

ORIGINAL ARTICLE

Effectiveness of Problem-based learning versus conventional lectures on knowledge retention and engagement, among adult nursing students in Pakistan.

Asia Aziz¹

ABSTRACT... **Objective:** To compare the difference in outcome, educational experience and knowledge retention of PBL and conventional (lecture based) teaching of adult nursing students of Pakistan. **Study Design:** Quasi-experimental Cross Over study. **Period:** January to March 2025. **Setting:** College of Nursing, Bahawal Victoria Hospital/QAMC, Bahawalpur. **Methods:** After taking ethical approval (Ref No: 2387/DME/QAMC Bahawalpur) total of 60 4th year nursing students were included (30 PBL and 30 conventional). Knowledge and competency related to myocardial infarction (MI) were assessed using a pretest posttest design with cross over to compare the knowledge acquisition and retention. The class attractiveness and overall educational experience was measured using a structured 12-item questionnaire. Perceptions regarding PBL were measured using a Likert-scale instrument. Data were analyzed using independent sample t-tests with significance set at $p \leq 0.05$. **Results:** PBL students demonstrated significantly higher knowledge in multiple MI-related domains including symptom recognition ($p=0.01$), ECG interpretation ($p=0.02$), laboratory interpretation ($p=0.009$), counseling confidence ($p=0.005$), and pathophysiology understanding ($p=0.01$). They also reported significantly higher motivation and perceived understanding with PBL compared to traditional methods ($p<0.05$). The PBL groups showed significantly higher knowledge retention in first post-test score ($p=0.001$). After crossover, final scores were even better and comparable though the group who took PBL later had a slightly higher scores. There was a significant time effect (f-value 112.5 and p-value <0.001). Reliability was acceptable to good and improved in post-test (Cronbach's alpha 0.84). **Conclusion:** PBL (Problem based learning) is associated with improved knowledge retention, greater perceived benefit, engagement, active participation and motivation as compared to traditional teaching. Exposure to both modalities/ hybrid approach maximizes benefits, leading to deeper understanding and better learning outcomes.

Key words: Knowledge Assessment, Nursing Education, Problem Based Learning, Student Engagement.

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INTRODUCTION

Medical education is significant in shaping the healthcare and to equip the future health care providers with required knowledge, expertise and attitude to provide high quality patient care.¹ According to the newer experiential methods of teaching, the trend in medical education is shifting from didactic teaching methodologies towards student centered methods.² PBL is one of the modern education skills which promotes deep learning due to its potential of enhancing knowledge retention and overall competence in medical learners.³ This instructional strategy also promotes medical learners to enhance skills, self-directed learning & critical thinking.⁴

A meta-analysis by Manuaba et al reported that

PBL helps in enhancing deeper learning.⁵ while some others studies observed PBL had no effect on surface/superficial learning.⁶ In Australia a study showed that students who followed PBL curricula exhibited equivalent rather more professional competencies in comparison to graduates trained through traditional teaching.⁷ Schmidt in his review concluded that there is considerable support for the idea that the activation of prior knowledge in the small-group setting is enhanced by PBL which provides opportunities for elaboration on that knowledge.⁸ A Meta-analysis told by Mark A Albanese revealed that PBL is more nurturing as compared to conventional system. PBL trained graduates perform better on clinical examination and faculty evaluations. One thing noted was that PBL students scored low in basic sciences evaluation

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as compared to conventionally trained graduates.⁹ A systematic scoping review of 45 comparative studies and 16 RCTs indicated PBL's superiority in learning, knowledge retention, clinical skills, problem-solving, and self-directed learning among students.¹⁰

While the existing literature provides valuable insight into effectiveness of problem-based learning (PBL) as an instructional tool in medical education, there are several potential literature gaps that require further exploration. First of all, the comparative impact of PBL vs traditional lectures in nursing is lacking. Secondly the learning outcomes and educational experience of PBL in nursing discipline in Pakistan, especially in southern Punjab is not researched. Lastly, the methodology of using pre-test, post-test after cross over is not evident from nursing literature in Pakistan. The objective of the study is to determine the difference in learning outcomes, knowledge retention and educational experience of PBL and conventional teaching on knowledge acquisition of adult nursing students in Pakistan.

METHODS

The current quasi-experimental cross over study was conducted from January to March 2025 to compare the effect of PBL and lectures on knowledge acquisition, class attractiveness and learning outcome in BS nursing students. A pretest posttest design with cross over was adopted. This study was conducted at college of Nursing Bahawal Victoria hospital/QAMC. The ethical approval was taken vide letter Ref No: 2387/DME/QAMC Bahawalpur. Study population was BS nursing students of 4th year academic year at Bahawal Victoria hospital/QAMC.

