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GEOGRAPHICAL EDUCATION THROUGH PROBLEM-BASED LEARNING: ESSAY IN TWO PORTUGUESE SCHOOLS

Educación geográfica a través del Aprendizaje Basado en Problemas: ensayo en dos escuelas portuguesas

Éducation géographique par l'Apprentissage Basé sur les Problèmes: essai dans deux écoles portugaises

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Abstract:

In the current educational context, the pressing need to redefine existing paradigms becomes undeniable, especially in the field of geographic education. Two portuguese teachers in initial training, confronted by this reality, chose to overcome challenges by introducing Problem-Based Learning into their classrooms, turning it into a fundamental pillar for the teaching and learning of Geography. The obtained results prominently highlight the students' motivation, fostering a deeper understanding of geographical concepts. Furthermore, a noteworthy development of crucial cross-cutting

skills was observed, with special emphasis on research, autonomy, and teamwork skills. The conclusions underscore the effectiveness of Problem-Based Learning as a didactic and pedagogical approach, emphasizing the ongoing imperative of innovation and adaptation in the educational field, particularly in Geography. This study not only validates the effectiveness of Problem-Based Learning but also emphasizes the importance of overcoming obstacles by teachers in training to implement dynamic and active approaches. The ability to transcend challenges proves essential to genuinely transform the educational process, preparing students to face increasingly prevalent future challenges. Thus, the initiative of these teachers in training not only illustrates the effectiveness of Problem-Based Learning but also highlights the relevance of resilience and innovation in the contemporary educational context, with particular emphasis on geographical education.

Keywords:

Teaching of Geography; Problem-Based Learning; Geographical Education; Teacher Learning.

Resumen:

En el actual contexto educativo, la necesidad apremiante de redefinir los paradigmas existentes se vuelve innegable, especialmente en el campo de la educación geográfica. Dos profesores portugueses en formación inicial, confrontados por esta realidad, optaron por superar los desafíos introduciendo el Aprendizaje Basado en Problemas en sus aulas, convirtiéndolo en un pilar fundamental para la enseñanza y el aprendizaje de la Geografía. Los resultados obtenidos resaltan de manera destacada la motivación de los estudiantes, fomentando una comprensión más profunda de los conceptos geográficos. Además, se observó un notable desarrollo de habilidades transversales cruciales, con especial énfasis en la investigación, la autonomía y las habilidades de trabajo en equipo. Las conclusiones subrayan la efectividad del Aprendizaje Basado en Problemas como enfoque didáctico y pedagógico, haciendo hincapié en el imperativo constante de innovación y adaptación en el campo educativo, particularmente en la Geografía. Este estudio no solo valida la eficacia del Aprendizaje Basado en Problemas, sino que también destaca la importancia de superar obstáculos por parte de los profesores en formación para implementar enfoques dinámicos y activos. La capacidad de superar desafíos resulta esencial para transformar genuinamente el proceso educativo, preparando a los estudiantes para enfrentar desafíos futuros cada vez más prevalentes. Así, la iniciativa de estos profesores en formación no solo ilustra la eficacia del Aprendizaje Basado en Problemas, sino que también destaca la relevancia de la resiliencia y la innovación en el contexto educativo contemporáneo, con énfasis particular en la educación geográfica.

Palabras Clave:

Enseñanza de la Geografía; Aprendizaje Basado en Problemas; Educación Geográfica; Aprendizaje del Profesor.

Résumé:

Dans le contexte éducatif actuel, la nécessité pressante de redéfinir les paradigmes existants devient indéniable, surtout dans le domaine de l'éducation géographique. Deux enseignants portugais en formation initiale, confrontés à cette réalité, ont choisi de relever les défis en introduisant l'Apprentissage Basé sur les Problèmes dans leurs salles de classe, en en faisant un pilier fondamental pour l'enseignement et l'apprentissage de la Géographie. Les résultats obtenus mettent en évidence de manière prominente la motivation des élèves, favorisant une compréhension plus profonde des concepts géographiques. De plus, on a observé un développement notable de compétences transversales cruciales, avec un accent particulier sur la recherche, l'autonomie et les compétences en travail d'équipe. Les conclusions soulignent l'efficacité de l'Apprentissage Basé sur les Problèmes en tant qu'approche didactique et pédagogique, mettant en avant l'impératif continu d'innovation et d'adaptation dans le domaine éducatif, particulièrement en Géographie. Cette étude valide non seulement l'efficacité de l'Apprentissage Basé sur les Problèmes, mais souligne également l'importance de surmonter les obstacles par les enseignants en formation pour mettre en œuvre des approches dynamiques et actives. La capacité à transcender les défis s'avère essentielle pour véritablement transformer le processus éducatif, préparant les étudiants à faire face à des défis futurs de plus en plus prévalents. Ainsi, l'initiative de ces enseignants en formation illustre non seulement l'efficacité de l'Apprentissage Basé sur les Problèmes, mais met également en lumière la pertinence de la résilience et de l'innovation dans le contexte éducatif contemporain, avec un accent particulier sur l'éducation géographique.

Mots-Clés:

Enseignement de la Géographie ; Apprentissage Basé sur les Problèmes; Éducation Géographique ; Apprentissage des Enseignants.

