The Role of Project-Based Learning (PBL) to Promote the Development of Student's Skills for Lifelong Learning

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Abstract. This paper analyses the impact of Project-Based Learning (PBL) on the development of lifelong learning skills among first-year students who participated in a PBL approach. The study involved 18 students, enrolled in the first year the Social Education bachelor's program, at Portucalense University, Porto,Portugal. The project involved three curricular units: Research Methods and Techniques II, Ethics and Education, and Information and Communication Society. Throughout the semester, students worked in teams of 3 to 5 members to provide answers to a research problem related to their professional field. To assessthe efficacy of PBL, a survey was administered at the semester's end, evaluatingstudents' experiences and the perceived development of competencies like problem-solving, teamwork, communication, and self-directed learning. Addition- ally, the survey examined how AI tools supported project development and enhanced critical thinking skills. Students identified tasks for which AI was used and suggested ways to maximize its benefits. Findings indicate that PBL contributed to skill development, particularly in collaboration, communication, and applying research techniques in real-world contexts. The continuous feedback and assessment process fostered a reflective learning environment. AI tools were usedfor literature reviews, data analysis, information retrieval, and generating insights, enhancing task efficiency. In conclusion, integrating PBL in the Social Education curriculum at Portucalense University effectively contributes to develop lifelong learning skills, preparing students for future career success.

Keywords: Project-Based Learning (PBL), Lifelong Learning Skills, Social Education, Artificial Intelligence (AI), Student Assessment.

1 Introduction

Lifelong learning is crucial in today's rapidly changing world, where technological advancements and changing job markets require individuals to constantly update their skills. This brings challenges to Higher Education, as the curriculum and teaching approaches must also be aligned with these demands. The development of lifelong learning skills is eesntial for students personal and professional development in Higher Education.

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In this context, Project-Based Learning (PBL) emerges as a pedagogical approach that fosters these essential skills. PBL involves students in collaborative projectsthat require problem-solving, research, and practical application of theoretical knowledge, thereby promoting active engagement and deeper learning.

Lifelong learning skills refer to the continuous, self-motivated pursuit of knowledge for personal or professional development. These skills encompass a wide range of competencies, including critical thinking, adaptability, and the ability to acquire new knowledge and apply it in diverse contexts. By embracing lifelong learning, individuals can enhance their employability, foster innovation, and remain competitive in their careers. Moreover, it promotes personal growth, intellectual fulfilment, and a broader understanding of the world. Cultivating these skills can lead to greater resilience in the face of change and a more adaptable, knowledgeable society.

Researchers have extensively studied lifelong learning skills across various disciplines, highlighting their significance in personal and professional growth. They have explored the factors that influence lifelong learning and the methods to cultivate these skills effectively.

One of the foundational studies in this area by Candy (1991) emphasizes the importance of self-direction in lifelong learning. Candy's work underscores the need for learners to take initiative, set personal learning goals, and pursue knowledge independently. This study laid the groundwork for understanding the critical components of lifelong learning skills, such as self-regulation and intrinsic motivation.

Fischer (2000) further expanded on Candy's ideas by examining how digital technologies facilitate lifelong learning. Fischer's research revealed that technology provides access to a vast array of resources and learning communities, enabling individuals to acquire new skills and knowledge more efficiently. The study highlighted the role of online platforms and digital tools in supporting continuous learning and collaboration among learners from diverse backgrounds.

Another significant contribution to the field is the work of Illeris (2004), who introduced a comprehensive model of lifelong learning that integrates cognitive, emotional,and social dimensions. Illeris argued that effective lifelong learning requires not only cognitive engagement but also emotional involvement and social interaction. This holistic approach to understanding lifelong learning skills development has been influential in designing educational programs and interventions that address the multifaceted nature of learning.

Further research by Knapper and Cropley (2000) examined the relationship between lifelong learning and employability. Their study found that individuals who actively engage in lifelong learning are more adaptable and better equipped to handle job transitions and career changes. The authors suggested that fostering a culture of continuous learning within organizations can enhance employee performance and innovation.