The sampling technique was nonprobability purpose sampling. After taking an informed consent (the students were briefed about the study objectives and methods of instruction before consenting to participate), (60) sixty 4th year students were enrolled. They were divided into two groups i.e. 30 students in PBL group (study group) and 30 students in traditional lecture method (control group) by simple randomization lottery method.

Inclusion Criteria

All willing 4th semester nursing students.

Exclusion Criteria

Students who had been absent for more than two sessions.

Participants underwent a pre-test consisting of MCQs to establish baseline knowledge of myocardial infarction (MI) after being allocated into groups A and B. Group A took Problem-Based Learning (PBL) as intervention, while Group B received lectures as control. Both groups received identical instruction on MI topics for 10 days, covering symptoms recognition, ECG interpretation, pathophysiology, immediate care provision, laboratory results interpretation, pharmacological management, and patient counseling. First Post-test, in MCQ format, followed the instruction for knowledge assessment. After the first intervention, a minimum 2-week washout period was given. Then a crossover was done, where Group A received lecture while Group B switched to PBL for 10 days. Another post-test using the same MCQs, was administered thereafter to all participants after they had completed their instructional period.

The score of pre-test were recorded in SPSS version 23 and Cronbach's alpha was measured. Then in phase 1 post-test, same assessment exam was given to both groups and the results were measured and recorded. After crossover, the phase 2 post-test results were recorded and reliability of the exams was measured. A questionnaire (attached as an annexure A) covering various aspects of myocardial infarction (as described above in intervention) was used as an instrument to determine the depth of knowledge of nursing students. Similarly, a questionnaire based on Likert scale regarding class attractiveness was administered for both PBL and lecture-based instructions at the end of intervention. (questionnaire attached as an annexure B). Mean and standard deviation were calculated for both PBL and lecture-based methods.

Mean and standard deviation of obtained scores were calculated for each group A and B for pre-test and post-test (both phases). Then mean and standard deviation of post-tests were compared

with the pretest scores of the Problem-Based Learning (PBL) and lecture-based learning groups to assess their effectiveness. This quantitative analysis utilized paired t-tests for various comparisons, maintaining a significance level of $p \leq 0.05$. Content validity was reviewed by subject experts. Internal consistency was assessed using Cronbach's alpha ($\alpha = 0.82$). Data were analyzed using SPSS version 23.0. Independent sample t-tests were applied to compare mean scores between group A & B. Results were expressed as mean $\pm$ SD, with $p \leq 0.05$ considered statistically significant. Informed consent was obtained from each student. Throughout the data collection procedure and reporting of results, participant anonymity and confidentiality was maintained.

RESULTS

The comparison of mean scores between Conventional and PBL nursing students based on their responses to a 12-item Likert scale questionnaire, regarding Myocardial infarction (MI)

knowledge and competency is shown in Table-I. Higher scores of PBL group indicate greater confidence, comprehension, and proficiency.

Table-II compares the difference in perceptions class attractiveness and engagement between lecture-based and PBL learning in nursing students in seven different categories. PBL students showed deeper understanding, engagement, and motivation.

In table-III the pre-test score showed that both groups were comparable at baseline. PBL yielded significantly higher Phase 1 scores (p-value 0.001). After crossover, final scores were even better and comparable though the group who took PBL later had a slightly higher scores. There was a significant time effect (f-value 112.5 and p-value <0.001). Reliability as measured by Cronbach's alpha value > 0.7 indicates acceptable internal consistency. Improved value in post-test (0.84) shows improved test performance after refinement and reduced guessing.

TABLE-I

Depth of knowledge, confidence, and proficiency of nursing students (n=60)