1. INTRODUCTION

In the global context of education, particularly in geographic education, there is a growing need to employ teaching methods, and more importantly, learning methods that go beyond the mere transmission of knowledge. This approach primarily seeks to develop complex and diverse skills among students. Geography, as a mandatory subject in Portugal during the third cycle of basic education, plays a crucial role by

offering a critical understanding of the world and the interactions between society and the environment (DGE, 2018a). It is imperative that Geography teachers possess a solid foundation in geographic science and continuously improve their training in geographic education (UGI, 1992; Cachinho, 2011).

There are different perspectives on didactic approaches. While some advocate for traditional methods focused on teacher-led instruction and knowledge acquisition, others promote more constructivist, interactive, and participatory methods. These approaches create conditions for students to engage in investigative and problem-solving activities, actively participating in the construction of their own knowledge (Naish, 1982; Westwood, 2008; Arends, 2012). Cachinho (2000) advocates for active Geography, which helps address the challenges of education in general and geographic education in particular, encouraging students to question geographic issues and develop skills that will be essential in their lives as critical and active citizens.

Problem-Based Learning emerges as an innovative and effective methodology for the development of essential skills. This methodology not only encourages problem-solving but also promotes teamwork, student autonomy, and meaningful learning experiences. Unlike traditional teacher-centered teaching, where knowledge is passively transmitted (Glasgow, 2019), in Problem-Based Learning, the teacher acts as a facilitator, encouraging students to build their own knowledge based on prior experiences, teamwork, and independent study (Cachinho, 2012; Sousa & Dourado, 2015; Lopes et al., 2019).

This approach prepares students not only to solve specific problems but also to develop key skills such as autonomy, leadership, creativity, communication, and critical thinking (Cachinho, 2011; Decree-Law No. 55/2018). In geographic education, Problem-Based Learning focuses on contemporary issues, using students' practical knowledge to promote the development of fundamental skills and attitudes (Mérenne-Schoumaker, 1985; UGI, 1992; Klein, 2013; UGI, 2016).

Despite the growing recognition of Problem-Based Learning's importance, there is a significant gap in the literature regarding its specific application in geographic education, particularly in the Portuguese context. This article aims, through the implementation of Problem-Based Learning in geographic education across two distinct scenarios, to identify the opportunities and challenges associated with its implementation. To achieve this objective, a teaching experiment was planned and implemented in two schools, one public and one private, with an 11th grade class and a 9th grade class, respectively. Students were exposed to real-world problems related to "The Internal Dynamics of Urban Areas" and "Development Contrasts" (DGE, 2018a; DGE, 2018b). Students' progress was recorded throughout the process using a combination of observations, analyses, and assessments of outcomes. This study argues that Problem-Based Learning, regardless of the context and with all the opportunities and challenges arising from its

implementation, offers a dynamic and engaging didactic-pedagogical approach that facilitates not only content understanding but also the development of essential cognitive, social, and emotional skills for students' academic and personal success.

The "Essential Learnings" emerge as a central guiding document in Portuguese education, defining not only curricular content but, above all, the skills students should develop throughout their educational journey. This focus on skills allows for curricular flexibility and the integration of innovative methodologies such as Problem-Based Learning. By emphasizing the development of skills like autonomy, critical thinking, problem-solving, and teamwork, the "Essential Learnings" encourage teachers to adopt teaching practices that go beyond the mere transmission of content. The curricular flexibility provided by these guidelines allows teachers to adapt their teaching methods, creating a more dynamic and student-centered environment. In this way, the "Essential Learnings" encourage the integration of methodologies such as Problem-Based Learning, aligning with the growing trend of valuing the development of skills and attitudes essential for 21st century success.

The article is structured into six sections, starting with an introduction that presents the theme, the research context, and the study's relevance. Next, the objectives and methodology are outlined, explaining the data collection and analysis methods as well as the scientific basis. The third section explores Problem-Based Learning, delving into its theoretical principles, conducting a literature review, and discussing the benefits and challenges of its implementation. The fourth section is dedicated to presenting and analysing the results obtained, offering an interpretation of the implementation of this teaching and learning methodology in two very different contexts. In the following sections, the critical discussion of the results and the conclusions highlight the study's contributions, evaluate the achievement of the objectives, and suggest new avenues for future research. The final section lists the bibliographic references that support the study.

2. OBJECTIVES AND METHODOLOGY

The present study aims to analyse the implementation of Problem-Based Learning as a fundamental element in the teaching and learning of Geography, from the perspective of two pre-service teachers. In this article, we present the methodology adopted to achieve these objectives, including primary and secondary sources, the choice of working method, and the procedures for analysis.

The collection of primary data involved lessons taught by the pre-service teachers who implemented Problem-Based Learning. Aspects related to classroom dynamics, student interactions, as well as their motivation and engagement, were recorded through naturalistic observation. This method allows for the observation of student behaviour in

their natural learning environment. To ensure a systematic and objective data collection, observation grids were used, defining specific indicators of behaviour and interaction. Additionally, to complement the data and provide a more detailed view of classroom dynamics, photographic records were used to document key moments during the didactic experiences.

The literature review was conducted comprehensively, covering relevant studies on the use of Problem-Based Learning in the educational context, particularly in Geography. The secondary sources included scientific articles, academic books, and educational reports discussing innovative pedagogical approaches and their impacts on the teaching and learning process.

