Seminars in Medical Writing and Education. 2024; 3:57
doi: 10.56294/mw202457

REVIEW

Problem-Based Learning (PBL): review of the topic in the context of health education

Aprendizaje Basado en Problemas (ABP): revisión del tema en contexto de la educación en salud

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Cite as: Gonzalez-Argote J, Castillo-González W. Problem-Based Learning (PBL), review of the topic in the context of health education. Seminars in Medical Writing and Education. 2024; 3:57. https://doi.org/10.56294/mw202457

Submitted: 15-08-2023 **Revised:** 31-10-2023 **Accepted:** 24-01-2024 **Published:** 25-01-2024

Editor: Dr. José Alejandro Rodríguez-Pérez
Translated by: Cristhian Alejandro Pérez Pacheco

ABSTRACT

Introduction: active methodologies promote learning through the resolution of real situations, promoting the construction of knowledge and skills. This turns the student into an active participant, strengthening their critical thinking skills. A bibliographic review was carried out with the objective of reviewing the problem-based learning method and its benefits in the context of medical education.
Methods: a bibliographic review was carried out between December 2023 and January 2024 in the main databases and other search services. The terms "problem-based learning", "health education", "medical education" were used as search descriptors.
Results: in medical education, the problem-based learning approach focuses on students addressing real clinical situations to develop diagnostic and therapeutic skills. This model seeks to ensure that, from the beginning of their training, future health professionals are involved in medical practice, instead of only acquiring theoretical knowledge. The development of critical thinking is essential to face real-world clinical situations, so learning must be student-centered and meaningful, involving problems that reflect real contexts of professional practice.
Conclusions: problem-based learning is one more strategy in the wide range of possibilities for teaching and developing medical education, and it has advantages and disadvantages like any other strategy.

Keywords: Problem-Based Learning; Health Education; Medical Education.

RESUMEN

Introducción: las metodologías activas promueven el aprendizaje a través de la resolución de situaciones reales, fomentando la construcción de conocimientos y habilidades. Esto convierte al estudiante en un participante activo, fortaleciendo sus habilidades de pensamiento crítico. Se realizó una revisión bibliográfica con el objetivo de repasar el método de aprendizaje basado en problemas y sus provechos en el contexto de la educación médica.
Métodos: se realizó una revisión bibliográfica entre diciembre de 2023 a enero de 2024 en las principales bases de datos y otros servicios de busqueda. Se emplearon los términos "aprendizaje basado en problemas", "educación en salud", "educación médica" como descriptores de busqueda.
Resultados: en la educación médica, el enfoque de aprendizaje basado en problemas se enfoca en que los estudiantes aborden situaciones clínicas reales para desarrollar habilidades diagnósticas y terapéuticas. Este modelo busca que desde el inicio de su formación, los futuros profesionales de la salud se involucren en el ejercicio médico, en lugar de solo adquirir conocimientos teóricos. El desarrollo del pensamiento crítico es esencial para enfrentar situaciones clínicas del mundo real, por lo que el aprendizaje debe ser centrado en el

estudiante y significativo, involucrando problemas que reflejen contextos reales de la práctica profesional. **Conclusiones:** el aprendizaje basado en problemas es una estrategia más en el gran abanico de posibilidades para la enseñanza y desarrollo de la educación médica, y tiene ventajas y desventajas como cualquier otra estrategia.

Palabras clave: Aprendizaje Basado en Problemas; Educación en Salud; Educación Médica.

INTRODUCTION

The rapid and constant advancement of science and technology since the mid-twentieth century necessities competent, creative, autonomous, and ethically sound individuals, capable of using new knowledge and technological innovations for the betterment of social progress.[1,2,3] Simultaneously, the swift pace of scientific and technological development leads to rapid knowledge obsolescence, underscoring the importance of individuals who can effectively manage their own learning.[4]

Subsequently, it is the responsibility of educational systems to equip individuals with the sufficient skills, enabling them to autonomously acquire the necessary knowledge for making timely decisions and selecting pertinent alternatives that facilitate the effective resolution of personal, professional, and social problems.[5,6,7]

Active methodologies facilitate the development of the teaching-learning process through activities and procedures based on the trainee's engagement in situations demanding the construction of knowledge and the development of skills, allowing learners to implement strategies and make decisions; in this way, they become active participants in the learning process, contributing to the development of thinking skills.[8,9]

Problem-Based Learning (PBL) is grounded in the resolution of problematic situations through which students significantly develop their cognitive structures, promote cooperative work, acquire skills for autonomous learning, and cultivate values such as responsibility, cooperation, and a commitment to truth.[10]

