysing the joint results of both groups of students, we can see that 85% of students agreed that the PBL approach improved both class dynamics and class productivity. This result is corroborated by previous studies, which suggested that innovative learning methods have positive effects in the class and improve students' performance (Chapman et al., 2016; Kozanitis and Nenciovici, 2022; Trullàs et al., 2022).

Concerning the students' motivation to attend and actively participate in classes, it should be noted that according to annual reports presented by bachelor pedagogical coordinators, one of the main reasons for academic lack of success at the Polytechnic University of Coimbra is related to students' absenteeism.

Identical conclusions have already been identified in other studies conducted in Portugal (Teixeira, 2013), and this problem has already been pointed out in the seventies of the last century (Mohamed et al., 1974). This latest study shows that, already in the 1970s, students' attitudes were identified as the main determining factor in the level of absenteeism. Therefore, if students recognise that their time in classroom is properly used (i.e., that classes are productive), and simultaneously that the learning process is student-centred (i.e., that classes are dynamic), it is expected that students feel intrinsically motivated to attend classes, using thus the benefits that being present in classroom brings, as pointed out by Kozanitis and Nenciovici (2022). According to the survey results, only 4% of students consider that the PBL methodology does not contribute to increasing levels of productivity and dynamics in the classroom.
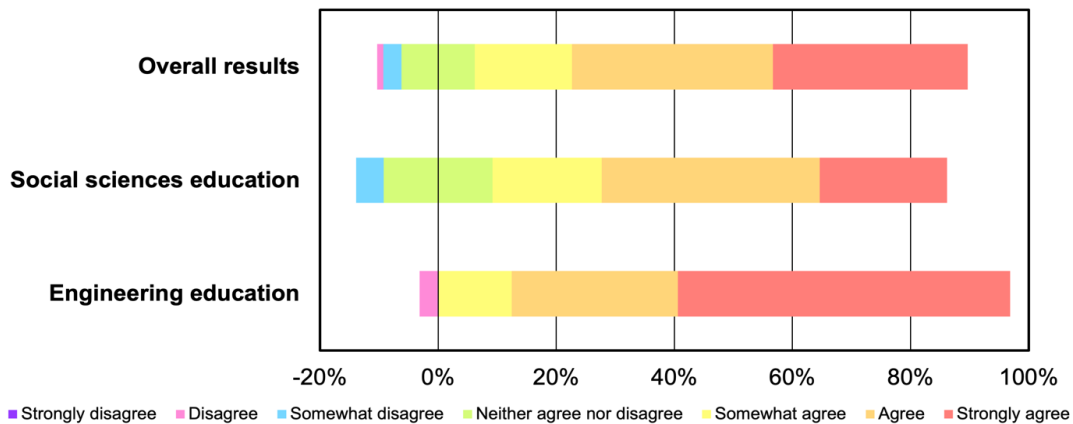

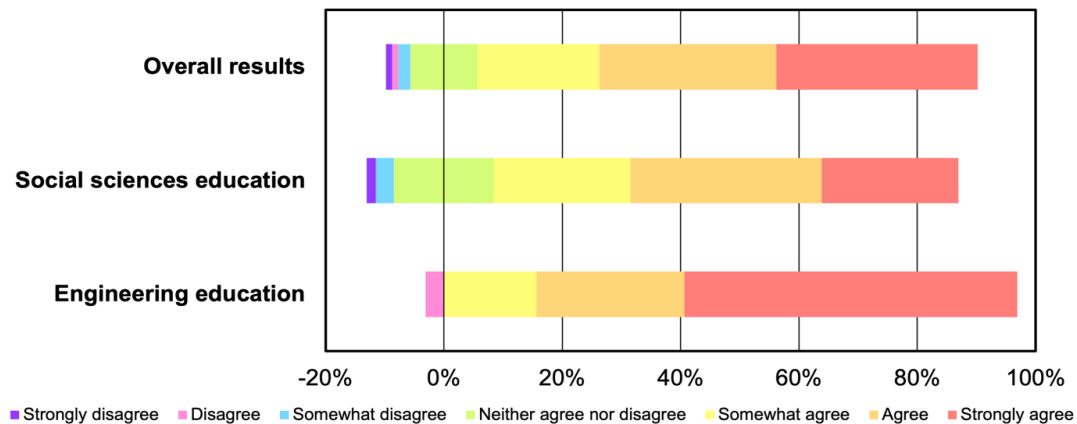**Figure 3.** Students' perception of the improvement of class dynamics

Figure 4. Students' perception of the increase of class productivity

When comparing the above results from social sciences and engineering students, the implementation of PBL as an active learning methodology is far more valued by engineering students. Results show that not only 97% of the students have a positive perception of this student-centred approach (20% more than students from social sciences education), as also the answer "strongly agree" represents more than 50% of the answers, which contrasts with only 22% from social sciences education respondents. Another interesting observation is that engineering students didn't show neutral opinions when asked if class dynamics (Figure 3) and class productivity (Figure 4) had improved. These findings may derive from the fact that the implementation of active learning methodologies represents a very different paradigm when compared to lecturing and exercise-solving classes, which continue to be the common pedagogical approaches mainly in social sciences education.

Intrinsically related to students´ motivation is their level of academic performance and their willingness to see this active learning methodology implemented in other subjects. These two dimensions of the analysis are depicted in Figure 5 and Figure 6, respectively. Based on students' positive perceptions of class dynamics and productivity, it is expected that their perception of the influence of the PBL approach on their final grade (Figure 5) would be positive, which is confirmed by the empirical outcomes. Overall, 85% of students consider that the implementation of the PBL approach allowed them to achieve better academic results. Although the numbers are not expressive, 3% of students answered that PBL methodology didn't influence their final grade, and 12% had no opinion. This conclusion is in line with other studies carried out in several educational areas, such as natural sciences (Aidoo et al., 2016), health sciences (Qin et al., 2016) and humanities and social sciences (Kozanitis and Nenciovici, 2022). Comparing social sciences and engineering students' perceptions, the previously identified pattern remains. For 56% of engineering students, PBL methodology strongly contributes to a higher final grade, compared to only 15% of social sciences students (Figure 5). Some students seem to have no well-defined position (6%), but no students have negative perceptions. In contrast, 5% of social sciences students don't recognise the added value of this pedagogical approach for their final grade.
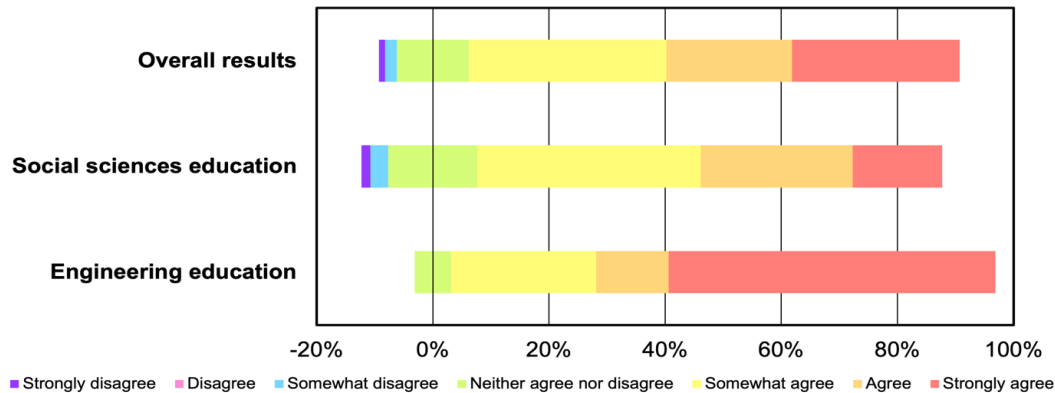
Figure 5. Students' perception of the increase in final grade
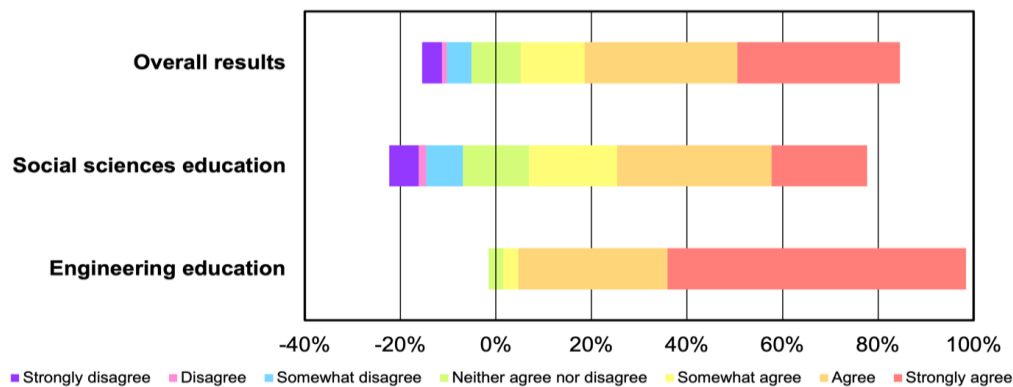