Given the objective of understanding the effectiveness of Problem-Based Learning in geographic education, a mixed-methods approach was chosen, combining both quantitative and qualitative techniques. Quantitative data collection was based on questionnaires administered to students, directly assessing their motivation, conceptual understanding, and the development of transversal skills. Qualitative analysis was carried out through observations of the lessons, offering deeper insights into the experiences of both the pre-service teachers and students.

In addition to analysing the impact of Problem-Based Learning, this study aims to:

- understand how Problem-Based Learning influences student motivation in Geography.
- investigate the development of transversal skills, such as research, autonomy, and teamwork, during the implementation of Problem-Based Learning.
- evaluate the challenges faced by pre-service teachers in introducing Problem-Based Learning and the strategies they adopted to overcome these challenges.

It is important to highlight some limitations of the study, such as the specific nature of the school context and the limited number of participants. These limitations should be considered when generalizing the results to other educational settings.

3. PROBLEM-BASED LEARNING

Problem-Based Learning is a methodology that shifts the focus away from content memorization, emphasizing instead the truly threshold concepts that are crucial for student learning (Savin-Baden & Tombs, 2018). This approach focuses on addressing undesirable or harmful problems that need to be tackled, solved, and overcome. It involves teamwork, autonomous learning, transferable skills, and meaningful learning experiences, all within a student-centered pedagogy. Unlike traditional, teacher-centered education, in Problem-Based Learning, the teacher acts as a learning facilitator

(Cachinho, 2012; Sousa & Dourado, 2015; Lopes et al., 2019). Students construct their own knowledge based on prior learning, teamwork, and independent study (Naish, 1982; Westwood, 2008; Arends, 2012; Lopes et al., 2019).

In Problem-Based Learning, forming effective teams is critical. Ideally, teams consist of eight to ten students, with rotating roles such as coordinator and secretary to ensure that all students have opportunities to develop skills. Teams are preferably formed randomly to promote inclusiveness. The methodology follows seven key steps, commonly referred to as "The Maastricht "7" Jumps" (Wood, 2003).

The teacher's role is to encourage participation, assist in team management, prevent distractions, ensure comprehension, and assess the team's performance (Wood, 2003; Sousa & Dourado, 2015). In Problem-Based Learning, the learning process and the journey taken are more important than the problem's actual solution, fostering an inclusive and integrative approach (Camargo, 2019).

Problem-Based Learning is one of the most innovative teaching methodologies, focusing on the development of essential skills such as argumentation, communication, creativity, and critical thinking (Sousa, 2010; Cachinho, 2011; Silviariza et al., 2020). The teacher's role shifts to creating meaningful learning experiences rather than simply transmitting knowledge (Glasgow, 2019). This approach prepares students for change, encouraging genuine learning (Sousa, 2010).

Problem-Based Learning equips students with life-relevant tools, promoting both independent and collaborative work, adaptability to change, initiative, leadership, respect for ethical principles, and many other critical skills (Cachinho, 2011; Decree-Law No. 55/2018). The methodology emphasizes significant concepts and promotes transdisciplinary, requiring knowledge from various disciplines to solve problems (Klein, 2013; Decree-Law No. 55/2018; Lopes et al., 2019).

The combination of independent work and teamwork enhances learning, fostering dialogue, sharing, and discussion, engaging students in the acquisition of social, intellectual, and emotional skills. When facing real-life challenges, students are motivated to mobilize their knowledge to solve them (Klein, 2013).

Problem-Based Learning provides diverse and lasting experiences by engaging students in tasks that simulate real-world situations. It promotes not only theoretical knowledge exploration but also the development of practical skills, covering all areas of the Student Profile at the End of Compulsory Education (Martins et al., 2017). For instance, in developing an environmental sustainability project, students can apply knowledge from various subjects such as science, mathematics, and geography, while also developing problem-solving, critical thinking, and/or creative thinking skills. Another example is creating a mental health awareness campaign, where students practice

communication, empathy, and collaboration—also essential skills. These experiences become meaningful as students are encouraged to research, explore, and find solutions, allowing them to learn through experience and transform themselves (Fink, 2013).

In the context of geographic education, it is essential to highlight that Problem-Based Learning can transform students' perceptions of Geography by initiating a significant shift in didactic-pedagogical practices aligned with this teaching methodology.

Teachers play a fundamental role in this process, needing to transform their classroom roles and their interaction with students (Mérenne-Schoumaker, 1985; Glasgow, 2019). As facilitators of learning (Cachinho, 2012; Sousa & Dourado, 2015; Lopes et al., 2019), teachers must replace the transmission of large amounts of information with a focus on quality and essential content. They need to expand their disciplinary expertise to include a wide range of transversal skills. In this context, teachers need to "teach less Geography and educate more geographically" (Cachinho, 2011), promoting a foundational geographic education that is essential for the formation of informed citizens, not just geographers (Mérenne-Schoumaker, 1985).

Geographic education promotes not only basic knowledge in Geography but also fosters understanding, tolerance, friendship, respect, and peace, encouraging students to engage in solving problems in their communities, countries, and globally (UGI, 1992). It is crucial for problem-solving approaches in Geography to focus on current issues (UGI, 1992), drawing on students' practical knowledge and perceptions (Mérenne-Schoumaker, 1985), promoting the formulation of questions, and the development of skills, knowledge, and attitudes, all grounded in the experiences and contributions of each student (UGI, 2016).

