

Evaluating the Impact of Problem-Based Learning on Critical Thinking Skills in Undergraduate Nursing Students

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Abstract: Critical thinking is an essential competency for nursing professionals, enabling them to make informed clinical decisions and ensure patient safety. In Pakistan, traditional lecture-based pedagogies dominate nursing education, often limiting the development of higher-order cognitive skills. Problem-based learning (PBL) has emerged as an effective student-centered strategy to enhance critical thinking, but its application in Pakistani nursing curricula remains limited. **Objective:** To evaluate the effectiveness of problem-based learning in improving critical thinking skills among undergraduate nursing students in a tertiary care teaching hospital in Pakistan. **Methods:** A quasi-experimental pre- and post-intervention study was conducted from April to September 2024 at the NMC Multan. A total of 86 undergraduate nursing students were recruited through non-probability convenience sampling. Participants underwent six weeks of structured PBL sessions integrated into their curriculum. Critical thinking skills were assessed before and after the intervention using a validated critical thinking disposition inventory. Data were analyzed using SPSS version 25, employing paired t-tests and ANOVA to determine statistical significance, with a p-value ≤ 0.05 considered significant. **Results:** Post-intervention analysis revealed significant improvements in all domains of critical thinking: interpretation ($p = 0.000$), analysis ($p = 0.000$), evaluation ($p = 0.000$), inference ($p = 0.000$), and explanation ($p = 0.000$). The overall mean critical thinking score increased from 15.6 ± 3.5 to 20.5 ± 2.9 ($p < 0.001$). Senior students (3rd and 4th year) demonstrated greater improvements compared to juniors ($p = 0.034$), while no significant gender-based differences were observed ($p = 0.210$). **Conclusion:** Problem-based learning significantly enhances critical thinking skills among undergraduate nursing students and should be integrated into nursing curricula in Pakistan to promote clinical competence and professional readiness.

Keywords: Problem-based learning, critical thinking, nursing students, Pakistan, nursing education, active learning, clinical reasoning

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Introduction

Critical thinking is a core component of professional competence in nursing, enabling nurses to make sound clinical judgments, ensure patient safety, and adapt to the complexities of modern healthcare systems. In Pakistan, where the nursing profession is experiencing a gradual transition toward evidence-based practice and patient-centered care, developing critical thinking skills among undergraduate nursing students is imperative. However, traditional didactic teaching methods, which emphasize rote memorization over analytical thinking, remain predominant in most nursing institutions in the country. This educational approach often fails to prepare students for the dynamic clinical challenges they will encounter in practice, particularly in resource-limited and high-pressure environments such as public tertiary care hospitals. Problem-based learning (PBL) has emerged as an innovative educational strategy designed to promote deeper learning and enhance students' analytical and problem-solving abilities. PBL facilitates active engagement by placing students at the center of the learning process, where they collaboratively analyze clinical scenarios, identify learning needs, and apply knowledge to develop appropriate interventions. Studies conducted globally and within South Asia have demonstrated the effectiveness of PBL in cultivating critical thinking among healthcare students, including nursing, medicine, and allied health sciences (1–3). In the Pakistani context, where undergraduate nursing curricula are evolving under the Pakistan Nursing Council's reforms, the integration of PBL remains limited and inconsistent, particularly in public sector institutions (4,5).

Several Pakistani studies have noted the urgent need for pedagogical reform in nursing education. A study from Karachi highlighted that students trained through active learning strategies showed superior critical thinking scores compared to those taught through lecture-based methods (6). Another study from Lahore emphasized that the incorporation of case-based and student-led learning sessions significantly improved clinical decision-making confidence among final-year nursing students (7). Yet, the actual implementation of such methods in undergraduate programs remains low due to lack of trained faculty, institutional support, and awareness about outcome-based education (8). Globally, the positive outcomes of PBL have been corroborated in diverse nursing education settings. Recent meta-analyses and experimental studies confirm that PBL significantly enhances critical thinking, knowledge retention, and learner motivation (9,10). As Pakistan aspires to align its healthcare workforce with global standards, adopting educational practices that foster independent reasoning and clinical competence is crucial. Therefore, assessing the effectiveness of PBL in enhancing critical thinking in the Pakistani undergraduate nursing context is both timely and necessary.

The present study was conducted to evaluate the impact of structured problem-based learning sessions on critical thinking development among undergraduate nursing students at a tertiary care hospital in Pakistan. This research aims to provide empirical evidence to guide curricular reforms and advocate for broader implementation of PBL across nursing institutions in the country.