Figure 6. Willingness to implement the PBL methodology in other subjects

Considering the previous positive effects on both the class's environment and the students' final grade, the positive results illustrated in Figure 6 are expected, with most students (85%) responding that they would like to see PBL methodology implemented in other subjects. Engineering students tend to be

more willing to see this type of approach replicated in other subjects, which is in line with our previous results.

The last group of questions proposed in the online survey aimed to assess the impact of PBL on students' social skills, thinking competences, and self-learning abilities. Eight different skills have been assessed, among them the so-called 21st century skills (World Economic Forum, 2016): critical thinking (problem solving), creativity, communication, and teamwork (collaboration), digital competences, and data analysis. Leadership and entrepreneurship are also part of the character qualities that students need to acquire or develop during their academic path to success in today´s world, as mentioned by Sukackė (2022).

Analysing the overall results, which are illustrated in Figure 7, it can be stated that more than 75% of all the inquired students consider that their transversal skills or competencies have been positively impacted by the PBL learning process. These findings are corroborated by previous research conducted by Costa et al. (2021) that concludes that the implementation of active learning methodologies generates high levels of
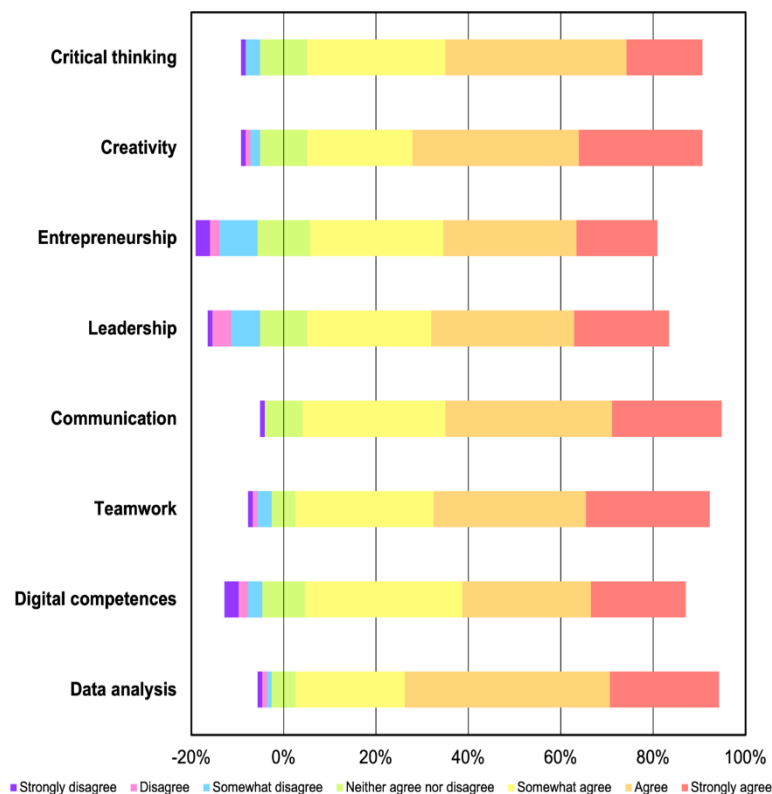

Figure 7. Students' perception on the improvement of transversal skills: overall results

satisfaction among students and is perceived as having a very positive impact on skills' development. The skills of critical thinking (problem solving), creativity, communication, and data analysis are those in which the outcomes are more noticeable (86% of students have a positive perception). In contrast, students' perceptions of the impact of the PBL approach on entrepreneurship, leadership, and digital competences present the worst results, highlighting 10% of the negative answers. The number of students without a formal conviction is equally considerable. Although further research is required, these last results may arise from the pedagogical approach itself. Indeed, and contrasting with other student-centred methodologies, such as co-creation and project-based learning, PBL practices do not presume a direct contact with third-party organisations or companies. This lack of a competitive atmosphere or the non-existence of a well-defined goal does not contribute to stimulating the entrepreneurial profile of students, as they may not be able to understand the applicability of the proposed challenges/problems. Concerning

leadership skills, the problem-based learning approach implies that students work in groups, and therefore teamwork is naturally developed, but only a small number of students take on a team leadership role. Regarding digital competences, although students are invited to use digital tools that are unfamiliar to many of them, there is no obligation to use them. Students can achieve all the goals by using common digital resources that they already dominate (Marshall Park and Wallace, 2020).
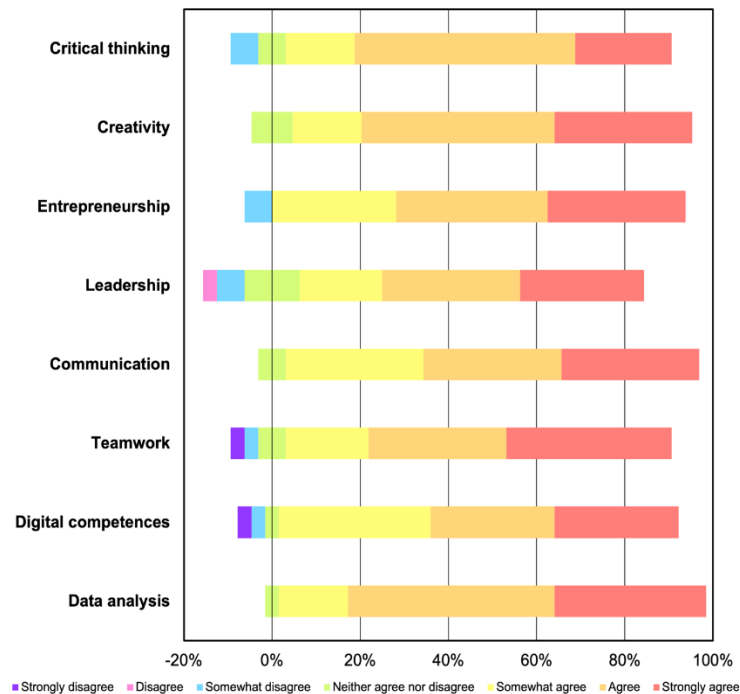

Figure 8. Students' perception on the improvement of transversal skills: social sciences education

The differences found in the previous analysis regarding the two fields of education under study (social sciences and engineering education) remain valid when students' perception of the impact of PBL methodology in their transversal skills is investigated. Results show that social sciences students (Figure 8) tend to have a less positive perception than engineering students (Figure 9). This result is in line with the literature that gives evidence that PBL methodology arose from the need for active learning practices especially in the medical and engineering fields (Knowles, 2020; McQuade et al., 2020).

