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THE ROLE OF PROBLEM-BASED LEARNING IN DEVELOPING CRITICAL THINKING SKILLS IN MEDICAL EDUCATION

This article explores the role of Problem-Based Learning (PBL) in developing critical thinking skills in medical education. The study applies a systematic analysis of theoretical literature and empirical research, including systematic reviews and meta-analyses. Results indicate that PBL enhances student engagement, communication, teamwork, problem-solving, and self-directed learning. Its effectiveness increases when combined with Case-Based Learning (CBL) but depends on student level, facilitator expertise, and institutional support. Practical value lies in identifying key conditions for successful implementation, such as structured small-group learning and authentic clinical scenarios. The need for improved assessment tools is emphasized. The study concludes that PBL aligns with competency-based education goals. Future research should focus on optimizing evaluation methods and integrating interdisciplinary approaches.

Keywords: *Problem-Based Learning (PBL), critical thinking, medical education, clinical reasoning, self-directed learning, active learning, curriculum development, facilitator training, small-group learning, student engagement.*

Introduction. Medical education is changing rapidly to meet the needs of current healthcare systems. For many years, medical schools relied mainly on traditional lecture-based teaching, where students were expected to memorize large amounts of information. While this method helped students learn basic facts, it often did not support the development of deeper thinking or prepare students well for real-life clinical situations. As a result, many educators are now turning to more active and student-centered teaching approaches. PBL is based on the idea that students learn best when they actively build knowledge through experience and reflection. It also supports important skills like communication, teamwork, and decision-making, which are essential for medical professionals. Unlike traditional methods that often focus on memorization, PBL encourages students to ask questions, think critically, and connect their learning to real clinical practice. Many studies have shown that PBL can improve how well students understand and remember information. It also helps them develop skills like critical thinking and clinical reasoning, which are crucial in medical settings. Because of these advantages,

PBL has been adopted by many medical schools around the world – either as the main teaching method or as part of a mixed approach that includes lectures and other activities.

In this article, the focus is on how PBL functions within medical education, its effectiveness, and its role in preparing students for clinical practice. The discussion also addresses common challenges associated with PBL and explores potential strategies for enhancing its application or integrating it with other instructional methods.

Analysis of relevant research. Problem-Based Learning (PBL) as an educational approach began in the mid-1960s, and its formal development is most often credited to McMaster University Medical School in Hamilton, Ontario, Canada. PBL was first implemented at McMaster University by Dr. Howard S. Barrows, a neurologist and medical educator. He was influenced by dissatisfaction with traditional medical education methods, which were seen as overly focused on memorization and not effective in preparing students for real-life clinical reasoning. The first full PBL curriculum was launched at McMaster in 1969, making it the birthplace of modern PBL as a structured, curriculum-wide educational model (Burrows, 1980). Since then, PBL has evolved and spread across disciplines and educational levels worldwide, particularly in medical, dental, nursing, and health sciences education, and later into engineering, law, business, and the social sciences.

The study by Jiang et al. emphasizes several key points on Problem-Based Learning: *Empirical evidence of effectiveness:* robust, recent empirical support for the positive impact of PBL on developing clinical thinking skills, particularly when integrated with Case-Based Learning (CBL). This can reinforce arguments that PBL contributes to higher-order cognitive development in medical education; *Improved critical and evidence-based thinking:* trainees exposed to the integrated CBL-PBL approach demonstrated significant improvements in critical thinking, systematic reasoning, and evidence-based decision-making. These are core competencies that PBL aims to cultivate, and referencing this can strengthen claims about PBL's relevance in preparing students for real-world clinical practice; *Relevance for curriculum design:* modern medical curricula should incorporate PBL (either alone or integrated with CBL) to align with current educational goals focused on producing reflective, independent, and analytically skilled practitioners (Jiang, 2025). Thus, integrating Problem-Based Learning with Case-Based Learning significantly

enhances clinical thinking skills in medical trainees, offering strong evidence for incorporating such methods into contemporary medical curricula.

