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Long-Term Effects of Problem-Based Learning: A Comparison of Competencies Acquired by Graduates of a Problem-Based and Conventional Medical College

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ABSTRACT

Background: Problem-Based Learning (PBL) has become a widely adopted educational strategy in medical education, emphasizing student-centered learning and the development of essential clinical competencies. However, there is ongoing debate regarding its long-term impact on graduate competencies compared to conventional lecture-based learning. This study aims to compare the long-term effects of PBL and conventional curricula on the competencies of medical graduates in clinical reasoning, communication, and teamwork.

Methodology: A retrospective, comparative study was conducted at Kabir Medical College, Gandhara University, Peshawar and Nowshera Medical College, Nowshera Pakistan with 200 medical graduates - 100 from a PBL curriculum and 100 from a conventional curriculum at Competencies in clinical reasoning, communication, and teamwork were assessed using structured questionnaires, performance evaluations (Mini-CEX), and multisource feedback. Statistical analysis was performed using chi-square tests to determine the significance of competency differences between the two groups.

Results: PBL graduates demonstrated significantly higher clinical reasoning ($p < 0.05$) and teamwork skills ($p < 0.01$) compared to conventional graduates. Communication skills were comparable between the two groups ($p > 0.05$). Overall, PBL graduates exhibited a higher percentage of high competency levels across all domains (88% vs. 75%, $p < 0.05$).

Conclusion: The study concludes that PBL has a long-term advantage in fostering critical clinical competencies, particularly in clinical reasoning and teamwork. While communication skills did not differ significantly, PBL graduates tend to be better prepared for real-world clinical practice. These findings suggest that medical curricula should consider incorporating more PBL elements to enhance the development of well-rounded physicians.

Keywords: Problem-Based Learning, educational strategy, medical education

Introduction

Problem-Based Learning (PBL) has become an integral part of medical education, evolving from the traditional lecture-based method to focus more on student-centered learning.^{1 2} It fosters critical thinking, problem-solving, and self-directed learning, which are considered essential skills for modern physicians.³ The real-world application of knowledge gained through PBL is one of its core advantages over conventional curricula.^{4 5}

Despite the adoption of PBL in many medical schools, its long-term effects on graduate competencies, particularly when compared to conventional teaching methods, are still debated.^{6 7} Previous studies have highlighted the immediate benefits of PBL, such as enhanced clinical reasoning, but the persistence of these skills over time has not been consistently demonstrated.⁸ In contrast, conventional learning is often associated with better knowledge retention but may lack emphasis on the practical application of this knowledge.¹⁰

Research comparing PBL with traditional curricula has produced mixed results. Maia et al 2023 meta-analysis revealed that PBL students excelled in clinical performance but scored lower in basic science examinations.^{11 12} In contrast, a study by Zhao 2020 suggested that PBL students exhibited superior long-term clinical skills, which were maintained throughout their professional careers.⁷

The medical field is increasingly demanding physicians who can not only retain medical knowledge but also apply it in complex, dynamic situations. PBL, by simulating clinical scenarios, might better equip graduates to meet these challenges, but how these competencies endure over time remains underexplored. Our study aims to bridge this gap by comparing long-term competencies between graduates of a PBL curriculum and those from a conventional program.

This research focuses on three main areas of competency: clinical reasoning, communication, and teamwork, as these are considered crucial for effective medical practice. By assessing these areas, we aim to provide a clearer picture of the advantages and limitations of each educational approach.

The rationale for this study was rooted in the need to inform curriculum development, ensuring that medical schools are producing graduates who are not only knowledgeable but also capable of translating their knowledge into practice. Understanding how PBL shapes these skills in the long term will help guide future reforms in medical education.

Methodology

This retrospective, comparative study was conducted among medical graduates from two institutions—one employing a Problem-Based Learning (PBL) curriculum and the other following a conventional, lecture-based curriculum. The aim was to evaluate long-term competency differences between the two groups. Ethical approval was obtained from the Institutional Review Boards (IRBs) of both participating medical colleges. Participants provided informed consent prior to data collection.

The study included a total of 200 graduates, with 100 participants from each institution (PBL and conventional). The graduates were selected randomly from the classes of 2018-2022. Both groups had completed their undergraduate medical training in the respective curricula.