Questionnaire Items	Mean $\pm$ SD		P-Value
	Conventional	PBL	
How confident are you in recognizing the typical symptoms of myocardial infarction (MI), such as chest pain or discomfort?	3.27 $\pm$ 1.34	4.27 $\pm$ 0.46	0.01*
Rate your ability to differentiate between the ECG findings of ST-segment elevation myocardial infarction (STEMI) and non-ST-segment elevation myocardial infarction (NSTEMI).	2.53 $\pm$ 0.92	3.40 $\pm$ 1.06	0.02*
To what extent do you feel confident in providing immediate care to a patient experiencing a myocardial infarction, including administering aspirin and oxygen therapy?	3.20 $\pm$ 0.94	3.20 $\pm$ 1.08	1.00
How comfortable are you in interpreting laboratory results related to myocardial infarction, like cardiac enzyme levels (troponin, CK-MB)?	2.33 $\pm$ 1.4	3.07 $\pm$ 0.8	0.009*
Rate your understanding of the pharmacological management of myocardial infarction patients, including the use of antiplatelet agents and beta-blockers.	2.80 $\pm$ 1.27	2.93 $\pm$ 1.16	0.766
How confident are you in providing education and counseling to myocardial infarction patients regarding lifestyle modifications and medication adherence?	2.53 $\pm$ 1.13	3.67 $\pm$ 0.90	0.005*
Rate your proficiency in assessing the psychosocial needs of myocardial infarction patients and their families, including addressing anxiety and depression.	2.67 $\pm$ 1.11	3.33 $\pm$ 1.3	0.141
How well do you understand the potential complications of myocardial infarction, such as arrhythmias, heart failure, and cardiogenic shock?	2.47 $\pm$ 1.25	3.27 $\pm$ 0.88	0.04*
How effectively can you prioritize nursing interventions for a patient presenting with acute myocardial infarction, considering factors such as pain management, oxygen therapy, and cardiac monitoring?	3.33 $\pm$ 1.45	2.87 $\pm$ 0.99	0.04*
Rate your understanding of the pathophysiology of myocardial infarction, including the sequence of events leading to myocardial tissue damage and necrosis.	2.07 $\pm$ 0.88	2.80 $\pm$ 1.47	0.01*
How comfortable are you in collaborating with other healthcare professionals, such as cardiologists and emergency physicians, in the care of myocardial infarction patients?	2.93 $\pm$ 1.22	3.20 $\pm$ 1.32	0.57
How comfortable are you teaching myocardial infarction patients the value of secondary preventive techniques like quitting smoking and taking prescription drugs as directed?	2.47 $\pm$ 1.46	3.47 $\pm$ 1.46	0.07

TABLE-II

Class attractiveness, motivation & engagement (n=60)

Items	Lecture Based	PBL Based	P-Value
On a scale of 1 to 5, how engaging do you find Problem-Based Learning (PBL) sessions in comparison to traditional lecture-based classes?	2.27 ± 1.1	3.20 ± 1.42	0.04*
How motivated are you to actively participate in Problem-Based Learning (PBL) sessions as opposed to traditional lectures?	2.13 ± 1	3.2 ± 1.27	0.02*
In your opinion, how effective is Problem-Based Learning (PBL) in preparing you for real-world nursing scenarios compared to lecture-based learning?	3 ± 1.51	3 ± 1.51	1
How much do you enjoy the interactive nature of Problem-Based Learning (PBL) sessions in contrast to the passive nature of traditional lectures?	2.87 ± 1.25	3.07 ± 1.49	0.69
To what extent do you feel that Problem-Based Learning (PBL) enhances your understanding of nursing concepts compared to lecture-based learning?	2.27 ± 1.1	3.13 ± 1.13	0.04*
In your opinion, how well does Problem-Based Learning (PBL) cater to different learning styles compared to lecture-based learning?	2.47 ± 1.36	3.13 ± 0.83	0.12
How likely are you to recommend Problem-Based Learning (PBL) as a preferred method of learning to other nursing students, based on your experiences?	2.67 ± 1.23	3.13 ± 1.51	0.36

TABLE-III

Comparison of scores across phases and between groups.

Parameter	Group A (Mean ± SD)	Group B (Mean ± SD)	Mean Difference (95% CI)	Cronbach's Alpha	t/F value	P-Value
Pretest Score	4.53 ± 1.21	4.63 ± 1.10	-0.10 (-0.62 to 0.42)	0.78	0.32	0.74
Phase 1 Post test Score	7.80 ± 1.05 (PBL)	6.50 ± 1.20 (Lecture)	1.30 (0.55 to 2.05)	0.84	3.45	0.001
Phase 2 (after cross over) Posttest Score	8.47 ± 1.02 (Lectures)	8.87 ± 0.95 (PBL)	-0.40 (-0.98 to 0.18)		1.52	0.13
Overall Time Effect (ANOVA)			—		112.5	<0.001
Time × Group Interaction			—		4.12	0.02