Researchers Trullàs et al. conducted a scoping review to assess the effectiveness of problem-based learning (PBL) in undergraduate medical education. Analyzing a wide range of studies, the authors found that PBL consistently enhances student engagement, satisfaction, and the development of essential skills such as communication, teamwork, problem-solving, and self-directed learning. Although findings on its impact on academic performance were mixed, the review highlights PBL's significant contribution to fostering critical thinking and preparing students for real-life clinical situations. The authors concluded that PBL is a valuable pedagogical approach that aligns well with the competency-based goals of modern medical curricula (Trullas, 2022).

The study by Zhou et al. explored the impact of an integrated Problem-Based Learning (PBL) curriculum on the development of clinical thinking skills in undergraduate medical students before entering clinical practice. The findings indicated that PBL positively influenced students' ability to approach clinical problems analytically and independently. This supports the view that PBL can effectively prepare students for the complexities of real-world medical decision-making (Zhou, 2023). The systematic review and meta-analysis by Wei et al. provides strong evidence supporting the use of Problem-Based Learning (PBL) to enhance critical thinking among nursing students. The authors analyzed multiple studies comparing PBL with traditional lecture-based instruction and found that students engaged in PBL consistently demonstrated greater improvements in critical thinking abilities. These findings suggest that PBL creates a more active, learner-centered environment that encourages students to question assumptions, evaluate evidence, and make well-reasoned decisions – skills essential in both nursing and broader clinical practice. This study underscores the value of PBL not only in medical education but across various health professions, highlighting its role in preparing students for complex, real-world healthcare challenges (Wei, 2024).

The meta-analysis by Manuaba et al. examined the impact of Problem-Based Learning (PBL) on critical thinking, problem-solving, and self-directed learning in first-year medical students. On the contrary, the study concluded that PBL did not show a clear advantage over traditional teaching methods in enhancing these skills at the early stages of medical education. These findings suggest that the effectiveness of PBL may depend

on the learners' level of academic development and might be more beneficial at later stages of training (Manuaba, 2022).

Aim of the Study. To investigate how Problem-Based Learning (PBL) contributes to the enhancement of critical thinking abilities among medical students. Specifically, the study seeks to evaluate the effectiveness of PBL in fostering critical thinking skills, clinical reasoning, and problem-solving capabilities, as well as to identify the key factors that influence the successful implementation of PBL within medical education curricula.

Research Methods. The study employs a comprehensive approach, synthesizing existing literature and empirical research to evaluate the role of Problem-Based Learning (PBL) in fostering critical thinking skills among medical students. Through systematic review and analysis of quantitative and qualitative studies, it examines how PBL influences clinical reasoning, problem-solving abilities, and self-directed learning. The research integrates findings from experimental comparisons, pre- and post-intervention assessments, and qualitative insights from students and educators, providing a holistic understanding of PBL's effectiveness and implementation challenges in medical education. This synthesis highlights best practices, key factors for successful integration, and gaps in current knowledge, offering a foundation for future investigation and curriculum development.

Results. Critical thinking in medical practice involves the ability to analyze complex situations, evaluate evidence, make informed decisions, and justify those decisions based on sound reasoning (Facione, 2015). These skills are fundamental to accurate diagnosis, appropriate treatment planning, and ethical decision-making in clinical settings.

The findings of this study underscore the alignment between Problem-Based Learning (PBL) and the development of critical competencies necessary for modern medical practice. By engaging students in authentic and often ambiguous clinical scenarios, PBL requires the integration of knowledge across disciplines, critical questioning of assumptions, and the application of logical reasoning. This method promotes the development of higher-order thinking skills through cycles of inquiry, analysis, and reflection, which are essential for effective clinical decision-making.

Furthermore, the collaborative structure of PBL encourages learners to articulate their reasoning, consider alternative perspectives, and work toward consensus-based solutions. These interactions mirror the interdisciplinary collaboration commonly encountered in clinical environments and contribute to the development of essential

communication and teamwork skills. Such competencies as active listening, conflict resolution, and shared decision-making, are increasingly recognized as vital for improving patient safety and enhancing the quality of care.

Additionally, the process of negotiating clinical problems in a team context fosters metacognitive skills and self-regulation, preparing students to become reflective and adaptive practitioners. The immersive and student-centered nature of PBL also supports the cultivation of professional identity and ethical reasoning by encouraging learners to navigate uncertainty and complexity in a structured yet flexible environment. Taken together, these elements suggest that PBL is not only effective in fostering cognitive competencies but also plays a crucial role in shaping well-rounded, resilient, and collaborative future physicians.