PBL emerged in the field of medical education in the 1960s.[4,11,12] It originated as an educational project by John Evans, involving the formation of student groups tasked with analyzing presented problems and guiding their own learning, thus diminishing importance to the memorization of concepts from the beginning of the degree.[13] Postman and Weingamer introduced a novel teaching method in their classes, focusing on active student participation and revolving around the formulation of open questions and problems that instigated students to solve them through a creative process.[14,15]

This methodology was first implemented at McMaster University in Canada and Case Western Reserve University in the United States.[4,12]

Since 1996, PBL has gained popularity, expanding its use worldwide; it has served as the foundation for other methods such as project-based learning; likewise, its application has extended to other university degrees.[4,11] Many of the world's most prestigious universities have incorporated PBL into their programs; numerous health and education ministries, along with associations of medical faculties, recommend PBL as a pedagogical strategy for transforming undergraduate and postgraduate higher education in their respective countries.[16]

Currently, PBL has transcended university education to become one of the most significant active learning methods, utilized in general basic education.[4,16]

A bibliographic review was conducted with the objective of reviewing the problem-based learning method and its benefits in the context of medical education.

METHODOLOGY

A search for information was conducted for the period from December 2023 to January 2024, utilizing the Redalyc, Elsevier Science Direct, PubMed/Medline, and SciELO databases, as well as ClinicalKeys services and the Google Scholar search engine. Advanced search strategies were employed to gather information, involving the structuring of search formulas with terms such as "problem-based learning", "health education", "medical education", as well as their equivalents in Spanish. From the resulting documents, those offering theoretical and empirical information about the study topic were selected, in either Spanish or English language.

DEVELOPMENT

PBL is considered a part of active methodologies as it focuses on student activity, where students construct their own learning through interaction with the environment in which they are situated. This method is based on the premise that individuals learn through experiences gained in their relationship with the world; problems arising from this relationship serve as incentives for seeking information, enabling the formulation and analysis of possible solution alternatives, drawing conclusions, and corroborating hypotheses, thereby generating new knowledge.[4,11,12]

https://doi.org/10.56294/mw202457

Using PBL as a didactic strategy enables students to integrate conceptual, procedural, attitudinal, and ethical knowledge, while engaging in cooperative and collaborative learning. This approach compels students to develop critical thinking skills.[13]

Problem solving serves as the driving force of learning, mobilizing the cognitive structures of students to comprehend knowledge acquired during the process of seeking new understanding. Through this, learners can substantiate decision-making and make logical judgments, thereby demonstrating that their reasoning is valid for solving the problem and achieving the learning objectives.[4,11]

It is centered around problem-solving in small groups utilizing knowledge as a tool, where learning is self-directed, and the teacher assumes a more passive and moderated role. [17] The use of well-selected daily problems serves as a guide for learning concepts, honing skills in information management, analyzing data and information, generating hypotheses, and fostering critical thinking. Moreover, it promotes meaningful learning for the student.[4,16]

PBL exerts a positive impact on student learning as it fosters the development of clinical competencies, academic engagement, self-directed, meaningful, and active learning, as well as academic performance, motivation, and participation, providing satisfaction and well-being to the student. Additionally, PBL stimulates critical thinking, facilitates student-student interaction, and diminishes the prevalence of burnout and stress. Ultimately, it develops metacognition.[11,18,19]

This strategy aims to cultivate a greater sense of responsibility for their learning processes among students, by reversing the traditional instructional sequence. So, instead of presenting theoretical content first and then applying it, students are introduced to a problem relevant to their context that they must solve, expecting that this problem will stimulate learning, through the use of inquiry as the primary didactic tool.[4,12,16,20,21]

While this technique may not result in statistically different academic performances compared to traditional teaching, it does enable students to perceive greater capacities for analysis, critical thinking, autonomy, and empowers them more in their own learning process.[12,16]

In PBL, within the problem scenario, the individual encounters not only the challenge of solving it but also the question of "how is it solved?". Consequently, the student undergoes the development of metacognitive processes and self-reflection; initially, this unfolds as an unconscious skill, and as the experience progresses, it transforms into a series of conscious, voluntary, and controlled strategies. While the problem scenario acts as an incentive, in PBL, it is not crucial whether the student solves it or not; the emphasis lies in the process and the neurocognitive functions and skills the student employs to fulfill their learning needs, search strategies, selection criteria, and critical analysis of information.[16,19,20]

The structure and problem-solving process are always open, encouraging a conscious understanding and fostering systematic group work in a collaborative learning experience.[11,21]

Several authors have summarized the competencies developed through PBL:[11]

- Relevant problem-solving in the professional area.
- Decision-making.
- Teamwork.
- Communication skills (argumentation and presentation of information).
- Development of attitudes and values: precision, revision, tolerance, etc.
- Planning of learning strategies.
- Critical thinking.
- Systematic learning.
- Self-learning, self-regulation, and self-evaluation.
- Creativity.