Special attention must be given to eliciting prior ideas. Learning necessarily involves relating new content to the schemas that students already hold, which enhances their satisfaction and motivation (Souto-González, 1998; Pierini et al., 2019). The collection and restructuring of students' previous ideas and social representations are fundamental in generating meaningful learning, as they allow teachers to understand the students' starting points. Prior ideas, often shaped by personal experiences or social representations, influence how students interpret new knowledge. By identifying and working with these ideas, it becomes possible to correct misconceptions and build learning more effectively, linking new content to what students already know, which facilitates and promotes deeper, more lasting learning (Souto-González, 1998).

As with other subjects in the national curriculum, there is a need for a shift in Geography teachers' practices, as they are the catalysts for educational transformation. This shift may involve the use of new technologies, education for development, and

Problem-Based Learning, fostering innovative didactic-pedagogical practices (UGI, 2016), with the aim of creating meaningful learning experiences for students.

4. RESULTS

4.1. Two different school contexts

In line with students' expectations, the didactic experiences systematically focused on the use of Problem-Based Learning methodology, in two Portuguese schools located in the Lisbon Metropolitan Area (Figure.1). One of the experiences took place in a public secondary school, while the other was conducted in a private school, both involving students from the third cycle of basic education.

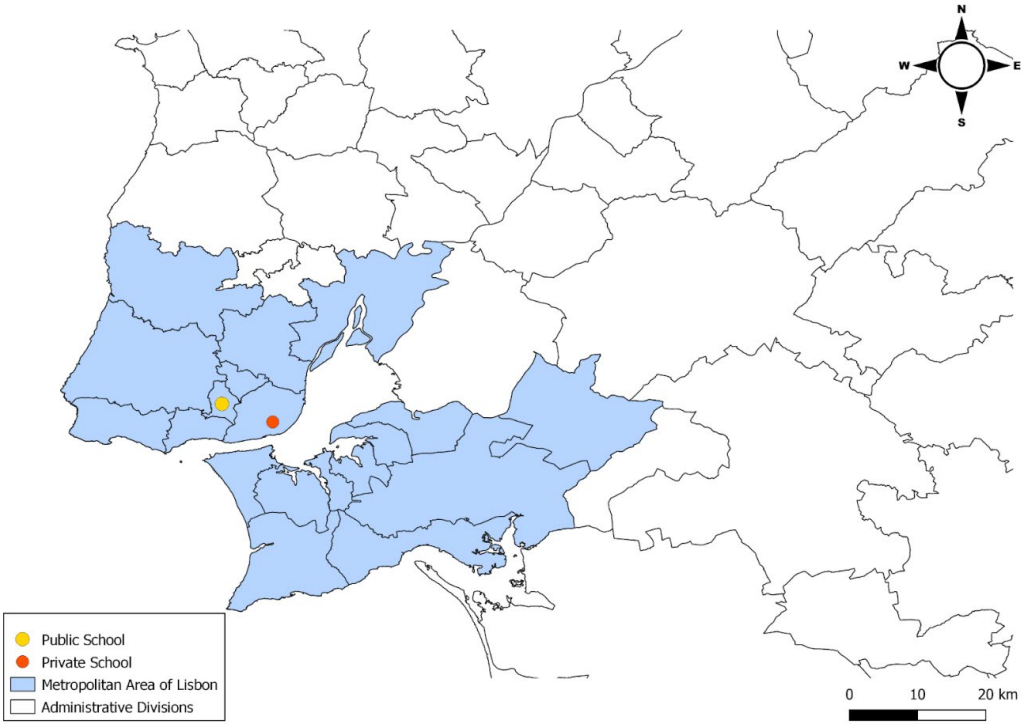

FIGURE 1. The educational institutions where the didactic experiences took place.
Source: Own elaboration.

At a public secondary school in Odivelas (managed by the state and controlled by the Ministry of Education), a didactic experiment was conducted with 11th grade students, based on the Problem-Based Learning methodology. The class, consisting of nineteen students, had a slight male majority, with boys representing 58% of the group compared

to 42% girls. This group of young students, with an average age around 16, faced the challenge of applying their theoretical knowledge to practical and urgent situations related to "Internal Dynamics of Urban Areas" (DGE, 2018b), specifically addressing contemporary "urban problems" in Portugal (DGE, 2018b).

It became clear that the class possessed several strengths that fostered a positive learning environment. Empathy and respect for differing opinions were indicators of a balanced classroom dynamic. Most students, calm and concerned about the inclusion of their peers, demonstrated positive academic performance and actively participated in the proposed activities.

However, it is also important to recognize the group's weaknesses. Some students were more restless and talkative, while others faced difficulties in interpersonal relationships. The presence of disengaged students highlighted the need to provide a meaningful and transformative experience through the Problem-Based Learning approach.

Notably, the classroom maintained a calm and productive atmosphere. The multicultural nature of the group and the students' empathy were key strengths, showing a very positive predisposition for teamwork, which is crucial for the Problem-Based Learning methodology.

On the other hand, the second experiment took place in a private school located in central Lisbon (privately managed but following the Ministry of Education's guidelines). This school stands out for promoting and valuing dynamic teaching methods, with a strong emphasis on project-based activities and problem-solving, in line with the Problem-Based Learning methodology, encouraging curricular integration and the development of multiple skills.