Recent studies have also focused on the role of higher education institutions in promoting lifelong learning skills. For instance, a study by Barnett and Jackson (2020) explored how universities can integrate lifelong learning principles into their curricula. The researchers advocated for pedagogical strategies that encourage critical thinking, problem-solving, and reflective practices, which are essential for lifelong learning.

They emphasized the need for educational systems to shift from traditional content delivery to more learner-centered approaches.

In the context of global trends, UNESCO (2016) highlighted the importance of lifelong learning in achieving sustainable development goals. The report emphasized that lifelong learning is crucial for addressing global challenges such as unemployment, inequality, and social inclusion. It called for policies that support lifelong learning opportunities for all individuals, regardless of age, gender, or socioeconomic status.

Overall, previous studies on lifelong learning skills development underscore the importance of fostering self-directed, technology-enhanced, and holistically integrated learning experiences. These studies provide valuable insights for educators, policymakers, and organizations aiming to cultivate a culture of continuous learning and adaptability.

Project-based Learning (PBL) is one of the most successful active learning methodologies used in the first year of Higher Education (Alves & Fernandes, 2022; Powell & Weenk, 2004). PBL is a student-centered pedagogical approach where students learn by actively engaging in real-world and personally meaningful projects. Unlike traditional learning models that emphasize passive absorption of information, PBL requiresstudents to collaborate, think critically, and apply their knowledge to solve complex problems.

PBL offers numerous benefits, particularly in higher education. One of the primary advantages is the enhancement of critical thinking and problem-solving skills. By engaging in projects that require the application of theoretical knowledge to practical scenarios, students develop a deeper understanding of subject matter. Additionally, PBL fosters collaboration and communication skills, as students often work in teams, thus pre-paring them for the collaborative nature of modern workplaces (Hmelo-Silver, 2004). PBL also promotes self-directed learning, encouraging students to take ownership of their educational journey and develop lifelong learning habits (Blumenfeld et al., 1991). Artificial Intelligence (AI) is recognized in academic, scientific and business circles asone of the pivots of technological change in the present industrial revolution (Mannuruet al., 2023). AI has revolutionized various areas of knowledge and human practice, offering innovative and efficient solutions to complex problems. AI generally refers tocomputer systems capable of performing tasks that typically require human intelligence, such as speech recognition and problem-solving. Advances in machine learningand deep learning have been fundamental to the development of AI, allowing computers to analyze large volumes of data and identify complex patterns with unprecedented accuracy (Sheikh et al., 2023). Within the field of AI, Generative Artificial Intelligence(GAI) represents a significant advance in the field of AI. GAI has the capacity to createnew content from existing data. IAG models can autonomously generate text, images, music, and programming code by learning complex patterns in large data sets (Yusuf et al., 2024). This capability results from using neural networks and machine learning algorithms to generate original results that mimic human creativity.

As mentioned, AI, particularly GAI, is becoming increasingly prominent in several sectors of society, including education. In the education field, generative AI, according to AlAli & Wardat (2024), presents promising opportunities to improve teaching and learning experiences through personalized learning, adaptive tutoring systems and the

creation of immersive learning environments. As technology continues to develop, generative AI is "ready" to transform educational practices and respond to the diverse needsof students in the digital age. These developments reflect a broad shift towards personalized and adaptive learning approaches.

Despite the added value of GAI in general and, in particular, in the educational context, it is necessary to critically analyze/evaluate the quality and reliability of the results presented by the tools in order to avoid, on the one hand, their misuse and, on the other hand, over-reliance on the content generated. As mentioned above, GIA tools help improve educational experiences, but their limitations and risks must be carefully managed. Tool responses can sometimes be inaccurate or biased, representing a considerable risk if used by teachers/students with a lack of critical thinking (Marchena et al., 2024). According to Țală et al. (2024), IAG tools, in particular ChatGPT, which has been the subject of several studies (Grassini, 2023; Shaji, Hovan and Gabrio, 2023), can improve student learning since, on the one hand, information that is already known can be expanded, potentially facilitating student research. On the other hand, trusting only in the tool's outputs can inhibit the student's critical thinking, practice and communication with teachers, reducing the development of learning and consequently negatively affecting the training/preparation of students for their future professional activity. For Qin et al. (2023), using GAI tools can lead to a withdrawal from subjectivity and an obstacle to developing creativity and autonomy. If one looks at the tools in termsof learning, the author argues that they have the potential to function as a personalized learning assistant, facilitating autonomous learning. However, this "convenient" learning mode can result in superficial engagement, promoting short-term, surface-level learning that prevents the development of more profound thinking skills.