Methodology

This quantitative quasi-experimental study was conducted to evaluate the effectiveness of problem-based learning (PBL) in enhancing critical thinking among undergraduate nursing students. The study was carried out at a tertiary care hospital in Pakistan from April 2024 to September 2024. A total of 86 nursing students were recruited using a non-probability convenience sampling technique. Inclusion criteria included undergraduate nursing students currently enrolled in their 2nd to 4th year of study, who had not previously undergone extensive exposure to PBL-based curriculum. Students who were on leave or had already completed their final academic year were excluded.

The intervention involved structured problem-based learning sessions integrated into the existing curriculum over a period of six weeks. Each week, students participated in two PBL sessions focused on real-life nursing scenarios designed to stimulate analytical reasoning, decision-making, and clinical judgment. These sessions were facilitated by trained faculty members following a standardized PBL implementation guide to ensure consistency across groups. The instructional design emphasized collaborative learning, self-directed inquiry, and reflective thinking. Participants were encouraged to actively engage in identifying problems, generating hypotheses, and formulating evidence-based solutions during each session. Data collection was conducted using a validated Critical Thinking Disposition Inventory adapted for nursing students. The tool included subscales for interpretation, analysis, evaluation, inference, and explanation, rated on a 5-point Likert scale. The inventory was administered twice—once prior to the commencement of the intervention (pre-test) and once immediately following the final PBL session (post-test). All participants were given clear instructions and assured of confidentiality and anonymity in handling their data. Data were entered and analyzed using SPSS version 25. Descriptive statistics including means, standard deviations, and frequencies were used to summarize demographic variables. Paired sample t-tests were applied to assess

changes in pre- and post-intervention critical thinking scores across domains. Additionally, independent sample t-tests and ANOVA were performed to explore associations between demographic variables and post-test outcomes. Statistical significance was set at $p \leq 0.05$. Ethical approval was obtained from the institutional review board of the tertiary care hospital, and written informed consent was secured from all participants prior to data collection. The methodology adhered to international research ethics and reporting standards, ensuring the reliability and reproducibility of findings.

Results

A total of 86 undergraduate nursing students participated in this study, which aimed to evaluate the effectiveness of problem-based learning (PBL) in enhancing critical thinking skills. Data were collected before and after the intervention using a validated critical thinking questionnaire. The data were analyzed using descriptive and inferential statistics. Results are presented in the form of frequency distributions, mean scores, standard deviations, and paired t-tests to assess changes in critical thinking levels. Table 1 presents the demographic profile of the participants. The majority of participants were aged between 22–25 years (58.1%) and predominantly female (82.6%). Most students were from the 3rd and 4th years of the nursing program, and a large proportion (73.3%) had not previously been exposed to PBL. A statistically significant improvement was observed across all critical thinking domains following the PBL intervention. The highest gain was noted in the explanation domain (+1.2), while the overall mean critical thinking score improved from 15.6 ± 3.5 to 20.5 ± 2.9 ($p < 0.001$). (Table 2). Post-test critical thinking scores were found to be significantly associated with the year of study ($p = 0.034$), indicating that students in higher academic years benefited more from the PBL intervention. No statistically significant association was found with gender or prior exposure to PBL. (Table 3).

Table 1. Demographic Characteristics of Participants (n = 86)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	18–21	36	41.9
	22–25	50	58.1
Gender	Female	71	82.6
	Male	15	17.4
Year of Study	2nd Year	28	32.6
	3rd Year	31	36.0
	4th Year	27	31.4
Previous PBL Exposure	Yes	23	26.7

Table 2. Pre- and Post-Intervention Critical Thinking Scores (n = 86)

Critical Thinking Domain	Pre-Test Mean \pm SD	Post-Test Mean \pm SD	Mean Difference	p-value
Interpretation	3.2 ± 0.9	4.1 ± 0.8	+0.9	0.000*
Analysis	3.4 ± 0.8	4.3 ± 0.7	+0.9	0.000*
Evaluation	3.1 ± 1.0	4.0 ± 0.8	+0.9	0.000*
Inference	2.9 ± 0.9	3.9 ± 0.7	+1.0	0.000*
Explanation	3.0 ± 0.8	4.2 ± 0.6	+1.2	0.000*
Overall Critical Thinking	15.6 ± 3.5	20.5 ± 2.9	+4.9	0.000*