In this context, the experiment involved a 9th grade class in the third cycle of basic education. The content explored with the students focused on "Development Contrasts," specifically addressing subtopics such as "Developed vs. Developing Countries" and "Interdependence between Areas with Different Levels of Development" (DGE, 2018a).

The group consisted of twenty-eight students, with nine boys and nineteen girls, aged between 14 and 15. Most of the students were born in Portugal, although there were students from other nationalities and some who had lived in other countries. This diversity enriched the learning process, bringing different perspectives and discussions into the classroom.

The educational environment revealed several strengths that contributed to a positive learning context. The absence of atypical behaviours, such as phobias, tics, or obsessions, indicated a healthy classroom dynamic. Most students were calm, participative, demonstrated satisfactory academic performance, and were actively involved in the activities.

However, it is equally important to acknowledge the weaknesses in the class. Some students were more energetic and talkative, requiring differentiated attention to ensure their full engagement in the activities. Others faced interpersonal difficulties, highlighting the need to promote inclusion and stronger bonds among classmates. The presence of more reserved students underscored the diversity of personalities, emphasizing the importance of respecting and valuing different interaction styles.

4.2. Two problems … two challenges!

In both contexts, the identified problems stemmed from a detailed characterization of the classes and the systematic collection of students' prior ideas, conducted through an initial lesson held before the start of the didactic-pedagogical experience. In both the private school and the public secondary school, debates and exploratory activities were proposed, allowing students to freely express their ideas, biases, prior knowledge, and perceptions about the topics to be explored. This initial collection was essential in identifying potential gaps and guiding the planning of the didactic experiences.

Throughout the experiences, students were divided into small work teams, forming a microcosm of cooperative work aimed at developing both academic and personal skills.

In the context of the secondary school, the main objective was to develop a strategic diagnosis of the urban problems in the city of Odivelas, encouraging students to explore the city's history, current conditions, and future challenges. This process placed learning in a real and meaningful context for the students.

During this didactic experience, the students became 'experts' on urban issues, challenged to produce a strategic diagnosis of the problems in Odivelas, a city that has experienced rapid urban growth in recent years. The teacher provided a memorandum, outlining the problem scenario, designed to simulate a real-life situation in which the students were tasked with identifying the main problems faced by the city and suggesting creative and viable solutions. Through independent and teamwork, the students explored a wide range of topics, from transportation and housing to environmental quality and social inclusion. Throughout the sessions, the students actively participated in group debates, analysed data, and made presentations, culminating in the creation of a strategic diagnosis that reflected their understanding of urban dynamics and the practical application of the knowledge they had acquired.

Each team's diagnosis was intended to respond to a request from the municipality, providing an inventory of the city's current problems. This would allow the municipality to develop informed action plans to address or mitigate these issues. The diagnosis began with an introduction, followed by a presentation of the city's problems and their underlying causes. The teams then reflected on the differences between these problems

and those faced by other Portuguese cities. Finally, they presented conclusions and recommendations to the municipality.

The students offered the municipality an opportunity to update its database on the city's issues, helping to evaluate and identify problems that had been resolved and measures that had been implemented in the short, medium, and long term. This approach promoted the sustainable development of the city and improved the quality of life for its residents.

This process concluded with an oral presentation, following the guidelines of the "Canberra Academic Skills Centre's Academic Skills Program" (2011). The strategic diagnoses and oral presentations encouraged deep reflection on the identified problems, allowing the students to formulate effective strategies and solutions. The activities took place in the real context of Odivelas, where the city's development and contemporary challenges were analysed in comparison with other Portuguese cities, reinforcing the students' analytical and critical skills.

Additionally, at the end of the educational experience, the teams presented their research and proposals to a former mayor of Odivelas, highlighting the practical application of their studies and providing a unique opportunity to receive direct feedback and interact with an influential political figure knowledgeable about the issues addressed.

In the context of the private educational institution, the focus was on the "contrasts of development" in international trade and the ideals of fair trade, using chocolate production as a concrete example. Starting with a fictional letter from the Secretary-General of the United Nations, which highlighted an alarming report about cocoa plantation workers in Ivory Coast who had never tasted chocolate, the teams were immediately alerted to the fact that the ideal of fair trade was not a reality.

The students were challenged to propose ways to address or mitigate this issue, illustrating a global example of fair-trade practices and promoting the emergence of more initiatives like this around the world. The work aligned with the Sustainable Development Goals, addressing inequalities, trade, peace, justice, and the role of Non-Governmental Organizations in these scenarios.

Each team had specific requirements to clarify the problem and assist in its resolution, including collecting data on the development of Ivory Coast, identifying key export destinations, mapping those countries, interpreting the Human Development Index and other relevant indicators, and analysing global disparities through anamorphosis.

The teams conducted a brief intermediate oral presentation, clearly identifying the problem and final objectives. They also created awareness posters depicting the actions taken to address the issue, drafted a letter to the Secretary-General of the United Nations describing their work, and delivered a final oral presentation based on their poster.

4.3. And the students? Some answers…

In the case of the experience developed with the 11th grade class, three categories of response were formalized (Figure.2), resulting from a careful analysis of student feedback obtained through questionnaires administered after the implementation of the teaching experience. The process involved open coding of the responses, as described by Strauss and Corbin (1998), where recurring patterns in the opinions expressed by the students were identified. This approach allowed for the grouping of qualitative data into three main categories, reflecting the most common perceptions regarding the effectiveness of the methodology compared to more traditional teaching and learning methods.