When asked about the main difficulties faced in applying the PBL methodology and about suggestions for improvements (the two open-ended questions of the questionnaire) most students referred to the difficulty of understanding the methodology step by step since it is a learning practice that breaks away from the traditional model. The main suggestion made by students was the implementation of interaction moments between the different teams within the class, allowing them to share the findings on the problem under analysis as well as receiving input from their classmates. These moments of sharing and interaction would enrich the groups' knowledge and open new perspectives based on the different strategies adopted by the different teams.
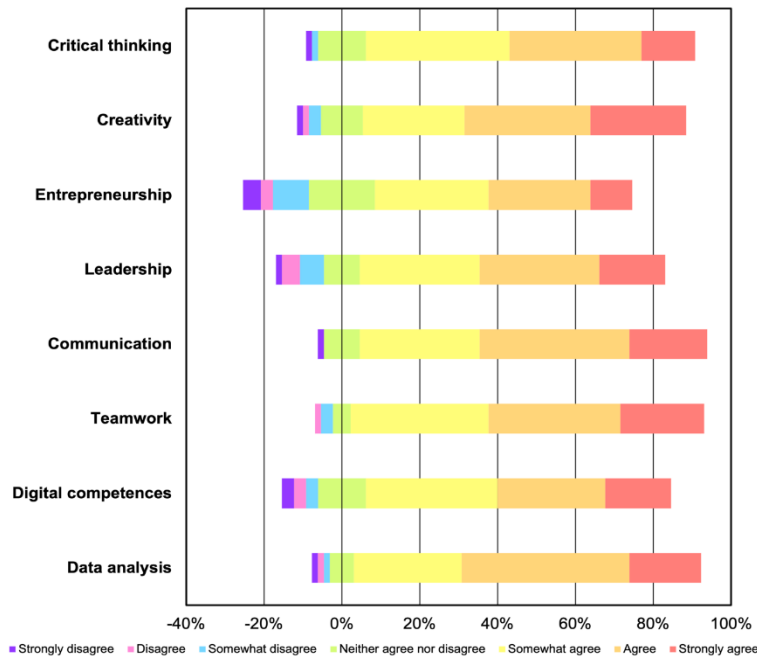
Figure 9. Students' perception on the improvement of transversal skills: engineering education

CONCLUSIONS

The main purpose of this paper is to examine students' perceptions of the implementation of innovative learning practices, in particular the problem-based learning (PBL) methodology, in higher education. The study employed a survey research methodological approach, and it was carried out within the context of a Portuguese Polytechnic Higher Education Institution - the Polytechnic University of Coimbra (PUC), using a sample of students from two different scientific areas, engineering and social sciences.

The survey outcomes corroborate previous findings that active teaching-learning methodologies, by implying that students become engaged in their learning process by thinking, discussing, investigating, and creating, have a positive impact on students' learning outcomes and enhances the development of competencies considered essential for career success in the 21st century, such as critical thinking, creativity, teamwork, communication, and data analysis. The results also indicate that over 90% of the students consider that the PBL methodology enables classroom dynamics and productivity, with positive impacts on students' final grades. Moreover, results give evidence that students would like to see PBL methodology implemented in other subjects. Another interesting result is the high degree of satisfaction expressed by the students regarding the application of PBL methodology in a classroom context (86%), which allows conclusions about the importance of extending its implementation. In addition, when comparing the results according to the education area of the students (social sciences and engineering), it was found that the perception of engineering students about the effectiveness of the PBL methodology is always more positive than the perception of social sciences students.

The findings from this study reinforce the conclusions of the previous works mentioned above, demonstrating that implementing innovative active learning practices in higher education is beneficial for students. These outcomes reinforce the need to rethink the current educational model. Efforts should be

made by policymakers to support the paradigm shift from traditional teaching and learning practices to student-centred active learning models, which requires profound changes to the curriculum structures and teaching-learning environments and methodologies.

Finally, the small sample size is a limitation of this study, and therefore, the interpretation of the results should be taken with caution. This is an important issue to address in future work. Other data collection methods, such as interviews and focus groups, can also be employed to complement data collection. Another interesting area for future research is the comparison of students' perceptions before and after implementing PBL in a course unit, as well as introducing the perception of the professors into the analysis.

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CO-CREATION AND PEDAGOGICAL INNOVATION IN HIGHER EDUCATION: AN ACCOUNT OF TWO TRAINEES AND FACILITATORS PARTICIPATING IN THE DEMOLA PORTUGAL INITIATIVE

Susana Amante, Filipa Rodrigues Pereira, and Ana Isabel Silva

ABSTRACT

Between 2021 and 2023, the Polytechnic Institute of Viseu (IPV), in Portugal, conducted two interdependent projects aimed at training teachers and fostering collaboration between industry and academia. These projects involved teams of students tackling challenges posed by local companies and non-profit organisations. One such challenge, 'The Mission of Libraries', explored the future role of libraries in society, partnering with the António Lobo Antunes library. Another challenge, 'Born to Save' collaborated with ARTIDERCA-Agência Criativa to enhance people's lives, particularly through children and their engagement with first aid practices. This paper presents the methodologies, tools, platforms, and tasks employed in addressing these challenges. Through a case study methodology based on the trainees' reflections on their facilitation process, the study subscribes to the core values identified by the training entity Demola Global. These values, namely communication, action, curiosity, diversity, imperfection, and responsibility contribute to co-creation and help build bridges between academia and the labour market. Such dynamics underpin active learning methodologies, impacting students, teachers, and communities. This research highlights the importance of pedagogical innovation training in preparing teachers to integrate challenge-based learning into their teaching practices and align with the expanded mission of Higher Education Institutions. The implications for policymakers lie in the need to support projects like the Demola Portugal Initiative, fostering collaboration between academia, industry and society to address innovative, real-world challenges.

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INTRODUCTION

Participation in training programmes focused on pedagogical innovation is crucial for academics to enhance their teaching practices and support active learning among Higher Education students through cross-disciplinary and collaborative work (Amante and Fernandes, 2023; Carlos, Reses and Soares, 2023; Amante and Fernandes, 2022; Fernandes and Amante, 2022; Lidolf and Pasco, 2020). This aligns with the broader objective of Higher Education to meet workforce demands, fostering innovation and contributing to a more dynamic and responsible economy.

As the landscape of academia, the labour market, and other public spheres continue to evolve due to scientific and technological advances, stakeholders face an increasing need to adapt and innovate (van Aduard de Macedo-Soares et al., 2016). Teaching staff, in particular, are now tasked with a third mission that extends beyond traditional roles, encompassing the production, application, and dissemination of knowledge through collaboration with non-academic sectors, thereby benefitting society at large (Costa et al., 2021; Sargento and Ferreira, 2023). We can even say that, in our contemporary Higher Education, there has been a notable transformation underway, which implies the transition from the traditional third mission to a more comprehensive quintuple mission. This expanded model integrates the public or civil society as a crucial fourth component, emphasising not only economic profit but also social value. Taking this evolution even further, there has been the incorporation of a socio-ecological perspective that underscores the interconnectedness of society and nature, and, in a so-called quintuple helix, it acknowledges the significance of sustainability and the co-development of society and the natural world (Mironova, Kumar and Murugesan, 2019; Martini, 2023).

To effectively fulfill this evolving mission of Higher Education Institutions, and embrace the quintuple helix model, teaching staff require comprehensive training in pedagogical innovation. As Guerra and Costa (2021, p. 1) remind us, "A pedagogical innovation can be the introduction of a resource and/or strategy that, when implemented and evaluated by teachers, leads to student learning". Thus, the training in pedagogical innovation should equip them with the skills and knowledge necessary to seamlessly integrate a socio-ecological perspective into their teaching practices and to incorporate pedagogical tools aligned with this expanded mission.

This need for pedagogical innovation training sets the stage for national projects like the Demola Portugal Initiative to flourish. Actually, the Demola Portugal Initiative aims to provide teachers with methodologies that facilitate co-creation, project-based learning, and knowledge sharing, thereby enhancing the learning process itself (Demola Global, 2023a). The Polytechnic Institute of Viseu (IPV) was one of fourteen Portuguese Higher Education institutions that ran two concurrent projects, focusing on pedagogical innovation and active learning methodologies: 'Learning based on co-creation processes' (a teacher training course, funded by POCH and held by Demola Global), implemented through the 'Link Me Up – 1000 Ideias' project (funded by COMPETE and aiming at developing cooperation between academia and industry).