GAI tools are becoming crucial for high education, whether personalized learning, computer-based assessment, intelligent educational systems or support for teaching staff. Such tools offer support that reduces expenses and improves learning outcomes (Gill et al., 2024). However, as mentioned above, IAG tools should not be seen as the "new" teachers but as collaborators in the teaching-learning process.

This study aims to analyze how PBL facilitates the development of lifelong learning skills among students and discuss the role of generative Artificial Intelligence (AI) in enhancing critical thinking within PBL projects. The paper is organized in four sections. The first section of the paper explores the literature review based on three essential topics that support the theoretical understanding of the study: lifelong learning skills, project-based learning and the role of AI in Education. The second section presents the methods, followed by the results analysis and discussion, in the third section. The paper ends with some conclusions and recommendations for future work, in the last section.

2 Method

The aim of this paper is to analyse the impact of Project-Based Learning (PBL) on the development of lifelong learning skills among first-year students who participated in a PBL approach. The study involved 18 students, enrolled in the first year of the Social Education bachelor's program, at Portucalense University, Porto, Portugal. The

project involved three curricular units: Research Methods and Techniques II, Ethics and Education, and Information and Communication Society. Throughout the semester, students worked in teams of 3 to 5 members to provide answers to a research problem,related to their professional field. Students progressed through several milestones, receiving continuous feedback that culminated in oral presentations and a final report. It is important to note that PBL has been the active learning approach privileged in the past few years of this program, with positive results already evidenced in the literature (Fernandes et al., 2018, 2020, 2021, 2022).

In particular, this study focuses on the following research questions:

- How does PBL impact the development of lifelong learning skills?
- What is the role of AI in supporting PBL projects?

The research design is based on a qualitative approach. To analyse the efficacy of PBL in promoting lifelong learning skills, a survey was administered to the students at the end of the semester. This survey was adapted from the original version of the survey developed Lima et al. (2017), a group of researchers from the University of Minho who have deep and extensive experience in PBL. The survey explored the following sections: I) project theme; II) student learning and skills developed; III) teamwork; IV) therole of the teacher; V) student assessment and VI) PBL as a teaching-learning method-ology. The survey also included an extra topic based on the use of generative artificialintelligence (AI) tools to support the project development. Students were asked to identify specific tasks for which AI was used in the project and suggestions on how AI couldbe maximized to benefit students' learning process. For the purpose of this paper, datawill focus mainly on evidence based on the students' perceived development of key competencies for life-long learning, such as problem-solving, teamwork, communication and self-directed learning and the role of AI for enhancing students' critical thinking skills.

3 Results and Discussion

The questionnaire received 15 responses. PBL was relevant for the students since they better understood the interconnection between the topics covered in the three UCs, as well as developed technical and soft skills for lifelong learning in an articulated and practical way. One of the aspects covered by the survey was the students' assessment of the use of PBL as a teaching and learning method. On a scale from 0 (strongly disagree) to 5 (strongly agree), 60% of the students responded that they strongly agree and agree. Figure 1 shows the same results distributed across the different items assessed.