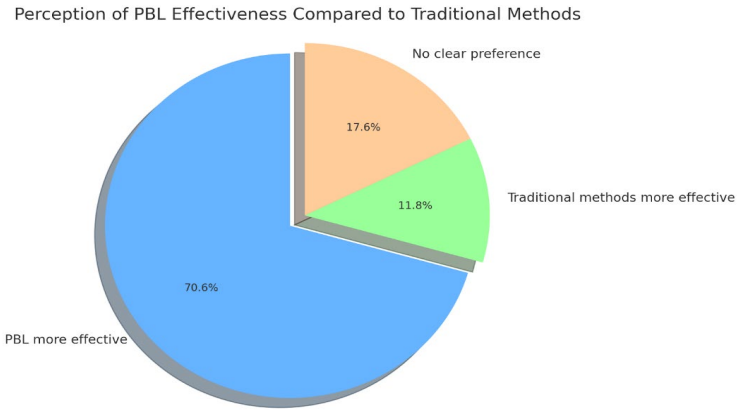

FIGURE 2. Perception of Problem-Based Learning effectiveness compared to traditional methods. Source: Data from the survey carried out with 11th grade students, 2024.

Many students expressed a clear preference for Problem-Based Learning, stating that engagement with practical problems significantly improved their understanding of the content: "I think Problem-Based Learning helped me understand the material better because I was solving a practical problem instead of just reading from the textbook".

However, it's worth mentioning that a minority of students preferred traditional methods, emphasizing the predictability and structure of more lecture-based classes: "I prefer regular classes because I can keep up with the teacher's pace".

On the other hand, some students maintained a neutral stance, suggesting that both methods were effective depending on the context. These students believed that Problem-Based Learning and traditional methods could coexist.

In the experience developed in the public school with 11th grade students, a significant portion of the students appreciated the Problem-Based Learning approach, considering

that it provided a better learning experience. Several students expressed in their comments a desire to repeat the experience. Among the feedback collected, notable opinions included: "I really liked working this way because I had the chance to explore the topic on my own and with my team"; "Problem-Based Learning helped me understand the content better since I was involved in solving a real problem, and that was more practical than just studying for tests"; "We had never worked this way before, and although it was a challenge, we managed to learn in a different way".

Most students mentioned that Problem-Based Learning was an innovative and effective methodology, as shown by the common desire to repeat the approach in other subjects. About 75% of the students displayed a very positive attitude towards Problem-Based Learning, believing it provided a better learning experience. Additionally, 60% expressed in their comments a desire to repeat the experience.

However, the limited time for activity development was pointed out as a problematic factor, as it hindered the creation of more in-depth strategic diagnoses, as acknowledged by 30% of the students: "I think we needed more time to develop our ideas and deepen our solutions, but it was still a good experience"; "The time was short, and I think that with more days, we could have presented even more complete ideas".

This constraint led the teacher to take a more direct role in keeping the teams focused, which restricted the free exploration that Problem-Based Learning ideally promotes.

During the session to gather prior ideas aimed at understanding what students knew about urban problems, a topic present in the Essential Learnings of Geography A (DGE, 2018b), it became clear that students had difficulty identifying issues related to tourism and gentrification. Additionally, they demonstrated limitations in articulating specific urban problems in Odivelas, referring to issues at scales different from the local level, indicating a limited perception of the urban problems they face daily. They also struggled to differentiate the size of cities. However, they showed awareness of living in a multicultural environment, demonstrating constant empathy for resident immigrants.

Despite these difficulties, the development of the topic was well received, with productive discussions and collaboration among students. Even as their first experience with Problem-Based Learning, evaluations were very positive. As mentioned, most students considered the methodology beneficial and showed interest in participating in similar experiences in other subjects. They praised the Problem-Based Learning approach, believing that with more time, they could have presented even more interesting and interdisciplinary results. The sessions were described as engaging, comprehensive, and innovative, sparking curiosity and promoting both independent and teamwork.

Significant improvements in students' skills, particularly regarding communication, cooperation, the application of geographical knowledge, and problem-solving, were

validated through direct observation during the sessions and the administration of questionnaires at the end of the educational experiences. The observation allowed for monitoring students' performance in team activities and their ability to practically apply the geographical content. Simultaneously, the questionnaires proved relevant, prompting the students to reflect on their progress. These tools enabled the collection of quantitative and qualitative data that, in turn, add validity to the potential of Problem-Based Learning.

At the private school located in the center of Lisbon, students not only participated actively but also demonstrated a remarkable commitment to the proposed activities. In each session, participation was marked by organization and active engagement within the teams. The students excelled in the clarity and justification of their communications, consistently using geographical language. Respect for classmates' contributions was a constant, reflecting a collaborative and respectful learning environment. These aspects were crucial within the Problem-Based Learning approach, especially in the context of geography education and citizenship training, highlighting its relevance in the holistic development of students.

The results from the summative assessment confirmed the success of this educational approach. The majority of students achieved quite satisfactory results on the Problem-Based Learning assessments (3rd test), with many performing excellently, even surpassing their usual performances (1st and 2nd tests) during more traditional classroom settings (Figure.3). As the end of the teaching experience approached, an evaluation test was conducted that not only assessed the knowledge acquired but also demonstrated the effectiveness of Problem-Based Learning in promoting autonomous learning and the practical application of the geographical concepts explored. It became clear that implementing such evaluation elements does not impede the use of these methodologies.