The study by Shumylo et al. underscores the integral role of creativity in medical education, positioning it as a catalyst for the development of critical thinking skills. The authors argue that fostering creative problem-solving within the curriculum enhances learners' capacity to navigate complex clinical scenarios, assess evidence critically, and make well-reasoned decisions. By engaging students in imaginative and flexible thinking processes, medical education can better equip future practitioners to confront the multifaceted and often unpredictable nature of healthcare practice (Shumylo, 2022). Scientist O. Isayeva emphasizes the importance of socio-humanitarian education in medical universities, highlighting its role in developing critical thinking, ethical reasoning, and effective communication skills among future physicians. The author argues that integrating humanities into medical curricula fosters a holistic understanding of patient care, enabling students to navigate complex social and ethical dimensions inherent in medical practice. This perspective aligns with the principles of Problem-Based Learning, which emphasizes critical analysis and collaborative problem-solving. By incorporating socio-humanitarian training, PBL can further enhance students' abilities to approach clinical scenarios with empathy, cultural sensitivity, and a comprehensive understanding of the human condition (Isayeva, 2017).

In their systematic review, Yu and Zin examined adaptations of Problem-Based Learning (PBL) aimed at enhancing critical thinking (CT) in higher education. Analyzing 20 studies, they identified five primary strategies: incorporating CT-focused activities, integrating digital technologies, combining PBL with other pedagogical approaches, utilizing CT-specific tools, and merging PBL with discipline-specific knowledge. All reviewed adaptations

demonstrated positive effects on students' critical thinking skills. The authors highlighted nine factors contributing to successful PBL modifications, including self-directed learning, interactive engagement, problem-solving emphasis, metacognitive activities, authentic learning experiences, a supportive environment, enhanced self-efficacy, and effective teacher facilitation. These findings suggest that thoughtfully tailored PBL approaches can significantly foster critical thinking development in students (Yu&Zin 2023). Building on this perspective, researchers Isayeva and Shumylo emphasize the importance of updated educational standards in the training of future medical professionals. These standards advocate for the implementation of innovative teaching methods, such as Problem-Based Learning, to enhance critical thinking and clinical reasoning abilities. PBL is highlighted as a key strategy in promoting active learning and better preparing students for the complexities of medical practice. This alignment between pedagogical innovation and professional competency requirements reinforces the relevance of integrating PBL into contemporary medical curricula (Ісаєва&Шумило, 2018). Furthermore, PBL helps students develop a deeper understanding of medical knowledge by contextualizing it within real-world problems. This approach contrasts with traditional methods, which often present knowledge in isolation. As students work through problems, they are required to apply theoretical knowledge to clinical scenarios, enhancing their ability to critically evaluate and integrate new information (Barrows, 1996).

The implementation of PBL in medical curricula varies across institutions, but certain common features are essential for its success. These include small-group discussions, the facilitation of self-directed learning, and the use of authentic clinical problems. Effective facilitators play a crucial role in guiding discussions, ensuring that students remain focused on the learning objectives while encouraging critical questioning and debate. Research by Albanese and Mitchell highlights that Problem-Based Learning (PBL) enhances clinical reasoning, problem-solving skills, and long-term knowledge retention among medical students. Additionally, PBL fosters self-directed learning and increases student motivation and engagement. Successful implementation of PBL in medical curricula depends on small-group learning facilitated by trained tutors, as well as the full integration of basic and clinical sciences. The process requires comprehensive faculty development and significant institutional resources. Challenges to implementation include resistance to change and increased

demands on faculty time. These factors are critical to consider when incorporating PBL into medical education programs (Albanese, 1993).

Building on this understanding, Srinivasan and colleagues conducted a comparative study of Problem-Based Learning and Case-Based Learning (CBL) following curricular reforms at two medical schools. Their findings indicate that while both approaches promote active learning and enhance clinical reasoning, PBL is particularly effective in encouraging self-directed learning and deeper engagement with complex clinical scenarios. This suggests that the selection between PBL and CBL should be guided by institutional goals and resources, recognizing that each method offers distinct advantages for medical education (Srinivasan, 2007).