DISCUSSION

The shift from traditional lecture-based teaching to student-centered approaches such as problem-based learning (PBL) has become a major focus in nursing education. The development of this system aims to produce qualified nurses who possess essential knowledge and clinical skills and the ability to think critically and learn throughout their careers. The findings of this study indicate that Problem-Based Learning (PBL) is associated with improved myocardial infarction-related knowledge retention, motivation and satisfaction among nursing students. These findings are consistent with a larger body of research that indicates PBL generally improves the educational outcome in nursing students.^{4,11} especially problem-based learning (PBL

The main benefit which people continuously observe

in PBL shows that it helps students become more engaged and actively involved in the learning process^{2,3,12,13}, which is also depicted in our results (Table-II). PBL requires students to participate actively through its small group discussions and case-based scenarios and self-directed learning activities which differ from traditional lectures that focus mainly on teacher instruction. The interactive design of the system helps students develop better cognitive skills and they become motivated to take responsibility for their educational journey. Research demonstrates that PBL creates collaborative learning spaces which enable students to study their academic material while working together with other students and teachers thus increasing their motivation to learn and their contentment with the educational process.¹⁴⁻¹⁶ PBL often improves critical thinking, motivation, and conceptual knowledge

more successfully than traditional lectures, according to research comparing PBL with lecture-based instruction in nursing education.^{11,13,17,18} Nursing students frequently express improved motivation and satisfaction with PBL's interactive and collaborative nature, and studies show that PBL promotes higher-order thinking skills, problem-solving, and self-directed learning.^{19,20}

Regarding knowledge retention, our study depicted significant retention and improved outcome in the post-test score of PBL (see Table-III), nevertheless, the current literature gives a mixed response. Most articles mentioned improved retention with PBL⁹⁻¹¹ especially problem-based learning (PBL, while some studies indicate that traditional lectures may be more effective for immediate knowledge acquisition due to their structured and content-rich delivery. A quasi-experimental study with nursing students demonstrated that both PBL and lecture-based learning improved post-test scores, but students preferred lecture-based teaching because it provided better immediate knowledge retention.¹⁷ Probably, delivering factual content during lectures enables students to memorize details temporarily. However long term retention is better observed in PBL or when information is delivered using both methods as noticed in our study also (Table-III). While motivation and pleasure with participation tend to be higher in students exposed to PBL, differences in enjoyment between student groups is not statistically significant in our study. The same effect is seen by Arian et al.¹¹ especially problem-based learning (PBL PBL also shows advantages in ethics education by improving moral development and critical thinking compared to lecture-based methods.¹⁸ Overall, evidence supports integrating PBL into nursing curricula enhance practical and communication skills, critical thinking, and confidence.^{12,13,21-23}

Despite these benefits, PBL is not without limitations. It is resource-intensive, requiring trained facilitators, smaller group sizes, and more time for implementation. Additionally, variability in facilitator expertise and group dynamics can influence learning outcomes. Some students may also struggle with the self-directed nature of PBL, especially if they lack prior experience or adequate guidance. In contrast,

traditional lectures are more efficient for delivering large volumes of information within limited time and are easier to standardize across institutions.^{7,9}

Our research showed that after crossover, when both groups have taken PBL and lectures, their performance was much improved. Recent educational research also suggests that a hybrid approach combining PBL and traditional lectures may offer the most effective strategy. Lectures can provide foundational knowledge, while PBL sessions can reinforce and apply that knowledge in clinically relevant contexts. This integrated approach addresses the limitations of each method while maximizing their strengths, leading to improved engagement, deeper understanding, and better learning outcomes.²⁴⁻²⁶

This study demonstrates that PBL leads to superior learning gains compared with lectures, consistent with constructivist learning theory. The crossover design strengthens internal validity by controlling for baseline differences and demonstrating reproducibility of the PBL effect. Notably, final outcomes were comparable, suggesting that exposure to both modalities is beneficial, with a possible sequencing effect where lectures provide scaffolding and PBL enhances application.

A single centered study coupled with limited sample size was some of the limitations that limited the generalizability of the study. Moreover, follow up time period was short and long term retention of knowledge was not assessed. Further multi-centered studies with greater sample size could help in validating the findings of this research.

CONCLUSION

PBL (Problem based learning) is associated with improved knowledge retention, greater perceived benefit, engagement, active participation and motivation as compared to traditional teaching. Exposure to both modalities/ hybrid approach maximizes benefits, leading to deeper understanding and better learning outcomes.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION	
1	Asia Aziz: Conception of idea, study design, acquisition of data, data analysis, drafting.