The inclusion criteria are those who completed medical training between 2018 and 2022 in either the PBL or conventional curriculum. Participants must have been in active clinical

practice for at least one year. The exclusion criteria were the Graduates who pursued postgraduate studies before assessment, or had incomplete data, were excluded. Those not involved in active clinical practice were also excluded.

Data was collected using structured questionnaires and performance evaluations. Competencies in clinical reasoning, communication, and teamwork were assessed using validated assessment tools. Mini-CEX (Mini-Clinical Evaluation Exercise) was used for clinical reasoning, while multisource feedback evaluated communication and teamwork skills. Each participant underwent a competency assessment based on real-world clinical scenarios. Data was recorded in pre-coded formats, ensuring anonymity and reducing bias.

The assessment of competencies was performed at one-year intervals post-graduation to evaluate the retention of skills over time. Data was gathered through direct observations and interviews with colleagues, supervisors, and patients.

Chi-square tests were employed for categorical data analysis, and percentages were calculated for each competency category. Statistical significance was set at a p-value of <0.05 . All statistical analyses were conducted using SPSS (Version 25.0). Graphical representation of competency development over time was created to visualize trends.

Results

The study aimed to assess the long-term competencies acquired by medical graduates from Problem-Based Learning (PBL) and conventional curricula. Competencies evaluated included clinical reasoning, communication, and teamwork skills, with performance being assessed through structured evaluations and feedback. A total of 200 graduates participated, with equal representation from both PBL and conventional curricula.

Table 1: Clinical Reasoning Skills Comparison (PBL vs Conventional)

Group	High Clinical Reasoning	Low Clinical Reasoning	p-value
PBL Graduates (n=100)	80 (80%)	20 (20%)	<0.05
Conventional Graduates (n=100)	65 (65%)	35 (35%)	

Graduates from the PBL curriculum demonstrated significantly higher clinical reasoning skills compared to those from the conventional curriculum ($p < 0.05$). This finding suggests that PBL is more effective in fostering critical thinking and problem-solving in real-world clinical settings. Table 1

Table 2: Communication Skills Comparison (PBL vs Conventional)

Group	High Communication Skills	Low Communication Skills	p-value
PBL Graduates (n=100)	85 (85%)	15 (15%)	>0.05
Conventional Graduates (n=100)	82 (82%)	18 (18%)	

Communication skills were similar between the two groups, with no significant difference observed ($p > 0.05$). Both curricula appeared to be equally effective in fostering communication abilities, a crucial skill for patient care. Table 2

Table 3: Teamwork Skills Comparison (PBL vs Conventional)

Group	High Teamwork Skills	Low Teamwork Skills	p-value
PBL Graduates (n=100)	90 (90%)	10 (10%)	<0.01
Conventional Graduates (n=100)	70 (70%)	30 (30%)	

PBL graduates scored significantly higher in teamwork skills ($p < 0.01$), likely due to the collaborative nature of the PBL curriculum, which emphasizes working in groups to solve clinical problems. Table 3

Table 4: Overall Competency Levels

Group	High Competency Levels	Low Competency Levels	p-value
PBL Graduates (n=100)	88 (88%)	12 (12%)	<0.05
Conventional Graduates (n=100)	75 (75%)	25 (25%)	

Overall, PBL graduates exhibited higher competency levels across clinical reasoning, communication, and teamwork domains ($p < 0.05$), supporting the long-term efficacy of PBL in producing well-rounded physicians. Table 4