Despite its numerous benefits, integrating Problem-Based Learning (PBL) into medical curricula presents several challenges. A major obstacle is the extensive faculty development required, as educators must transition from traditional roles of content delivery to becoming facilitators who guide student-centered learning (Dory, 2017). PBL demands considerable time and institutional resources for effective implementation, including the design of high-quality clinical case scenarios and the creation of reliable assessment methods that accurately evaluate students' critical thinking and clinical competencies. Furthermore, the evidence concerning the long-term effects of Problem-Based Learning (PBL) on critical thinking remains inconclusive. While several studies indicate that PBL enhances initial problem-solving abilities, its sustained impact may diminish over time in the absence of continued engagement in reflective practice and active learning (Penty, 2015). Therefore, although PBL is effective in fostering critical thinking skills, the persistence of these benefits likely depends on its integration with complementary educational experiences, such as clinical rotations and ongoing professional development.

Scientists Almulhem et. al conducted a cross-sectional comparative study to evaluate the implementation of Problem-Based Learning (PBL) at Imam Abdulrahman bin Faisal University (IAU) in Saudi Arabia, gathering perspectives from both facilitators and medical students. The study involved 46 facilitators and 324 students, who assessed PBL across three dimensions: small group learning, problem case scenarios, and facilitator roles. While both groups generally viewed PBL positively, facilitators consistently rated its implementation higher than students. Notably, trained facilitators and those leading sessions within their specialties provided more favorable evaluations. Among students, females and those

in advanced academic years expressed more positive perceptions. The study identified areas needing improvement, including enhancing group dynamics, providing adequate training before initiating PBL, ensuring the relevance of case scenarios, and refining facilitators' approaches to assigning group roles and delivering feedback. The authors recommend comprehensive training for both facilitators and students to optimize PBL outcomes (Almulhem, 2022).

Thus, Problem-Based Learning (PBL) is a powerful educational approach that significantly enhances clinical reasoning, problem-solving abilities, and self-directed learning among medical students. Its successful implementation depends on key elements such as small-group discussions, effective facilitation, authentic clinical problems, and comprehensive faculty development. While challenges such as resource demands and resistance to change exist, PBL's capacity to actively engage students and foster deeper learning makes it a valuable component of modern medical curricula. Moreover, comparative studies suggest that PBL offers unique advantages over alternative methods like Case-Based Learning, particularly in promoting self-directed inquiry and complex problem engagement. Therefore, careful consideration of institutional goals and resources is essential when integrating PBL into medical education programs to maximize its benefits.

Although Problem-Based Learning (PBL) has demonstrated efficacy in enhancing critical thinking skills among medical students, several challenges hinder its widespread adoption. A primary barrier is faculty resistance to transitioning from traditional didactic teaching methods to the facilitative role required in PBL. Addressing this challenge necessitates robust faculty development programs that focus on the pedagogical shift and provide training in effective assessment techniques. Additionally, the resource-intensive nature of PBL presents significant institutional demands. The development of high-quality clinical cases and the provision of adequate support for small-group learning require substantial time, effort, and financial commitment from medical schools. Ensuring the success of PBL thus depends on the allocation of sufficient resources to support its comprehensive implementation.

Moreover, assessment strategies must evolve to capture the complex and multidimensional aspects of critical thinking. Conventional evaluation methods, such as multiple-choice examinations, may fail to adequately assess students' problem-solving and clinical reasoning capabilities. Alternative

approaches, including formative assessments, peer evaluations, and reflective journals, offer more nuanced insights into learners' critical thinking development and should be integrated into PBL curricula (Gul, 2011).

Conclusions. Problem-Based Learning (PBL) has emerged as a highly effective pedagogical strategy in medical education, with a demonstrated capacity to enhance critical thinking, clinical reasoning, problem-solving skills, and self-directed learning among medical students. Central to its success are key elements including small-group collaborative learning, the facilitative role of trained educators, engagement with authentic clinical cases, and the integration of basic and clinical sciences. These components collectively create an active learning environment that better prepares students for the complexities of contemporary clinical practice.