Simultaneously, some basic principles have been established to take into consideration when implementing PBL:[11]

1. The student is responsible for their learning.
2. Problems must respond to the reality of the student and generally are related to the future professional life.
3. Problems must have multiple solutions and enhance investigative skills.
4. Learning is integrated and interdisciplinary; it must respond to different topics and contexts.
5. Cooperation among peers is essential.
6. At the end of the problem-solving process, reflective analysis is necessary regarding the obtained results, utilized solution paths, lessons learned, and concepts and principles related to the problem.
7. Individual and collective evaluation focus on the progress towards the achievement of the proposed objectives.
8. Self-evaluation is a relevant element that serves as feedback to the student about the work deployed in solving the problem.[11]

In the field of medical education, the problem-based learning approach centers on students addressing and

solving clinical situations akin to those they will encounter in their future professional practice. The objective is for them to acquire skills for diagnosis, treatment selection, and analysis of the relationship between theoretical foundations and clinical practice. The creators of this model aimed to involve medical students in practical medical scenarios from the onset of their training, rather than confining them to acquiring theoretical knowledge during the initial years with the promise of its later application in their professional careers.[20,22]

In the training of future healthcare professionals, the development of competencies such as critical thinking is crucial, this is necessary for addressing clinical situations that extend beyond the confines of the classroom. This implies that learning must be student-centered and, simultaneously, meaningful, involving problem-solving situations that correspond to real-world contexts they will encounter in their subsequent professional practice.[20]

The duration of rotations in clinical and surgical specialties is limited to weeks, necessitating the adoption of more efficient didactic strategies than traditional lectures, case or clinical history reviews, educational-assistance rounds, and slide seminars commonly used in these subjects.[23]

Problem-Based Learning (PBL) has consistently shown a greater impact on the acquisition of skills and knowledge for the professional practice of physicians compared to other teaching strategies.[23]

There are experiences in the field of PBL implementation in medical education worldwide.[23] Studies, such as the one conducted by Ortega et al.[24] demonstrate that PBL is a strategy that facilitates the integration of theory and practice, developing the learning of new knowledge through the utilization of prior knowledge; it encourages research and contributes to professional experience.

In collaborative learning, the first thing learned is recognizing others as a source of learning. Group members need to integrate certain principles into their functioning, including; adopting a shared work methodology, participating in group decision-making, sharing equal responsibility for the outcomes, and understanding that beyond common learning objectives, the overarching goal of the group is personal development.[16]

The method

In the implementation of Problem-Based Learning (PBL), three key actors always participate: the problem, the tutor, and the student. The problem assumes a pivotal role as the central axis of discussion and student learning, serving as a guide for the tutor in directing students towards its resolution. The tutor, in turn, utilizes the Socratic method to guide student discussions and ensure the fulfillment of established objectives. Ultimately, the student is positioned at the core of the strategy, making decisions about the topics to be addressed, their depth, and applying that knowledge in the resolution of the problem.[20,22]

These actors also interact in other didactic strategies employed in medical education, such as case-based learning or project-based learning; however, what distinguishes PBL from these strategies is the manner in which the actors interact.[22]

Once the problems are identified, students are asked to formulate hypotheses or diagnostic impressions that respond to the posed questions; the tutor must guide the discussion to generate at least one hypothesis for each of the identified problems. Finally, students are required to propose study objectives that enable them to verify or discard the proposed hypotheses.[22]

Through this method, students can cultivate diagnostic and communication skills, enhance their ability to navigate uncertainty, gain a deeper understanding of the ethical and emotional aspects encountered by healthcare professionals, and develop teamwork, information retrieval, and comprehension skills related to evidence-based medicine. Additionally, they can hone their ability to integrate different disciplines related to medical practice.[22]

PBL is not confined to problem-solving, it is an intentional, organized, planned, and systematic process.[4] In practice, it has to function simultaneously as a learning method, a curriculum composed of cases, and a tutoring system. Therefore, there is a broad universe around its application, development and implementation, and for working effectively in teaching performance.[25]

Successful experiences reported have utilized PBL as a curriculum organizer, not merely implemented in isolated courses. In PBL, the design of problem scenarios, integrating disciplines vertically and horizontally in the curriculum, facilitates that learning incentives achieve the strengthening of neural networks. These networks remain stable over time and are quickly accessible when engaging in professional practice.[16]

The tutor

In PBL, the tutor assumes a pivotal role, serving as a facilitator, by creating an environment conducive to collaborative and cooperative learning with a primary focus on the student's learning process.[16,26]