The project entitled 'Learning based on co-creation processes' (POCH-04-5267-FSE-000818), our focus in this study, started formally in January 2021 and its first edition finished in July 2021. Its main objective, as listed online at https://site.ipv.pt/cocriacao_proj.htm, was to enhance the quality, effectiveness, and efficiency of teaching practices by introducing new tools and methods. Through this initiative, teachers were provided with the opportunity to experiment with co-creation, acting as co-creators during their training sessions, and later as facilitators of co-creation processes. They supported their teams of students in learning, sharing, and co-constructing knowledge, scenarios or solutions to societal challenges and issues raised by local organisations/partners. Additionally, the initiative aimed to develop competencies in

teachers to bridge the gap between academia and industry, preparing students to meet the needs of society and enabling their participation in sustainable development and addressing real challenges. Thus, teachers helped students develop and enhance their transversal skills in the co-design of innovative and sustainable projects that called for critical thinking, communication, teamwork, and collaborative work, supported by technological platforms and resources (IPV, 2023).

Just like the first edition, conducted online via Microsoft Teams for a total of 344 hours (192 hours of synchronous sessions and 152 hours of asynchronous workload), the second edition occurred weekly from September that year to February 2022. It retained the same objectives, tools, and tasks but introduced some changes and new approaches. These included two face-to-face bootcamps – one in Coimbra and another in Porto for the northern group of Polytechnic Institutions – and increased breakout room discussions amongst the several participants from the Consortium.

The third and fourth joint editions took place from January to June 2022, based on the same principles and methodologies, despite the addition of some new tasks and other features, such as the creation of five thematic tracks: 'Healing the Planet' (Sustainability), 'Future of Work' (Work Life), 'Human Beings in the Modern World' (Human Nature), 'Byte-Powered Future' (Technology) and 'Value Creators of Tomorrow' (Business) (Demola Global, 2023b).

The concurrent projects ended for the teaching staff, students, and companies in June 2023, upon completion of the sixth edition, and the total participation of "… 900 polytechnic teachers, 600 companies from Portugal and internationally and around 5,000 students from Portuguese polytechnics and international institutions" (Demola Global, 2023c).

Some of the platforms used were Demola Atlas (https://atlas.demola.net), Demola Chat (https://chat.demola.net), Demola Portal (https://portal.demola.net) for students, and Miro (https://miro.com). The first one enabled task management, since, on Demola Atlas, the trainees/facilitators could monitor the students' contracts, their pre-evaluation, their progress, submission of individual or group tasks, and their final assessment. The students completed the different tasks using Miro, a collaborative, online canvas with different templates, in which teams could unleash their creativity designing mind maps and empathy maps; tested hypotheses; identified stakeholders/user groups; created affinity diagrams and, among other tasks, analysed and compiled information (e.g., PESTLE analysis; 'How might we…?' questions). They used Demola Portal, then, to submit their work. Demola Chat provided all participants with the opportunity to communicate and share resources effectively. Canva (https://www.canva.com/pt_pt/), a free graphic design platform, was also used in this process, both by students to make their videos for the final pitch, and by trainees to write their final report, in which they reflected upon the whole process as facilitators.

In the next few pages, we intend to emphasise the significance of engaging in training programmes aimed at pedagogical innovation for academics. We will achieve this by examining specific methodologies, tools, platforms, and tasks that shaped two out of the sixteen challenges featured in the third and fourth concurrent editions. From finding a partner organisation and outlining a societal challenge faced by that entity to marketing and selecting students from the consortium, and even from abroad, after considering their applications, to training sessions where tools and strategies were learnt and put into practice, to meetings with teams and member(s) of the organisation, in which facilitation skills were put to test, … – all those perceptions, learnings, and practices will be discussed. Demola Global conveys that communication, action, curiosity, diversity, imperfection, and responsibility are the core values that contribute to co-creation and help build bridges between academia and the labour market. Therefore, these had to be developed by teachers first, so that they could guide their students in developing ideas collaboratively and accepting different points of view, reaching common goals. Ultimately, the study highlights the imperative for policymakers to endorse projects like the Demola Portugal Initiative. These

endeavours play a pivotal role in promoting collaboration amongst academia, industry, and society to tackle innovative, real-world challenges.

METHODOLOGY

Teachers' reflections play a fundamental role in improving educational processes, as the following quotation highlights: "En esto contexto, se asume que la reflexión que realizan los docentes es fundamental para la mejora de los procesos formativos y un imperativo en la incorporación de prácticas innovadoras que impacten en los resultados de aprendizaje del estudiantado" (Brevis-Yéber, Mas-Torelló & Bueno, 2022, p. 270)[9]. As suggested, introspection is imperative for the integration of innovative practices that can have a positive impact on students' learning outcomes.

As previously mentioned, this study aims to outline two challenges that two teachers at the Polytechnic Institute of Viseu designed during their Pedagogical Innovation training in the 'Learning based on co-creation processes' project. They subsequently facilitated these challenges from January to June 2022, as part of the third and fourth joint editions of the 'Link Me Up – 1000 Ideias' project. These initiatives were integral components of the broader Demola Portugal Initiative. This research adopts a qualitative methodologic approach (Sampieri, Collado and Lucio, 2006) to analyse the dynamics that underpin active learning methodologies and that have a far-reaching impact on the profile of the student, the teacher, and the surrounding communities. In fact, this research aligns with the objectives outlined above, emphasising the development of competencies in teachers to work as facilitators of co-creative projects that bridge the gap between academia, non-academic sectors, society at large, and sustainable practices. The selected challenges, involving a public library and a private company, both situated in the region of Viseu, not only offered diverse contexts for learning but also underscored the Demola Portugal Initiative's commitment to addressing real-world issues with a focus on inclusivity and sustainability, according to the researchers' reflections on the projects they participated as trainees and facilitators. Data were collected from their reflections on their facilitation process of 'The Mission of Libraries' and 'Born to Save', making it a case study, since the methodology relies on empirical evidence and allows for the description, understanding and explanation of human behaviour (Babbie & Mouton, 2001, p. 270). As Flick puts it (2023, p. 8), "[t]he subjectivity of the researcher[s] (…) becomes part of the research process. Researchers' reflections on their actions and observations in the field, their impressions, irritations, feelings, (…) become data in their own right, forming part of the interpretation…"

The two IPV teachers, who both participated as trainees and facilitators in the Demola Portugal Initiative projects, collaborated with the coordinator of the pedagogical innovation training course for this article. Together, they illustrate the Initiative's pivotal role in equipping teaching staff with tools and new active methodologies. These enabled multidisciplinary and multicultural student teams to seek innovative solutions, thereby enhancing their transversal skills: critical thinking, communication, teamwork, leadership and adaptability, all supported by technological platforms and resources. Their reflection upon each challenge illuminates the phase prior to the implementation process, the work developed, the difficulties encountered, and the outcomes achieved.

While the findings resulting from the researchers' reflections on the Demola Portugal Initiative and, specifically, on the two challenges, are confined to the regional context of Viseu, the fact is that this pedagogical innovation training course and the implementation of active learning methodologies occurred in other Higher Education Institutions across Portugal. Demola Global's business model had already been

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[9] *In this context, it is acknowledged that the reflection undertaken by teachers plays a crucial role in enhancing formative processes, and it is deemed imperative to incorporate innovative practices that have a positive impact on student learning outcomes (our translation).*

successfully applied in Spain (Catalá-Perez, Rask and Miguel-Molina, 2020) and, among other settings, in Japan (Kämppi, 2019). The proven success of the Demola methodology contributes to its marketability and reputation. This lays the groundwork for the emergence of analogous initiatives worldwide, replicating innovative pedagogical approaches and improving educational practices.

SETTING THE SCENE, RESULTS AND DISCUSSION

Both challenges were developed concurrently, each one aiming to solve its own societal shortcomings. Let us start by getting to know the one entitled 'The Mission of Libraries' and then 'Born to Save'.

The Mission of Libraries

Traditionally, the mission of libraries has universally been recognised as central to supporting learning, literacy, and reading, empowering literate, informed and participative societies. Communities rely on them for freedom of expression, yet libraries have had difficulty attracting audiences other than those in schools. Rethinking the role and mission of libraries was, thus, of utmost importance. How to do it? This was the challenge: *Once upon a book… what and how will the libraries of the future be changed?*

In light of the above, and in attempting to answer our research question, a team of four students and a facilitator working in the Department of Language Sciences at the Polytechnic Institute of Viseu met the partner entity, the António Lobo Antunes Municipal Library, located in Nelas, Portugal, to discuss the overall direction of libraries and the different ideas that could contribute to solving this societal challenge. This challenge allowed the team to work within communities, inviting them to engage in this process. This means and requires updating traditional roles in our digital age in order to better understand community needs. So, they departed from some questions that they felt the urge to answer, such as: what can services and librarians do to meet the changing user expectations? How can Libraries (re)impact peoples' lives? How can we help libraries (re)track communities' steps towards them? What will the libraries of the future be like?