Nevertheless, the broad implementation of PBL is met with considerable challenges. Faculty resistance remains a significant barrier, as educators accustomed to traditional didactic methods must adapt to new roles that emphasize guidance over direct instruction. Addressing this requires sustained investment in faculty development programs aimed at equipping instructors with the necessary skills and mindset for effective PBL facilitation. Furthermore, the resource-intensive nature of PBL – encompassing the development of high-quality case materials, provision of adequate tutor support, and restructuring of curricula – demands substantial institutional commitment in terms of time, personnel, and financial resources.

Assessment practices within PBL contexts also require reform to appropriately capture the multifaceted nature of critical thinking and clinical competence. Traditional examination formats, such as multiple-choice questions, may inadequately reflect the complex cognitive processes fostered through PBL. Consequently, more comprehensive assessment modalities—including formative evaluations, peer assessments, and reflective exercises—are recommended to provide a richer, more accurate appraisal of student learning outcomes.

Moreover, evidence regarding the long-term impact of PBL on critical thinking suggests that its benefits may diminish without continued engagement in reflective practice and experiential learning opportunities such as clinical rotations and ongoing professional development. Thus, PBL should not be viewed in isolation but rather as part of an integrated educational framework that supports lifelong learning.

Comparative analyses further indicate that PBL offers distinct advantages over other active learning methodologies, such as Case-Based

Learning, particularly in fostering deeper self-directed inquiry and engagement with complex, real-world clinical problems. Ultimately, the successful integration of PBL into medical curricula necessitates deliberate alignment with institutional goals, resource availability, and continuous evaluation to optimize its contribution to the development of competent, reflective, and adaptive healthcare professionals capable of meeting the dynamic demands of modern medicine.

Future research should focus on longitudinal studies to evaluate the sustained impact of PBL on critical thinking and clinical competence throughout medical training and into professional practice, as well as explore innovative assessment tools and faculty development models that can further optimize PBL implementation.

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АНОТАЦІЯ

Шумило Мирослава, Шлімкевич Інна. Роль проблемно-орієнтованого навчання у розвитку критичного мислення в медичній освіті.

Метою статті є дослідити роль проблемного навчання (ПН) у формуванні навичок критичного мислення в медичній освіті, а також оцінити його ефективність у порівнянні з традиційними методами викладання. Для досягнення поставленої мети використано системний аналіз наукової літератури, включаючи теоретичні праці, результати емпіричних досліджень, систематичних оглядів і метааналізів. Особливу увагу приділено впливу ПН на розвиток клінічного мислення, прийняття рішень на основі доказів, а також формування навичок самостійного навчання.

Результати дослідження свідчать, що ПН сприяє підвищенню залученості студентів до навчального процесу, розвитку комунікативних і міжособистісних навичок, формуванню вмінь працювати в команді та ефективно розв'язувати клінічні завдання. ПН демонструє особливу ефективність при інтеграції з навчанням на основі клінічних випадків, створюючи умови для поглибленого засвоєння знань і їх практичного застосування. Однак рівень ефективності залежить від ряду чинників — академічної підготовки студентів, професійної компетентності фасилітаторів, а також організаційної підтримки з боку закладу освіти.

Практичне значення дослідження полягає у виокремленні ключових умов для успішного впровадження ПН: створення структурованого навчального середовища в малих групах, залучення автентичних клінічних сценаріїв,

проведення підготовки викладачів. Окрема увага приділяється проблемі оцінювання результатів навчання — наголошується на необхідності розробки інструментів, що дозволяють якісно оцінити рівень критичного мислення, а не лише засвоєння фактологічного матеріалу.

У висновках стверджується, що інтеграція ПН у сучасні навчальні програми відповідає концепції компетентнісного підходу в медичній освіті, сприяє підготовці майбутніх лікарів до викликів клінічної практики, а також формує основи для безперервного професійного розвитку. У перспективі доцільним є розширення міждисциплінарного підходу, включення соціогуманітарних компонентів у підготовку медиків, а також вдосконалення методик оцінювання та фасилітаторського супроводу.

***Ключові слова**: проблемне навчання (ПН), критичне мислення, медична освіта, клінічне мислення, самостійне навчання, активне навчання, розвиток навчальних програм, підготовка викладачів, навчання у малих групах, залучення студентів.*