The tutor embodies a combination of a learning facilitator and a content expert, skillfully applying their knowledge within the tutoring context. Group dynamics are facilitated when students possess knowledge and prior experience with the PBL strategy. Otherwise, it becomes necessary to conduct an initial introduction for all students in the course, especially for first-year students, and it is advisable to assign groups to more

https://doi.org/10.56294/mw202457

experienced tutors.[16,24,26]

The tutor must abstain from merely transmitting information and instead, play a highly active role in guiding the process and acting as a mediator of learning. They should ensure the participation of all students, foster discussions, and enrich the case under study with their knowledge and previous experiences, primarily gained during clinical subjects.[24,26]

The experience and knowledge of the educator as a facilitator of learning are fundamental for effective learning outcomes. Therefore, training programs targeted at teachers to enhance their skills and infrastructure to provide guidance in the implementation of this strategy are essential.[19]

The problem

The problem case serves as a pivotal and triggering factor in PBL because if there is no problem, there is no learning. [25] While this strategy can be applied across various professional domains, it is in the health field, and especially with clinical cases, where greater benefit can be obtained, on the basis of the development of higher-level cognitive processes, fostering critical and creative thinking, teamwork, decision-making. Additionally, it promotes a predisposition to innovation and a reflective attitude. Solving a presented problem, such as a clinical case, is also a method for analyzing and reaching an accurate diagnosis; compelling individuals to engage in reasoned thinking of the problem.[24]

Writing, designing, or structuring these didactic elements is not a simple task; it is the result of several factors including: the teaching staff's writing skills, disciplinary knowledge, experience with the method, etc. It will always require pedagogical mediation that imbues it with a formative intention to project the achievement of professional competences.[25]

Evaluation in PBL

Utilizing PBL implies assuming responsibility for improving evaluation methods. The use of traditional exams, when students have been immersed in an active learning experience, can lead to confusion and frustration. Evaluation is expected to address content learning outcomes; the knowledge that students contribute to the group reasoning process, and in accordance with their personal interactions with other group members.[21]

Tutors should explore diverse assessment options that also function as additional tools in the students' learning process. Students should have the opportunity for self-assessment, peer assessment, evaluation of the tutor, and appraisal of the group's work process along with its outcomes.[21]

Advantages and disadvantages

In terms of advantages, through this method, students can develop diagnostic and communication skills, greater ability to navigate uncertainty, better understanding of the ethical and emotional aspects confronted by healthcare professionals, and skills for teamwork, information seeking, comprehension of evidence-based medicine, and for the integration of different disciplines related to medical practice. In addition to the above and taking into account that PBL is now incorporated within constructivism, where the student is the protagonist of the teaching-learning process, Sola suggests that it allows students to develop action capabilities rather than merely accumulating knowledge. This fosters students to think and act based on the knowledge they have already acquired.[22]

Even with all the evidence in its favor, PBL is not exempt from having disadvantages, like any other teaching tool. It is necessary to emphasize that its implementation is not free from obstacles, where teachers and students coexist in an educational culture based on curricula and methods that prioritize the transmission of knowledge rather the acquisition of competencies.[19,22]

PBL is a costly teaching method that demands competent teachers capable of leading small groups of 8 to 10 students; which increases the number of required faculty.[17]

In Latin America, there is considerable variability in the quality and organizational structure of medical schools. These schools can be affected by the size and budget of each university, as well as the level of investment by each country in higher education. Given this scenario, ensuring a uniform standard of quality for the PBL approach across all universities becomes a complex challenge.[17]

The PBL approach has a well-defined structure and necessitates the adaptation of university curricula to ensure methodological rigor, requiring more time for class preparation and implementation. Adherence to traditional teaching methods and apprehension about departing from the Flexner model can impede the widespread adoption of PBL.[17,22]

Occasionally, students may exhibit a less constructive attitude towards their own learning. PBL necessitates that students modify their preparation methods and adopt new approaches to studying, which can be challenging in the absence of well-developed skills and appropriate study methods.[17]

Additionally, the implementation of the strategy requires: tutor training, the creation of quality materials, and creative development of the teaching and evaluation process, etc.[22]

Furthermore, there is currently a questioning about the role of PBL in the acquisition of theoretical

knowledge, as some literature suggests that through the use of this strategy, there is no improvement in this area, or even that less theoretical knowledge is acquired compared to the use of traditional strategies.[22]

CONCLUSIONS

Problem-Based Learning is one strategy among the diverse array of possibilities for teaching and developing medical education, and it has both advantages and disadvantages like any other strategy. PBL is not a universal solution to all the challenges posed by health education currently, but when used appropriately in conjunction with other teaching strategies, it can complement efforts to address the sector's challenges.

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FINANCING

No financing.

CONFLICT OF INTEREST

There are no conflicts of interest.

AUTHORSHIP CONTRIBUTION

Conceptualization: Javier González Argote.
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