It seems that, nowadays, libraries also need to be part of solutions that enhance key policy objectives in today's information society. This includes digital skills, creating equitable access to digital content, sustainable development, employment, and education. This goes hand in hand with the quintuple mission of Higher Education Institutions, discussed above.

Taking all this into account, it is important to describe the processes of co-creation and collaboration that took place right from the beginning till the end of the project. Once the challenge was defined in partnership with the entity, it was time to select the students to form the team. For this purpose, just like the other 15 challenges, this one was also published in the Atlas Platform (Demola Portal for students - https://portal.demola.net) and widely disseminated in several sessions organised locally at the five schools belonging to the Polytechnic Institute of Viseu and also in an online main session for all IPV students.

Each challenge got several applications, from students enrolled in the Polytechnic Institutes that make up the Consortium and also from other national and international Higher Education Institutions. To do so, applicants submitted their CV and their motivation for having applied to each specific challenge. The selection process meant that 48 students were distributed among the 16 challenges that took part in the two joint editions, the third and fourth ones. Focusing specifically on 'The Mission of Libraries', there were two students taking the Degree in Basic Education (teacher training), one exchange student from Brazil,

already graduated in Philosophy and, at the time, studying Business Management, and a student taking the Degree in Plastic Arts and Multimedia, all of them studying at IPV (cf. Fig. 1). Once the team was formed and the agreements were signed, mechanisms were streamlined to schedule the first meeting in which the participants introduced themselves.
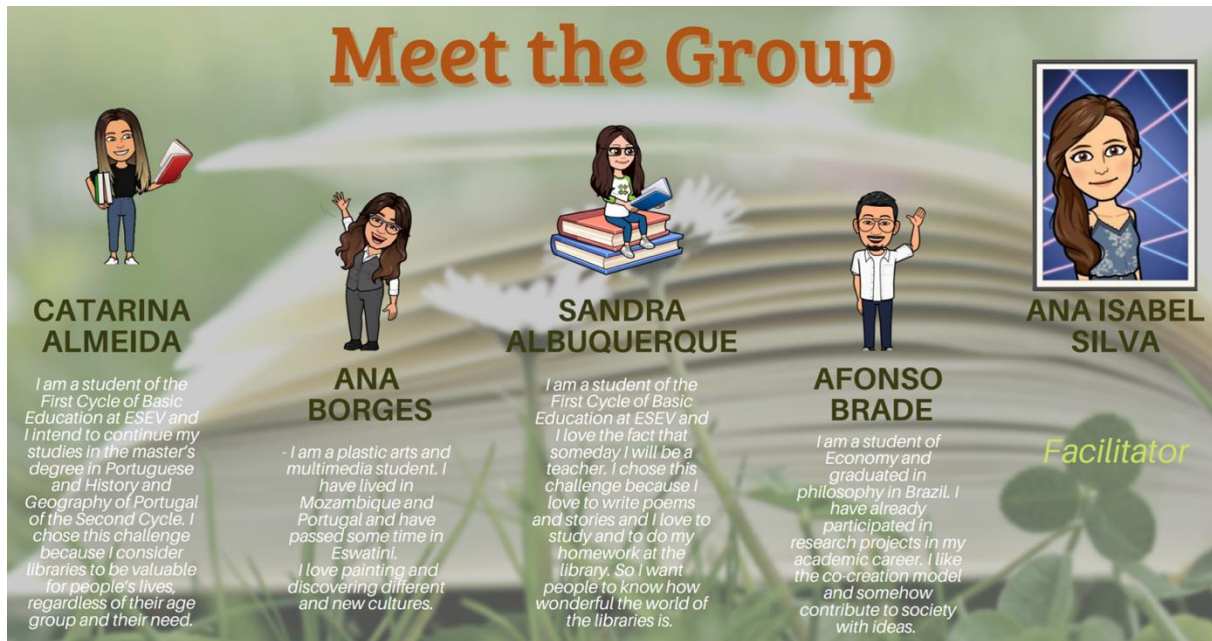

Figure 1. Meet the Group (Source: 'The Mission of Libraries' students' report)

Besides this, the functioning, and the schedule of tasks over the 10 weeks were explained, as well as the tools available so that the team members could work collaboratively and cooperatively in real-time remote environments, such as Demola Chat, Miro, Zoom and Microsoft Teams, as we will explain further.
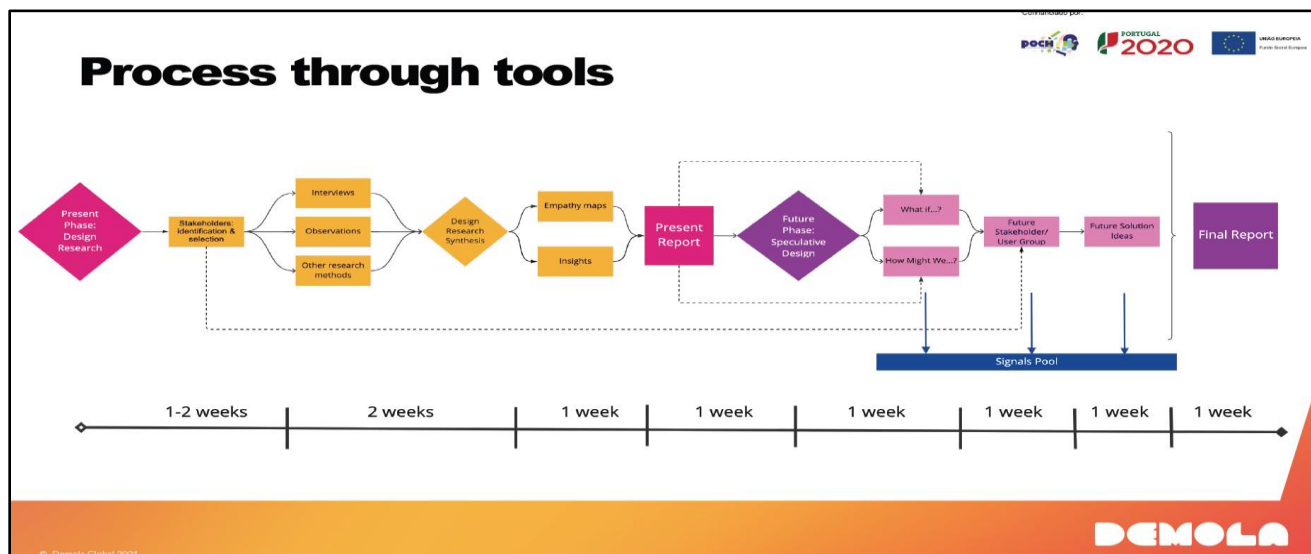

Figure 2. The ten-week process *(Source: Demola Global, 16th training session)*

The team met every Friday from 11:00 am to 12:30 pm. The partner entity participated in a total of four sessions, giving feedback to the students. Additionally, a tour of the António Lobo Antunes Municipal Library was held on the 19th of April 2022, in Nelas.

The weekly tasks were always scheduled according to the facilitator's weekly training. As a result, after each Tuesday training session, the facilitator prepared the team sessions based on the research steps and tasks identified in Fig. 2 below and, then, allowed the students to bring in and share useful, meaningful and dedicated information about the challenge.

These target groups were redefined bearing in mind empirical data, such as the students' observation of the behaviour of library users; the tour of the António Lobo Antunes Library in which the team was told personal stories, namely by the architect who designed the library, Francisco Keil, and other participatory agents, such as the sociocultural animator Carlos Henriques, working in the department of education of the library.