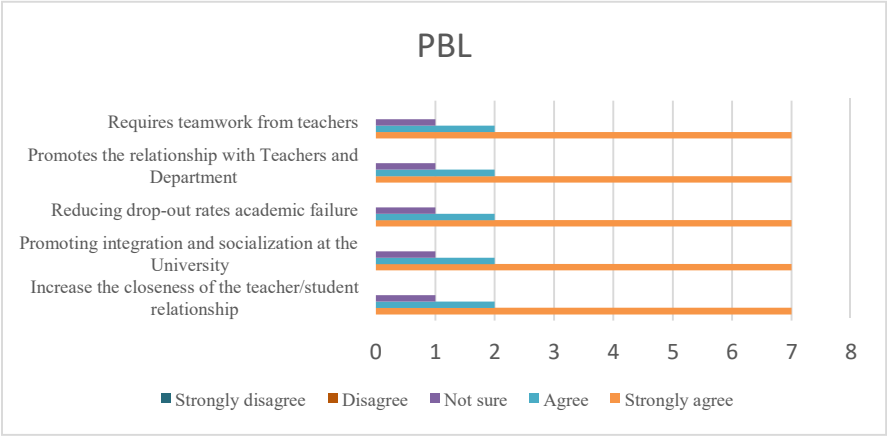

Fig. 1. PBL as a teaching and learning methodology

The students considered that PBL strongly contributes to developing skills, i.e. learning skills that will be the basis for lifelong learning/growth. Figure 1 shows the students' ratings of PBL's contribution to the soft skills developed. In all the soft skills, nearly 100% of the answers point to total agreement or agreement with the development of these skills in a PBL context.

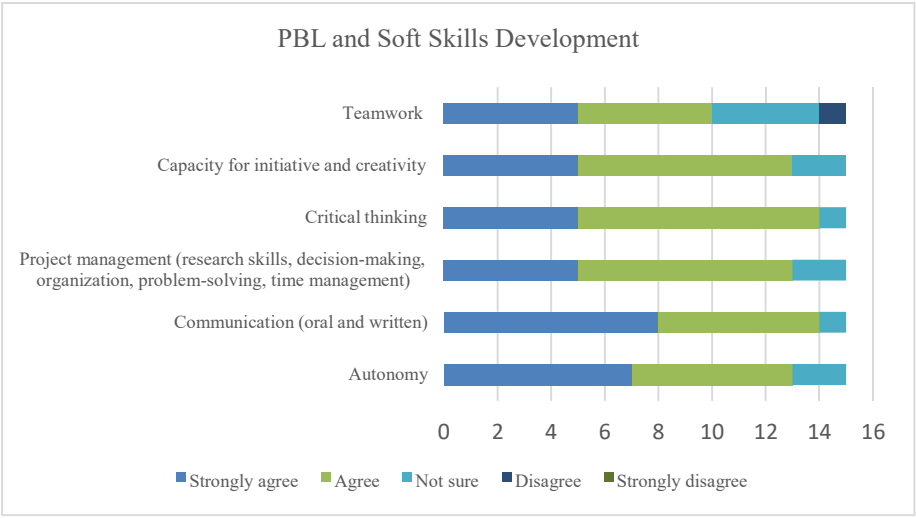

Fig. 2. Soft Skills Development

Concerning the development of hard skills, which are developed by complying with the syllabus, most students answered that they strongly agree or agree that PBL contributes to this process, both in terms of learning and understanding and in terms of applying the syllabus to real cases.

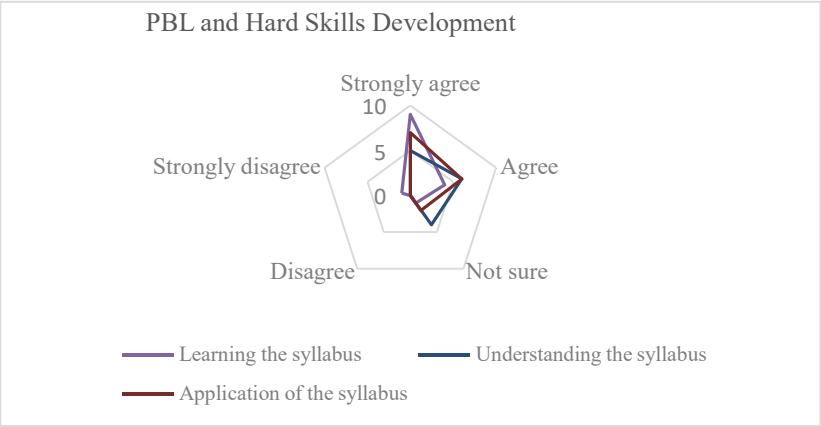

Fig. 3. Hard Skills Development

In addition to analysing the impact of using PBL on skills acquisition, the questionnaire also gauges to assess the students' use of generative AI. The following results were obtained from the question, "Did you use AI during the PBL project?":

Table 1. The use of AI

Answer option	% of answers
Never	0%
A few times	13%
Sometimes	73%
Often	7%
Always	7%

The results show that most students used generative AI, and to the open question “Indicate which AI tools were used to carry out the PBL project.”, the tool mentioned was ChatGPT.