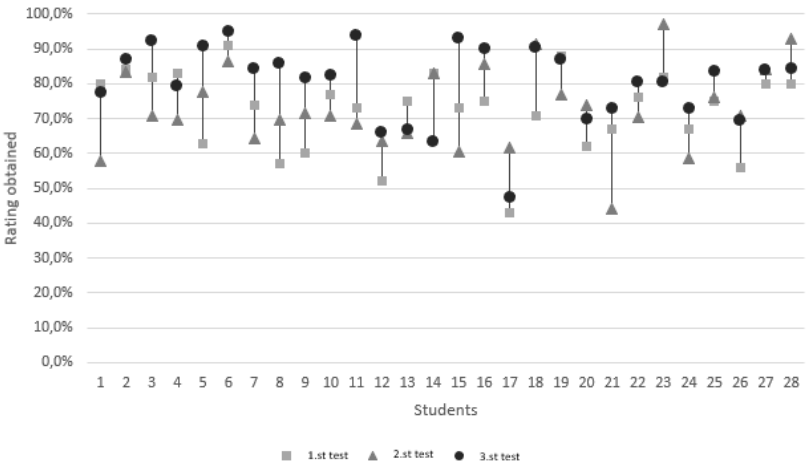

FIGURE 3. Comparison of the scores obtained in the summative assessment tests. Source: Data from the survey carried out with 9th grade students, 2024.

Students particularly valued the continuous feedback provided during the experience, as well as the fairness and transparency in assessment, along with the supportive learning environment created in the classroom. The resolution of the proposed problems was well received, facilitating discussions and collaboration among students, while promoting autonomy and responsibility in learning. Similar to the context of the public school, most students considered Problem-Based Learning to be a positive methodology and expressed interest in having similar experiences in other subjects.

Overall, the classes were described as engaging, characterized by activities that sparked curiosity and fostered both independent and teamwork. Students not only responded positively to Problem-Based Learning but also demonstrated significant growth in their communication skills, teamwork, and application of geographical knowledge. This progress was confirmed through direct observations conducted by the teacher throughout the activities, during which students' participation, interaction, clarity and justification of ideas, respect for classmates' contributions, and use of geographical language were monitored. This experience not only enriched learning but also prepared students to tackle complex challenges collaboratively and effectively.

Additionally, when asked (1) whether they would like to have more Problem-Based Learning experiences, (2) if they would like to have experiences with this teaching-learning methodology in other subjects, (3) if they found it easier to learn with Problem-Based Learning, (4) if they learned by working in teams, and (5) what they thought of the methodology, the overwhelming majority considered this teaching and learning approach to be positive (Figure.4).

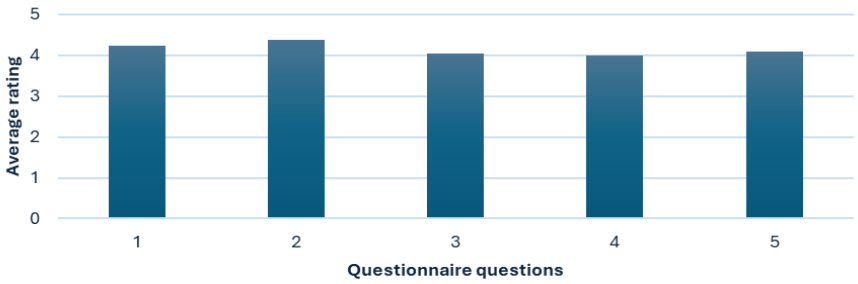

FIGURE 4. Student feedback on Problem-Based Learning. Source: Data from the survey carried out with 9th grade students, 2024.

The evaluation conducted, combined with direct observation, student surveys, and the assessment of the final products created by the teams, provides evidence and confirmation of the evolution of students' knowledge and skills throughout the Problem-Based Learning experiences.

5. DISCUSSION

To implement Problem-Based Learning, carefully structured scenarios were developed based on the profiles of the classes, school contexts, and the students' prior knowledge. Both scenarios sparked students' interest, serving as emotional triggers that encouraged curiosity and engagement—essential elements for meaningful learning.

Despite the teacher trainee's moderate expectations, the implementation exceeded these expectations significantly. The students enthusiastically embraced the experiences, even without prior exposure to the methodology. The practical and collaborative approach facilitated the transition to this new teaching model, fostering responsibility and motivation. The students showed adaptability and demonstrated great interest in problem-solving, highlighting the true effectiveness of Problem-Based Learning.

The experiences also allowed students to develop essential skills in leadership, teamwork, empathy, and critical thinking, which are crucial for personal and professional success. This process was fundamental in developing intervention skills, empowering them to directly address the analysed problems.

Students' evaluations of the experiences were extremely positive. They emphasized how much they learned and engaged with the topics, valuing the relevance and applicability of the knowledge acquired. The opportunity to work in teams, conduct independent research, and present results creatively was highly appreciated, resulting in a strong sense of achievement and satisfaction. Current results confirm this transition, showing that, while students need time to adapt, Problem-Based Learning provides a richer and more engaging learning experience. These results were obtained through satisfaction surveys and self-assessments administered to students, as well as through direct observation by the teacher throughout the experience. Table.1 presents a summary of students' perceptions of the Problem-Based Learning methodology compared to traditional methods.