The information gathered was discussed during the weekly sessions and written down on Miro, a collaborative platform. This gathering of information was an important opportunity for students to make inferences or discover key insights. Afterwards, on Miro and on the Demola portal, four empathy maps were created, one per stakeholder. Each empathy map attempted to address the following topics: what the users say, what they do, what they think and what they feel.

Seven insights emerged from the empathy maps, regarding 'The Mission of Libraries', but we debugged each of them and chose five:

1. Communities rely on libraries for freedom of expression, yet libraries have had difficulty attracting audiences ot''
2. her than those in schools. Rethinking the role and mission of libraries is, thus, of utmost importance.

2. Libraries will always be temples of knowledge, democracy and diversity, characterised by silence. It is a safe and comfortable place, but it does not attract everyone.

3. Users recognise the usefulness and relevance of libraries, but they demand changes, such as improving the quality of access to internet services, digital content and even to other learning materials such as board games, as well as books in different languages and cultural activities. This seems to enhance conviviality in all the spaces of a library: it would be enhanced for recreation and leisure.

4. The quality of the information in the repository is ensured by the librarian and archivist, but also by the schoolteacher librarians. However, the massive publication of books and publishing projects does not seem to leave much room for libraries to be their custodians. It seems that books, from a material point of view, can be a problem. There just isn't room for so many. There is a need to select and bring, to the library services, people who have books, and who can lend them to others, without the book residing in the library, but circulating through communities of avid readers.

5. The quality of the information in the repository is ensured by the librarian and archivist, but also by the schoolteacher librarians. How can librarians be helped?

These inferential readings anticipated the future design but required reflection on the whole process, which, in turn, culminated in gathering information in the 'Present Report'. As the tasks were to be carried out weekly and submitted on Sundays, this report allowed the students to synthesise the whole process, but not always with enough time for proper reflection. Throughout this process, the students carried out research and tried to find signs of change, collaboratively, paying attention to megatrends and target needs.

This attention allowed them to select news, films, stories, images, reports and events that may be connected to this challenge, even if in a tenuous or implicit way, i.e., with repercussions for this challenge. For example, the report about robots in a library in Finland and the paradigm shift of the librarian's function when robots are part of the tasks; or the welcoming speech of the President of the Portuguese Parliament, Augusto Santos Silva, during the participation of the President of Ukraine, in which he highlighted the universality and importance of the Portuguese language and its cosmopolitan, rich, historical and dialogical use, with a large acquis (a collection that is still not represented in all libraries); or the British Council's projects to stimulate libraries in the most diverse communities were also analysed. This allowed us to ask questions about the future, in a task that was named 'What if…?' and 'How might we…?', depicted below, in Fig. 3:
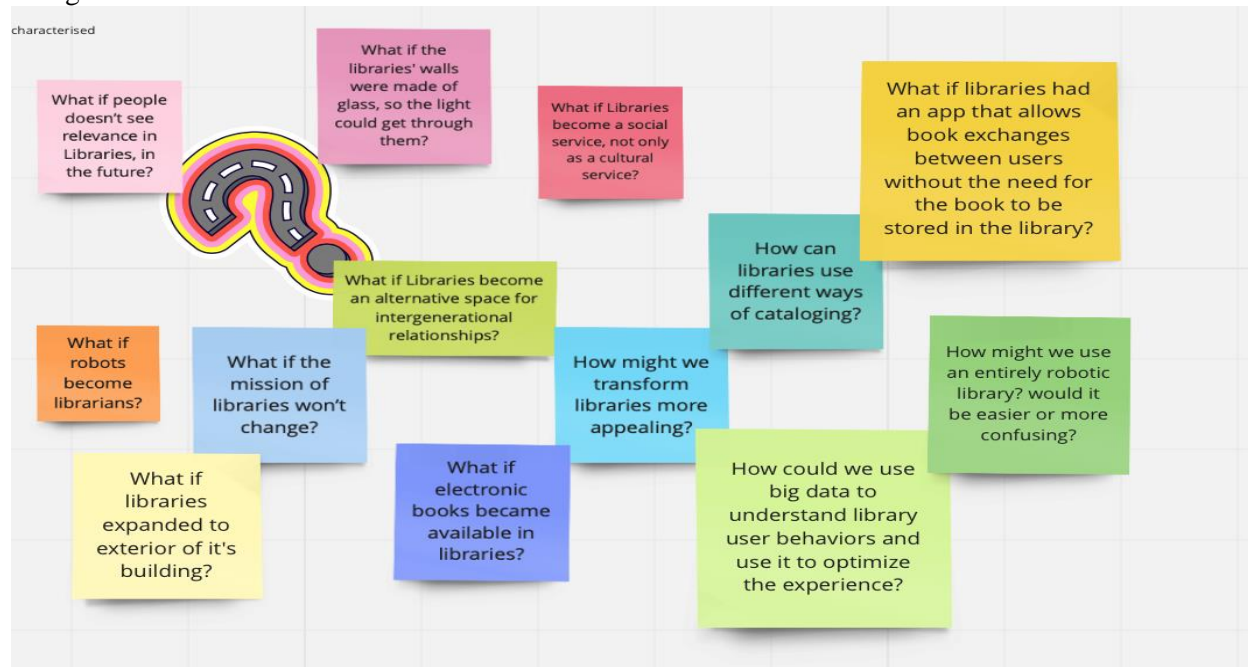

Figure 3 – 'What if…?' task developed collaboratively *(Source: 'The Mission of Libraries' team on Miro, week 7)*

Once this questioning was finished, the 'persona of the future' was created, which led to the question: *who and how will the stakeholders be in 20 years?* Aligned with the path traced considering the different tasks, and reading the different signs, the team created the *persona* of the future. This persona would look for a new library identity, with different leisure and outdoor areas, perhaps even including a *local bistrôt*, with *books a la carte*. Additionally, they proposed different methods of cataloguing books in a more appealing, intuitive, and visually oriented manner, as well as using visual software to enhance search accuracy, and connecting robots to ensure the users' needs are met efficiently. This challenge brought to the surface the role of librarians, what they do, and what they represent in a local community. There is more complexity in their functions and purposes than students could think of. Being aware of that and the research conducted allowed the team to identify and interpret the information they had gathered by communicating and being open to alternative perspectives. Even when they were looking for a direction and being afraid to step up, their different cultural backgrounds, personal values and opinions were discussed among all the team members, partner entity included. At the time when the final pitch took place, the team was able to redefine a library, giving it a whole new appearance and dimension, and especially a new identity, so-called 'A library beyond books' in the short video presentation which was completed in June/22, when the project ended. Besides that, in the concluding pages of their final report, the team of students reflected on the invaluable skills garnered through their immersive co-creation experience. Some referred to the soft skills they acquired, such as collaboration, communication, and adaptability, whereas others mentioned that the

project's dynamic nature required them to face and overcome challenges, fostering problem-solving abilities and resilience. Moreover, they all considered that the collaborative environment encouraged creativity, allowing them to explore innovative solutions and think critically about real-world issues, as the following testimonial attests, in Fig. 4.
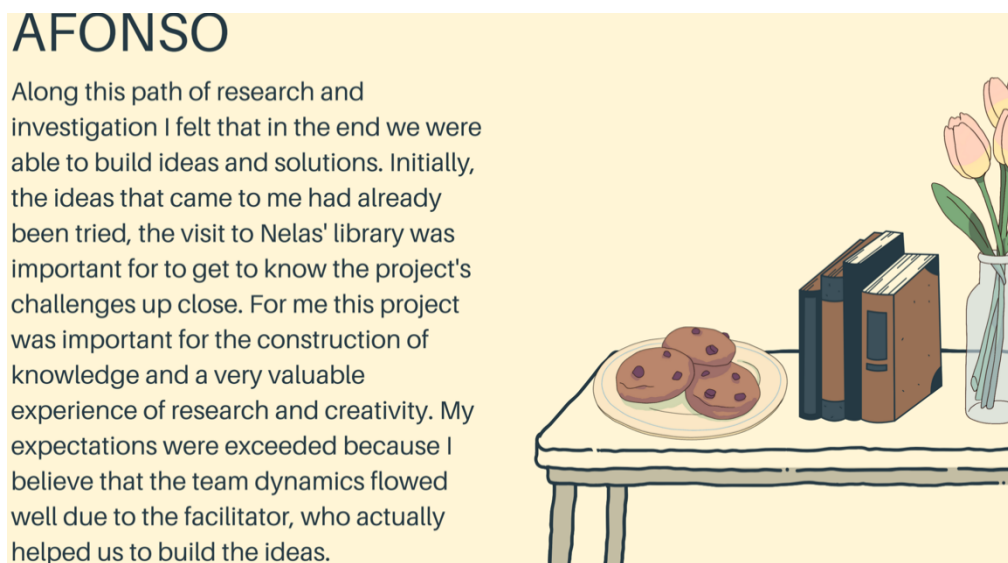

AFONSO

Along this path of research and investigation I felt that in the end we were able to build ideas and solutions. Initially, the ideas that came to me had already been tried, the visit to Nelas' library was important for to get to know the project's challenges up close. For me this project was important for the construction of knowledge and a very valuable experience of research and creativity. My expectations were exceeded because I believe that the team dynamics flowed well due to the facilitator, who actually helped us to build the ideas.