Concerning the question, “What is the purpose of using AI in the project?” the results were as follows:

Table 2. The use of AI in project development

Answer option	Number of answers
Literature review	5
Contribution of CUs	1
Integration of the SDGs	5
Project methodology	2
Preparation of data collection instruments	5
Analysis of results	4
Project conclusions	3

Report writing	3
Structuring the oral presentation	5
Others (improve writing)	1

The table above shows that the use of IA is diverse over the project's development, ranging from the beginning of the research process to the writing and presentation.

Finally, the question was raised: “Do you believe that the use of AI in the PBL project has contributed to the cultivation of lifelong learning skills? If so, how?”. The response was overwhelmingly positive, with 87% (13 responses) answering yes and only13% (2 responses) nulls. The 'how' aspect elicited various responses, such as “ .. broadened our perspectives and expanded our horizons”, “...It motivates students to becomeself-reliant learners”, all of which were consistently justified as an additional asset in skill long life development.

From the results presented, it can be concluded that PBL contributes positively to developing soft and hard skills throughout life, and the students are aware of this. Concerning the use of AI tools, students still need to develop their knowledge of the rangeof tools on the market. The answers given show that students only use ChatGPT. However, the students know that the tool can support them in different tasks, such as re- search, writing reports or creating presentations.

The survey also asked students to give an overall evaluation of the PBL project. To this end, two open-ended questions were asked, asking students to identify positive and negative aspects with the following questions: (1) "What were the most positive aspects of this PBL experience?" and (2) "What were the least positive aspects of this PBL experience?".

The answers to question (1) were similar to those mentioned above (Figure 1 e 2) obtained through the closed questions, i.e., "The PBL experience can bring several positive aspects for both students and teachers. Firstly, the development of problem-solving skills stands out. Students learn to identify problems, formulate hypotheses, conduct research, and propose solutions, improving their critical and analytical skills. In addition, PBL promotes active and engaged learning, increasing students' involvement andmotivation through active participation in the learning process"; "This experience had some positive aspects, such as group work and time management"; and "establishing more contact with other students, putting into practice what we learn in a more theoretical way, acquiring new knowledge". “Learning differently” also stands out. In short, the students found the PBL project a good experience. In short, the students found the PBL project a good experience.

The answers to question (2) are more related to group dynamics, stress, and coordination with projects from other courses, e.g., "lack of communication from some members of the group and lack of sharing of documents which hinders the progress of the project"; "stress" and "managing time between PBL and the tasks to be presented in it, with other courses". The students' evaluations show a need to improve time management.

4 Conclusions and Future Work

Nowadays, HEIs have so-called digital natives, students who need to be continually motivated and challenged, and where informative classes do not meet this framework, although it is still common practice. Digital students require different classroom dynamics. In this context, active learning strategies attract the attention of researchers andteachers from different areas of knowledge, as they stimulate students' motivation andcommitment to tasks where they are challenged to develop lifelong skills. Not least, students who are digital natives are currently experiencing a boom in AI tools. These tools are widely used and cover a wide range of tasks, promoting a more interactive and receptive learning environment.

In the study presented in this article, we found that using PBL contributed to the good performance of the students who attended the three courses. It contributed, to the lifelong development of hard and soft skills, increased the success rate of the courses, and allowed students to understand the interconnection and dependence of the courses in the curriculum as previously demonstrated. Another important point is the 'awakening' of students to the use of generative AI. Students are already using it, but it is very much based on the ChatGPT tool, ignoring, on the one hand, the tool's potential as a collaborator in any academic or even research work. On the other hand, they overlookthe range of existing tools for different tasks.

Future work should focus on the successful integration of AI tools in higher education as valuable resources to complement and enhance active learning strategies. Re- search could focus on developing training programs for both educators and students, ensuring they can effectively use AI to foster deeper engagement and skill acquisition.Additionally, studies could explore the impact of various AI applications on student motivation and performance across diverse subjects. Comparative studies between traditional and AI-integrated pedagogies could also highlight best practices and areas forimprovement.

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