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# PROBLEM-BASED LEARNING IN UNDERGRADUATE MEDICAL EDUCATION

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**ABSTRACT**

*Problem-Based Learning (PBL) has transformed undergraduate medical education, moving away from traditional methods towards student-centered approaches that foster critical skills such as clinical reasoning and teamwork. This study aims to analyze the use of PBL in medical training, emphasizing its relevance in a constantly changing educational environment. A literature review was conducted from 2020 to 2025 in academic databases, selecting articles that addressed the implementation and benefits of PBL. The results revealed that, although cognitive performance between students using PBL and traditional methods may be comparable, those participating in PBL report greater satisfaction and engagement with their learning. Furthermore, PBL promotes metacognitive skills and self-regulation, which are essential for tackling complex clinical situations. However, its implementation faces significant challenges, such as a lack of resources and insufficient training for tutors, especially in developing country contexts. Group interaction, crucial for PBL, can be affected by group dynamics and tutors' perceptions, highlighting the need for adequate training. Innovations such as the use of virtual patients and flipped classrooms have proven to enrich the learning experience, increasing the authenticity and applicability of knowledge. In conclusion, PBL is a valuable tool for preparing future physicians, despite the challenges it faces, and its integration into medical education is essential for developing adaptable and competent professionals in the face of 21st-century challenges.*

**PALABRAS CLAVES**: *Problem-Based Learning (PBL), Medical Education, Clinical Reasoning, Metacognitive Skills, Self-Regulation.*

## INTRODUCTION

In undergraduate medical education, teaching methods have significantly evolved over the past decades, shifting from traditional lecture-based approaches to active, student-centered methods. Among these, the use of clinical cases and problem-based learning (PBL) stands out for its ability to develop critical skills such as clinical reasoning, problem-solving, and teamwork (1).

PBL is a methodology that emphasizes the application of knowledge through the resolution of real or simulated problems, fostering the acquisition of practical skills and meaningful learning by moving away from rote memorization to focus on the integration of knowledge into clinical situations (2). This approach is particularly relevant in a field like medicine, where the ability to apply theoretical knowledge in practical contexts is essential.

It is based on the premise that learning is more effective when students face real or simulated problems that require the application of prior knowledge and the acquisition of new knowledge in an autonomous and collaborative manner. This approach not only promotes the retention of information but also prepares students to address the complex and multifaceted challenges they will encounter in their professional practice (3). However, the implementation of PBL is not without challenges, including the need for adequate resources, tutor training, and adaptation to different educational contexts (4).

One of the main benefits of PBL is its ability to foster generic competencies such as teamwork, communication, and critical thinking. Navarro et al. highlighted that multiprofessional PBL in a health research module promoted skills such as interdisciplinary work and critical capacity among students from various health disciplines (5). Furthermore, the use of multimedia tools, such as radiological images and interactive videos, has been shown to improve students' understanding and critical thinking during PBL sessions (6).

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Currently, medical education faces challenges such as the rapid evolution of knowledge and the need to train adaptable professionals, making PBL a valuable tool for promoting meaningful learning and the development of key competencies. Against this background, the objective of this research is to analyze the use of Problem-Based Learning in undergraduate medical education, providing a comprehensive view of how PBL can contribute to preparing future doctors for the challenges of the 21st century, highlighting its relevance in an ever-changing educational and clinical environment.

## METHODOLOGY

This bibliographic review was conducted with a systematic approach to ensure comprehensiveness and rigor in the selection and analysis of studies through an exhaustive search in academic databases such as PubMed, Scopus, Web of Science, and SciELO, using combinations of keywords such as "problem-based learning," "medical education," and "undergraduate." Inclusion criteria covered articles published between 2015 and 2025 in English and Spanish that addressed the implementation, benefits, limitations, and perspectives of problem-based learning in undergraduate medical education. Duplicate studies, non-peer-reviewed articles, and those not specifically focused on the context of medical education were excluded. Article selection was carried out in three stages: title review, abstract analysis, and full-text reading. Data extracted from the selected studies were organized into thematic categories, allowing for qualitative and comparative analysis to identify trends, gaps, and key findings in the use of problem-based learning in medical training.

## RESULTS

A study conducted in Chile compared PBL with traditional teaching methods in a physics course for medical students. The results showed that, although cognitive performance was similar between both groups, students participating in PBL reported greater satisfaction with the teaching methodology (7). This suggests that PBL is not only effective in terms of learning but also enhances students' perception of the educational process.

Another key benefit is PBL's ability to engage students in their own learning process. According to Stentoft, project-based PBL allows students to direct their own learning, increasing motivation and engagement with the content (8). This approach also fosters the development of metacognitive competencies, such as self-regulation and collaboration in environments without facilitators.

Studies like Azer's have pointed out that the quality of this interaction can be influenced by factors such as group dynamics, students' perceptions, and tutors' experience (4). On the other hand, the use of technological tools, such as videos and virtual patients, has been proposed as a way to enrich the learning experience and increase its relevance and authenticity (9). These innovations not only improve students' understanding but also prepare them to effectively face complex clinical situations.

Despite its benefits, PBL faces several challenges, especially in resource-limited contexts. Solano et al. identified barriers such as lack of resources, insufficient faculty training, and resistance to change in institutions in developing countries (10). Additionally, group interaction, a central component of PBL, can be affected by factors such as group dynamics and tutors' perceptions, which can influence learning effectiveness (4).

Another significant challenge is the variability in the quality of feedback provided during PBL sessions. Pangastuti et al. developed a constructive feedback model for PBL tutorials, highlighting the need for synchronized guidelines and sufficient time for tutors to adapt to the model (11). This underscores the importance of training facilitators to maximize PBL's impact.

PBL has evolved to include new tools and approaches, such as flipped classrooms and virtual patients. De Jong et al. demonstrated that flipped classroom formats in a European public health course improved student-teacher interaction as well as the application of acquired knowledge (12). On the other hand, Noverati et al. highlighted that the use of virtual patients and videos in PBL increases the authenticity and memorability of cases, better preparing students for future clinical interactions (10). Moreover, PBL has been successfully integrated into specific disciplines such as bioethics and radiology. Bosch-Barrera et al. described how PBL enabled medical students to develop skills for managing ethical conflicts in clinical practice (13). In radiology, Terrón Lozano et al. demonstrated that PBL helped students acquire radiological diagnostic skills and critical reasoning (14).

## CONCLUSION

Problem-based learning is a transformative educational methodology that has proven effective in training medical students. Although it faces challenges in its implementation, its benefits in terms of meaningful learning, critical competency development, and student satisfaction are undeniable. As medical education continues to evolve, PBL will remain a crucial tool in preparing future healthcare professionals for real-world challenges.

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