Figure 4. A student's reflection on the challenge (Source: The Mission of Libraries' students' report)

These ideas culminated in a pitch later that month, competing with the 15 other challenges of the third and fourth joint editions, among them 'Born to Save', which we will describe below.

Born to Save

While the reflection on the challenge above discussed active methodologies that a trainee in the pedagogical innovation training course carried out with her multidisciplinary and multicultural team of students, in the field of Humanities and Social Sciences, the 'Born to Save' challenge enables us to notice how students of Plastic Arts and Multimedia engaged in the collaborative exploration of solutions to a health-related case tailored for children to handle.

'Born to Save' presented a challenge that empowered children to make a difference, offering them the opportunity and space to perform first aid techniques, participate in the so-called chain of survival and, who knows, potentially save lives. This challenge had as its target children aged between 5 and 10 or 12 years old. Recognising the adventurous, critical and curious nature of the younger generations, this challenge aimed to develop tools so that a child alone could be able to correctly perform first aid procedures as specific as placing a victim on his/her side in a safe lateral position or initiating CPR manoeuvres.

The challenge was facilitated by an IPV teacher working in Communication and Information Sciences and also a volunteer firefighter, and it was developed in partnership with a creative agency of communication and advertising, headquartered in the district of Viseu, ARTIDERCA – Agência Criativa. In order to respond to the mission of social responsibility which companies should be sensitive to, the facilitator and the partner entity challenged the 'Born to Save' team to think of a digital tool that children could consult and use, and from there develop knowledge for learning first aid. To form the team, the process was similar to that described when presenting the challenge entitled 'The Mission of Libraries'. Despite a different focus, the tasks and tools used were the same, as the facilitators of both challenges were

participating in the same projects within the Demola Portugal Initiative. Besides that, they shared the understanding that, as Sánchez and Gutiérrez-Esteban (2023, p. 2) point out,

… education becomes an open activity that cannot be limited to closed spaces, which recognizes the individual differences of each person when acquiring learning and tries to respond to each of them. In addition, education has a physical and, increasingly, a virtual structure to respond to educational demands and is committed to innovation as a driver of evolution…

The use of the Miro tool as a virtual platform for developing and building the team's ideas enabled and largely promoted collaborative work. The whole team could edit and change what they considered fundamental in the various boards, and they could do it collectively and synchronously. Each member, wherever they were, could move around the boards and at the same time see what other members were adding and/or changing.

The Miro platform allowed for very creative and even fun interactions: the use of colourful frames, the insertion of pictures that were suggestive of the theme being dealt with, and the possibility of adding arrows to create the idea of a flowchart were fundamental to adapting the procedures to the target audience for which they were working, as we notice below, in Figure 5.


Figure 5. 'Future Solution Ideas' task developed collaboratively *(Source: 'Born to Save' team on a Miro board, week 9)*

Another tool that was used a lot was the Zoom platform, through which several meetings were scheduled and held among the members of the team and between the team and the partner, as shown in Fig. 6 below.

The working dynamics implemented had very positive outcomes, contributing to the exchange of ideas and to start drawing the final purpose of the students' participation in this process – to provide children with tools so that they can be part of the solution in an emergency.

Every week the team had tasks assigned to them by the facilitator, who had previously received them from Demola trainers, just like the facilitator of the 'The Mission of Libraries' challenge. These tasks were aimed at evaluating and questioning the problems being analysed. Despite much effort and time being put into the tasks, the team showed great interest and commitment, that is, the students were motivated and always came up with contributions and suggestions that added value to the challenge.

Figure 6. A Zoom meeting among the members of the 'Born to Save' team (*Source: 'Born to Save' trainee and facilitator, week 4*)
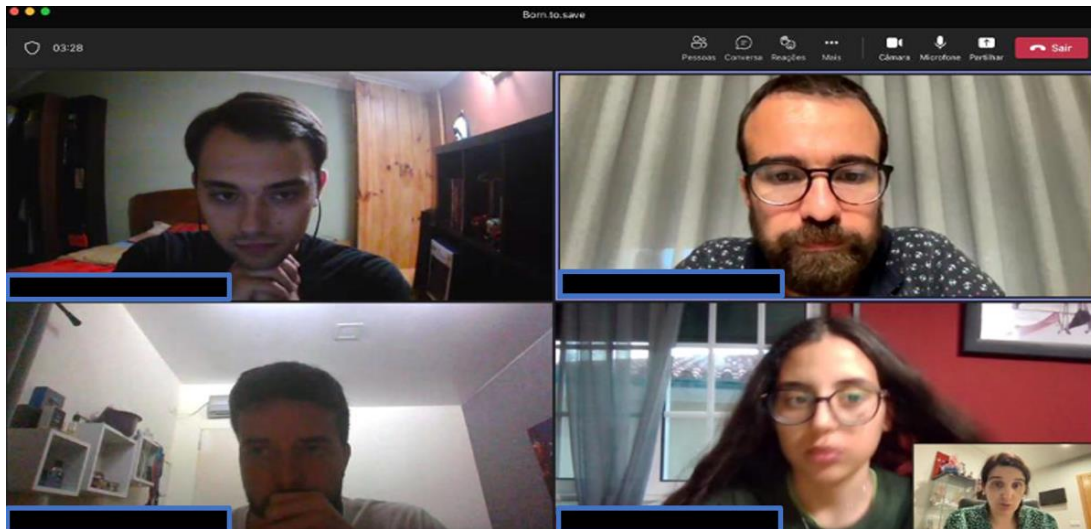
Students started their work with a literature review to get acquainted with the topic and strategise how to go ahead. The members of the team were students of Plastic Arts and Multimedia, all of them studying at the School of Education of the Polytechnic Institute of Viseu, in Portugal, and none of them had any knowledge in this area, so the challenge was intense, but, as they claimed, "very rewarding".

The team conducted interviews with kindergarten educators, firefighters, parents, and nurses. The information gathered allowed for a better understanding of the context of those who live and know the reality of children both at home and at school. On the other hand, the nurse specialists and the firemen contributed in terms of giving insights into techniques that the children could learn in an easier and even quicker way. As a significant input, these exchanges made it possible to outline the general conditions for achieving the intended goal.

Parents claimed that children are interested in multimedia products with some interactive features that challenge them. This idea was also emphasized by preschool educators, who acknowledged that children are very curious and open to new discoveries and that their willingness to learn allows them to be interested in something new. As far as the firefighters were concerned, they shared that children are interested in the activities they routinely perform and that dozens of children who say they want to be firefighters in the future visit them on a daily basis, which allows them to "learn how to act and behave in the same manner firefighters do". On the other hand, the nurses provided a more technical contribution regarding the practices and techniques that can be performed by children if they are trained and become aware of them.

During the meetings with the partner entity, the team was able to clear up doubts at the most practical level, trying to understand what kind of digital resources they could develop, which software to use, whether it was possible to think of more than one solution, and how they could present it to the target users: the children. Taking advantage of the partner's experience in this area of work, the team had all their concerns addressed, gained new insights and ideas, and became aware of whether or not they were on the right track.