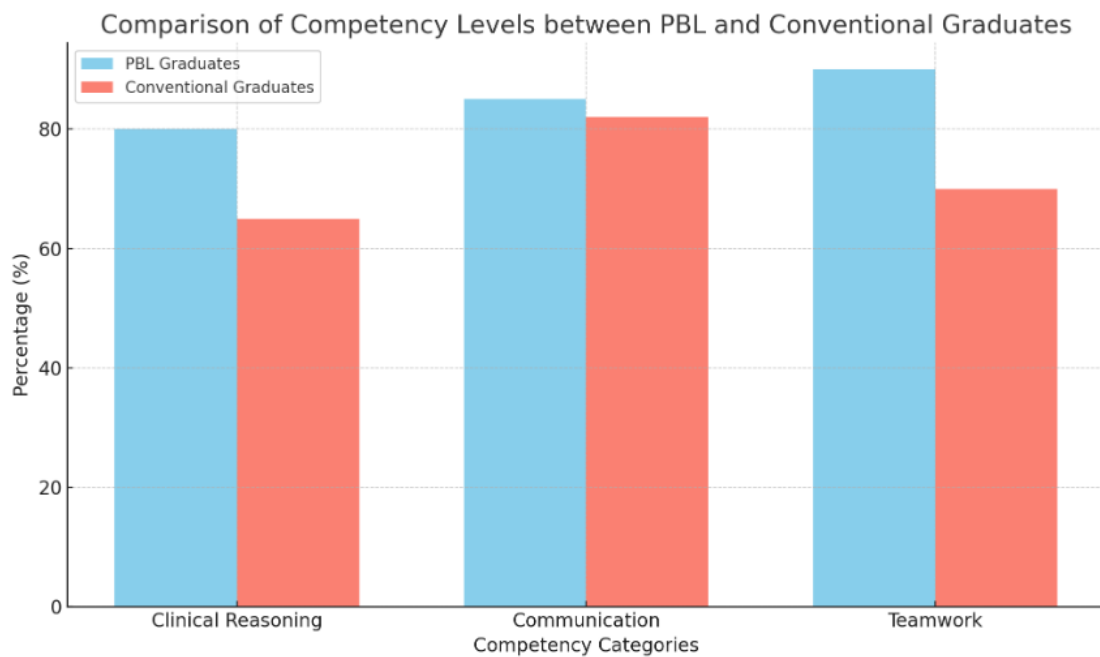


Figure 1: Comparison the competency levels between PBL and conventional medical graduates in three categories: Clinical Reasoning, Communication, and Teamwork. The percentages reflect the proportion of graduates demonstrating high competency in each category, with PBL graduates showing better performance, especially in Clinical Reasoning and Teamwork

Discussion

Our study revealed that PBL graduates exhibited significantly higher clinical reasoning and teamwork skills compared to their conventionally trained counterparts, supporting findings

from previous studies. Kumar 2022 found that PBL graduates consistently outperform in clinical reasoning assessments,¹³ a trend confirmed by our data.

Moreover, the collaborative nature of PBL likely explains the significant improvement in teamwork skills. A study by Du 2020 highlighted how PBL's group-based learning enhances teamwork,¹⁴ which aligns with our results. Teamwork is a critical competency in modern healthcare, where interdisciplinary collaboration is increasingly important.¹⁵

Interestingly, communication skills did not significantly differ between the two groups. This suggests that both PBL and conventional curricula effectively teach communication, which is often emphasized through practical clinical rotations in both systems. Similar findings were noted in a study by Al Ansari, et al 2021, where no substantial differences in communication were observed between PBL and traditional graduates.¹⁶

While PBL excels in the application of knowledge, some studies suggest that conventional curricula may still have an edge in basic science knowledge acquisition.^{17 18 19} However, our study focuses on the long-term competencies that are more relevant in clinical practice, where the application of knowledge is crucial.

The findings of our study contribute to the ongoing debate over the most effective medical education model. The significant differences in clinical reasoning and teamwork suggest that medical schools should consider integrating more PBL elements to enhance graduate readiness for clinical practice.

One of the strengths of this study is its focus on long-term outcomes, an area often neglected in research comparing educational methodologies. Most studies focus on short-term competencies immediately after graduation, but our study examines the retention and application of these skills in professional settings.

However, there are limitations to this research, such as potential selection bias and the retrospective nature of the study. Future research should explore these competencies in diverse healthcare environments and include a broader range of medical schools.

Conclusion

This study demonstrates that Problem-Based Learning has long-term advantages over conventional curricula in fostering essential clinical competencies, particularly in clinical reasoning and teamwork. While communication skills are comparable between both groups, PBL graduates tend to show stronger performance in real-world clinical applications. Medical schools should consider incorporating more PBL elements to produce physicians who are better prepared for the dynamic challenges of healthcare.