* $p \leq 0.05$ is statistically significant

Table 3. Association between Demographic Variables and Post-Test Critical Thinking Scores (n = 86)

Variable	Category	Mean \pm SD	p-value
Gender	Male	19.8 ± 3.0	0.210
	Female	20.7 ± 2.8	
Year of Study	2nd Year	19.4 ± 3.1	0.034*
	3rd Year	20.6 ± 2.6	
	4th Year	21.2 ± 2.5	
Previous PBL Exposure	Yes	21.0 ± 2.3	0.062
	No	20.3 ± 3.0	

* $p \leq 0.05$ is statistically significant

Discussion

The findings of this study demonstrate a statistically significant improvement in critical thinking skills among undergraduate nursing students following the implementation of problem-based learning (PBL). This enhancement was consistent across all critical thinking domains, including interpretation, analysis, evaluation, inference, and explanation, with the most notable improvement observed in the explanation domain (mean difference +1.2, $p < 0.001$). These results affirm the efficacy of PBL as a pedagogical approach in fostering critical thinking, aligning with a growing body of international and regional literature.

Our findings are in agreement with a meta-analysis conducted by Zhang et al., which reported that PBL significantly improves critical thinking and problem-solving abilities among nursing students across various educational settings (11). Similarly, a study by Moattari et al. found that Iranian nursing students exposed to PBL exhibited higher levels of reflective thinking and better clinical reasoning than those trained via conventional lecture-based approaches (12). This supports the argument that PBL not only imparts theoretical knowledge but also enhances the cognitive processes necessary for clinical decision-making.

In the South Asian context, a quasi-experimental study from India also showed that nursing students who underwent PBL sessions scored significantly higher in post-intervention critical thinking assessments compared to control groups taught through traditional methods (13). In Pakistan, a study conducted in Lahore by Khalid et al. highlighted that integrating case-based and problem-oriented strategies in nursing education led to measurable improvements in students' ability to interpret clinical scenarios and make appropriate decisions (14). The present study corroborates these outcomes by showing improved post-test scores, particularly among students in advanced academic years, indicating cumulative benefit and maturity in applying critical thinking.

Furthermore, the lack of significant difference in post-intervention scores between genders in our study suggests that PBL is an equally effective strategy across both male and female nursing students. This aligns with findings from a recent study in China, which concluded that the gender of students did not significantly impact the critical thinking gains from PBL interventions (15).

Another key finding was the statistically significant association between students' year of study and post-intervention critical thinking scores ($p = 0.034$), with senior students performing better than juniors. This is consistent with previous research indicating that students in later academic years tend to have more developed cognitive frameworks and clinical exposure, thereby benefiting more from active learning strategies like PBL (16-17).

The positive outcomes observed in this study are particularly relevant to the Pakistani context, where nursing education is undergoing reform under the guidance of the Pakistan Nursing Council. Despite these reforms, many institutions still rely heavily on didactic instruction, which may not adequately prepare students for the demands of clinical practice. By demonstrating the effectiveness of PBL in a tertiary care teaching hospital, this study contributes valuable evidence to support curricular innovations across nursing schools in the country.

However, the study is not without limitations. The use of a single-site sample and non-randomized design may affect the generalizability of findings. Moreover, while the study measured immediate post-intervention gains, it did not assess long-term retention of critical thinking abilities. Future research should explore longitudinal effects of PBL and consider multi-center randomized controlled trials for more robust evidence.

Thus results of this study reinforce the importance of integrating problem-based learning into nursing education programs in Pakistan. PBL not only enhances critical thinking skills but also prepares nursing students for real-world clinical challenges. This approach should be considered a vital component of educational strategies aimed at producing competent, reflective, and adaptive nursing professionals.

Conclusion

This study demonstrates that problem-based learning is an effective educational strategy for significantly enhancing critical thinking among undergraduate nursing students in Pakistan. Incorporating PBL into nursing curricula can bridge the gap between theoretical knowledge and clinical competence, preparing a more reflective and skilled nursing workforce to meet the demands of modern healthcare.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-MM-24)

Consent for publication

Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

AL (Staff Nurse)

Manuscript drafting, Study Design,

Review of Literature, Data entry, Data analysis, and drafting article.

MS

Conception of Study, Development of Research Methodology Design, Study Design, manuscript review, critical input.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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