There were two hypotheses on the table: 1) the development of colourful and animated information leaflets, with a QR code for older people, giving them access to some video/animation/music; and 2) the development of an animated book with first aid exercises to be used on the child's favourite cuddly toy, with stickers as a bonus for the mission accomplished.

The biggest advantage of participation in this co-creation process is that the team had the opportunity to step out of their comfort zone. They got a taste of the responsibility that comes with the opportunity to create and develop an idea that delivers solutions to the labour market. They developed activities to solve challenges of a more societal nature and directed towards specific problems that require tangible solutions.
All these activities focused on the dynamics of finding the best solutions for what the project wanted to achieve, allowing children to feel prepared to react and act in emergency situations, correctly applying techniques and procedures learned.

Understanding the interests and preferences of the team, a solution was sought to meet the areas that each member wanted to develop. The partner also gave his tips and guidelines so that the final product would be as creative, original, fun, and also didactic as possible.

Thus, the team chose to focus all their energy on the development of an interactive television series for children. The objective was to allow young people to co-construct knowledge and, by watching the TV series, they would be led to make decisions in emergency/risk situations, also assessing the importance of memory. Each episode of the series would follow a chronological line: presentation of knowledge on the theme – problem/event – interaction/decision. Each time the child made a wrong decision, they would be encouraged to continue by giving them the chance to repeat the wrong step and move forward in the series towards the main purpose: saving a life.

The team of students developed the whole workflow in a framework designed in the Miro platform, so that it was easier to understand where the child could make a mistake, and which path the series would have to follow (cf. Figure 7)[10].

Feedback from all those involved in the process was highly positive. The team was praised for the idea and the audacity to have chosen this societal challenge and to have come to the scenario of an interactive TV show as a possible solution. The team members showed concern for others and, consequently, deserved the recognition of all, especially the partner who was very pleased with the proposal presented and the details with which they built all the dynamics of the TV series. In the final pages of their report, the students added a section entitled "Personal interpretations", where they claimed that participating in the challenged-based project was a unique experience. In one of the student's words, "After these two short months, I see that all those fears are behind me, and that at the end I take with me new skills, values, knowledge and an incredible experience..." (R.A.).

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[10] For a comprehensive view of this workflow, cf.
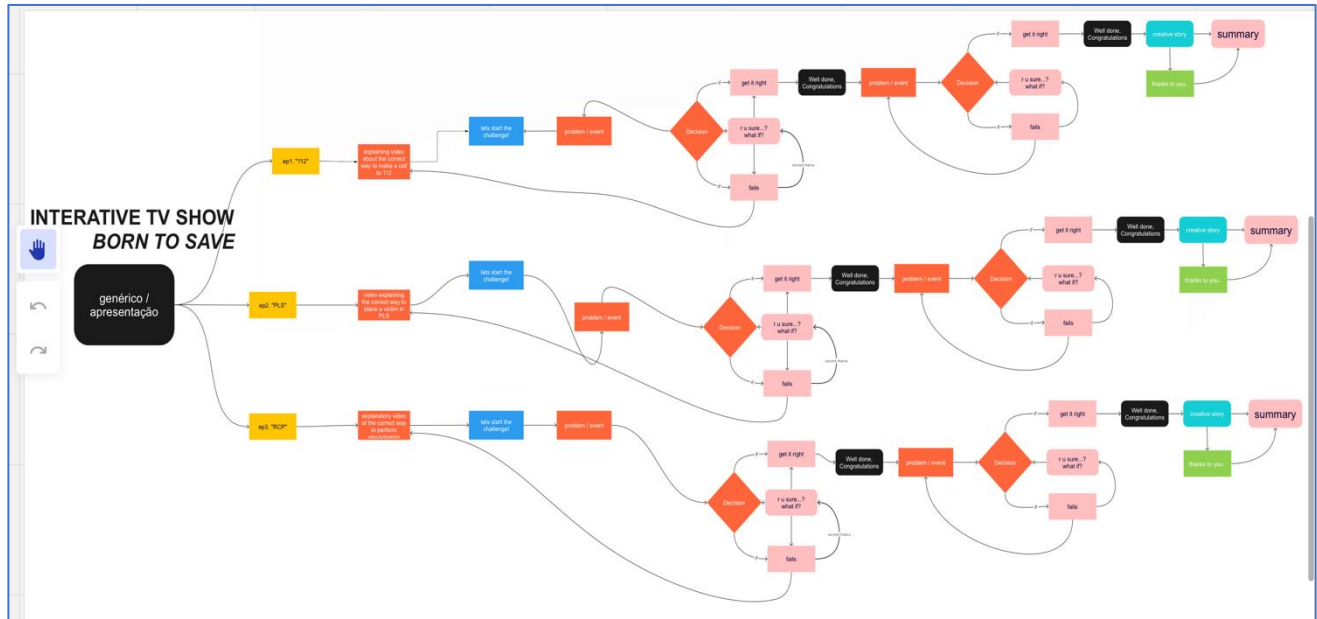https://miro.com/app/board/uXjVNz7oico=/?share_link_id=206096914438

Figure 7: Workflow of a TV series designed on Miro *(Source: 'Born to Save' team, week 10)*

CONCLUSIONS

In conclusion, this study unveils the impact of the co-creation process facilitated by the Demola Portugal Initiative, particularly evident in the experiences of the teams participating in the third and fourth joint editions. By engaging with companies and organisations to tackle societal challenges collaboratively, participants transcended traditional roles as mere teachers or students, embracing new identities as innovation facilitators and professional talents. Reflecting on the accounts of the two trainees who also acted as facilitators, it becomes clear that this initiative propelled the participants to respond adeptly to the demands of the labour market and society at large. This adaptive stance aligns with Velu's observations (2023, p. 2) which claim that "[t]eachers must, therefore, adapt their pedagogical practices and beliefs to the new ideas. In this way, educators are tasked with aligning newly developed concepts with long-established pedagogical beliefs and practices." This transformative shift also resonates with the evolving pedagogical paradigm described by Rijnsoever, Sitzler, and Baggen (2023) in their scholarly article, echoing the need for alignment with rapidly changing societal dynamics.

Every week the teams were tasked with providing innovative solutions to challenges posed by Demola Global, leveraging dynamic collaborative tools like Miro and employing data analysis techniques such as empathy maps to generate insights. The consistent weekly follow-up ensured thorough monitoring of the process and provided a platform for clarifying doubts and uncertainties, facilitated by the contribution of the partner organisations who proved to be fundamental throughout this whole endeavour.

While the 'Link Me Up' project primarily aimed to enhance students' problem-solving abilities, the participation of teachers as both trainees and facilitators of the 'Learning based on co-creation processes' project significantly enriched their pedagogical repertoire. This sentiment, echoed by other programme participants (Amante, 2023), underscores the importance of exposure to innovative teaching and learning techniques that promote active student engagement and collaborative knowledge construction.

Drawing from these insights, policymakers are urged to recognise the pivotal role of initiatives like the Demola Portugal Initiative in fostering synergistic collaboration between academia, industry, and society. Strategic support for such projects is paramount to cultivating an ecosystem conducive to

innovation, addressing real-world challenges, and equipping individuals with the skills necessary to navigate and thrive in a rapidly evolving landscape. By championing initiatives that bridge the gap between theory and practice, policymakers can catalyse transformative change and cultivate a culture of innovation that drives sustainable societal progress.

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COMMITTEE ON PUBLICATION ETHICS

Regarding our manuscript having passed an Ethics Committee, the application for this project dates back to December 2019 (call no. POCH-67-2019-12, available online at https://www.poch.portugal2020.pt/pt-pt/Candidaturas/Documents/Aviso%20n%C2%BA%20%20POCH-67-2019-12.pdf A consortium comprising 14 Polytechnic Institutes in Portugal, including the Polytechnic Institute of Viseu, underwent a rigorous evaluation by an external Jury, ensuring full compliance with both external and internal ethical standards. This project, approved on 18/06/2020, was financially supported by POCH, Portugal 2020, and the European Social Fund. Its overarching objective was to enhance the quality and innovation within the educational and training systems in Portugal.

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