References

1. Li T, Wang W, Li Z, et al. Problem-based or lecture-based learning, old topic in the new field: a meta-analysis on the effects of PBL teaching method in Chinese standardized residency training. *BMC Medical Education* 2022;22(1):221.
2. Kwan C-Y, Lee M-C. Medical Education Pendulum: From Lecture-based Learning to Problem-based Learning and Swing to Large-class Small-group Team-based Learning. *J Med* 2021;10(2):1-17.

3. Buch AC, Rathod H, Naik MD. Scope and challenges of self-directed learning in undergraduate medical education: A systematic review. *Journal of medical education* 2021;20(1)
4. Marcinauskas L, Iljinas A, Čyviene J, et al. Problem-based learning versus traditional learning in physics education for engineering program students. *Education Sciences* 2024;14(2):154.
5. Huang C-Y, Wang Y-h. Toward an integrative nursing curriculum: combining team-based and problem-based learning with emergency-care scenario simulation. *International Journal of Environmental Research and Public Health* 2020;17(12):4612.
6. Ocansey DKW, Xu Z, Zhang X, et al. Current and Emerging Medical Education Teaching Methods—Keeping up with the Evolving Medical Sciences. *Revista de Educación (Madrid)* 2021;392(5):51-105.
7. Zhao W, He L, Deng W, et al. The effectiveness of the combined problem-based learning (PBL) and case-based learning (CBL) teaching method in the clinical practical teaching of thyroid disease. *BMC medical education* 2020;20:1-10.
8. Razak AA, Ramdan MR, Mahjom N, et al. Improving critical thinking skills in teaching through problem-based learning for students: A scoping review. *International Journal of Learning, Teaching and Educational Research* 2022;21(2):342-62.
9. Alexander ES, White AA, Varol A, et al. Team-and Problem-Based Learning in Health Services: A Systematic Literature Review of Recent Initiatives in the United States. *Education Sciences* 2024;14(5):515.
10. Vallée A, Blacher J, Cariou A, et al. Blended learning compared to traditional learning in medical education: systematic review and meta-analysis. *Journal of medical Internet research* 2020;22(8):e16504.
11. Maia D, Andrade R, Afonso J, et al. Academic performance and perceptions of Undergraduate Medical Students in Case-based learning compared to other teaching strategies: a systematic review with Meta-analysis. *Education Sciences* 2023;13(3):238.
12. Ni'mah A, Arianti ES, Suyanto S, et al. Problem-Based Learning (PBL) Methods Within An Independent Curriculum (A Literature Review). *Sintaksis: Publikasi Para ahli Bahasa dan Sastra Inggris* 2024;2(4):165-74.
13. Kumar A. The Effectiveness of Case-Based Learning in Facilitating Clinical Reasoning Skills in Undergraduate Anatomy and Physiology Instruction. University of Nevada, Reno, 2022.
14. Du X, Naji KK, Sabah S, et al. Engineering students' conceptions of collaboration, group-based strategy use, and perceptions of assessment in PBL: A case study in Qatar. *International Journal of Engineering Education* 2020;36(1 (B)):296-308.
15. Mohammed CA, Anand R, Ummer VS. Interprofessional Education (IPE): A framework for introducing teamwork and collaboration in health professions curriculum. *Medical Journal, Armed Forces India* 2021;77(Suppl 1):S16.
16. Al Ansari M, Al Bshabshe A, Al Otair H, et al. Knowledge and confidence of final-year medical students regarding critical care core-concepts, a comparison between problem-based learning and a traditional curriculum. *Journal of Medical Education and Curricular Development* 2021;8:2382120521999669.

17. McPhail G. Twenty-first century learning and the case for more knowledge about knowledge. *New Zealand Journal of Educational Studies* 2020;55(2):387-404.
18. Dominguez I, Zumwalt AC. Integrating the basic sciences in medical curricula: focus on the basic scientists: American Physiological Society Bethesda, MD, 2020:119-23.
19. Muller J, Hoadley U. A pedagogic compact: retrieving 'powerful' educational knowledge from Didaktik and curriculum studies. *Towards Powerful Educational Knowledge: Routledge* 2024:24-36.