Category	Percentage of Student (%)
PBL provides a richer learning experience	75
PBL is more engaging than traditional methods	70
PBL improved my collaboration skills	80
I needed time to adapt to PBL	50
I would like to repeat the PBL experience	80

TABLE 1. Students' perceptions of Problem-Based Learning. Source: Data from the survey carried out with 11th grade students, 2024.

The data presented demonstrate that 75% of students believe that Problem-Based Learning offers a richer learning experience, while 70% consider it a more engaging approach. Additionally, 80% of students felt an improvement in their teamwork skills, although 50% mentioned that they needed time to adapt to this new methodology. Finally, 80% of students expressed a desire to repeat the experience, including the implementation of this teaching and learning methodology in other subjects.

Comparative studies reveal that while traditional methodologies focus on the transmission of knowledge by the teacher, Problem-Based Learning places students at the center of the process, promoting autonomy and collaboration. This paradigm shift is essential for developing critical skills in the 21st century. The similarities between current results and previous studies reinforce the effectiveness of Problem-Based Learning, while the differences highlight advancements in the use of digital tools and students' adaptation to new methodologies.

The results of this research pave the way for various future perspectives. The acceptance and effectiveness of Problem-Based Learning in geographic education suggest that this methodology can be successfully applied in other subjects. Future experiences could explore the adaptation of Problem-Based Learning in diverse contexts, promoting interdisciplinary learning. Moreover, the effective use of digital tools should be expanded. Investing in educational technology and training teachers to utilize these tools can further enhance the outcomes of Problem-Based Learning. Personalizing learning experiences by identifying and addressing the individual needs of students can maximize the benefits of Problem-Based Learning.

Additionally, it should be noted that both implementations of Problem-Based Learning demonstrated that when students are placed at the center of the educational process and confronted with real problems, there is not only an improvement in knowledge retention but also a significant development of social, ethical, and analytical skills. These experiences reinforce the idea that education should be more than a mere means of knowledge transmission; it should also be a preparation for life, empowering students to transform their communities and, by extension, the world.

6. CONCLUSIONS

This study successfully achieved its initial objectives and confirmed its hypotheses, highlighting the importance of Problem-Based Learning as a vital theme in geographical education. The implementation of Problem-Based Learning in two distinct Portuguese schools demonstrated its effectiveness, resulting in increased student motivation and a deeper understanding of geographical concepts. Moreover, students exhibited substantial growth in essential transversal skills such as research, autonomy, and teamwork.

Throughout the process, the pre-service teachers faced various obstacles while implementing Problem-Based Learning, including initial resistance to methodological change, curricular adaptation, and classroom time management. Overcoming these challenges required resilience, innovation, and a continuous commitment to transforming the educational process. The ability to adapt to these obstacles was crucial in creating a dynamic and active teaching and learning environment that fosters more meaningful learning experiences.

The most notable results of this investigation underline the effectiveness of Problem-Based Learning as a pedagogical approach, particularly in the context of geographical education. The ability of pre-service teachers to overcome obstacles and implement dynamic and active methodologies was fundamental in promoting a genuine transformation in the educational process. Resilience, in this context, refers to the pre-service teachers' capacity to adapt and persevere in the face of the challenges they encountered during the implementation of Problem-Based Learning. As Gu and Day (2007) suggest, resilience is essential for teachers, enabling them to confront adversities and maintain the effectiveness of their teaching practices. Overcoming barriers such as resistance to change and time management required a flexible and adaptable attitude-central characteristics of resilience in the educational context. Furthermore, pedagogical innovation played a crucial role in allowing the creation of dynamic, student-centered learning environments. Fullan (2013) emphasizes that innovation is a driving force for educational transformation, introducing new practices that break from traditional methods and promoting more meaningful learning experiences. The use of Problem-Based Learning exemplifies this innovation by engaging students in more interactive and collaborative activities, preparing them more effectively to face the challenges of the 21st century.

For future research, it is recommended to disseminate the results of this study in various educational contexts and levels to enhance the understanding of the applicability and effectiveness of Problem-Based Learning in diverse educational settings. Additionally, exploring the long-term impact of Problem-Based Learning on students' skill development and their academic, professional, and personal trajectories would provide valuable insights into the sustained benefits of this methodology.

From a political-educational standpoint, it is crucial for initial and continuous teacher training systems to incorporate methodologies like Problem-Based Learning more systematically and structured. It is recommended to create training programs that address the practical challenges faced by educators when implementing active methodologies. Introducing specific Problem-Based Learning modules in pre-service teacher training, creating collaborative learning networks between schools and universities, providing resources and teaching materials that facilitate the application

of the methodology in everyday school life, and encouraging pilot experiences in different subjects are measures that could promote greater integration of Problem-Based Learning into educational practice.

In summary, this study validates the effectiveness of Problem-Based Learning, emphasizing the importance of resilience and innovation in the contemporary educational context, with particular emphasis on geographical education. The experiences of the pre-service teachers illustrate the relevance of active methodologies in creating more meaningful teaching practices that effectively prepare students for future challenges. Ongoing research in this area is essential to refine and adapt pedagogical practices to the emerging needs of the 21st century, ensuring that education remains relevant, impactful, and responsive to the evolving landscape of global challenges.

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