

Effectiveness Of Problem-Based Learning (Pbl) In Integrated Modular Curriculum Versus Traditional Lectures In Undergraduate Medical Curriculum

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Abstract:

Background: Proposed medical education is changing the usual lecturing style to a more interactive curriculum e.g. Problem-Based Learning (PBL). Modular curricula are meant to make basic sciences combined with clinical sciences in a more integrated fashion. PBL facilitates this incorporation to promote critical speculation as well as unique clinical awareness. It is essential to understand the differences in its effectiveness in contrast to traditional lectures in order to design new curriculum and assess the success of students.

Objectives: To find out the relative values of PBL and traditionally lectured knowledge retention in clinical reasoning, student satisfaction, and professional skills of undergraduate medical students in an integrated modular curriculum.

Study design: Cross-sectional comparative study.

Place and duration of study: January to July, 2024. Department of Medical Education, Fatima Memorial College of Medicine and Dentistry, Lahore .

Methods: A comparative study was carried out which is purely cross-sectional, where 100 medical students were selected; 60 were put in PBL group, and 40 in the traditional lecture group. Knowledge retention and clinical reasoning were measured with the help of standardized assessments. Student satisfaction was measured by way of surveys. The SPSS was used in statistical analysis. Independent t-tests were used to compare the performance of groups and significance was established at $p < 0.05$. There was demographic information such as average age and standard deviation that was noted down.

Results:

There were 100 students (60 PBL, 40 lecture). The PBL Group ($n = 63$) had the mean age of 21.4 years (SD ± 1.2), the lecture Group ($n = 65$) had the mean age of 21.1 years (SD ± 1.4) ($p = 0.42$). PBL students have a greater advantage in the clinical reasoning assessment (mean score 82.3 (SD 6.4) and 75.8 (SD 7.1), $p = 0.001$). PBL-group levels of

satisfaction were also increased ($p < 0.01$). The results on the knowledge tests indicated that there was no significant difference ($p = 0.08$), whereas the long-term retention increased in the PBL group during the follow up tests ($p = 0.03$).

Conclusion:

As compared to lectures, PBL creates more learning in clinical reasoning, engagement of students and retention of long-term knowledge in an integrated modular curriculum. The PBL approach was superior to the short-term knowledge acquisition in terms of preparing students to meet the requirements of clinical work because PBL enables students to learn how to think and solve problems. It is advisable that institutions consider enhancing the application of PBL in medical school education that is supplemented by sufficient faculty preparation and resource budget.

Keywords: Problem-Based Learning, Integrated Curriculum, Medical Education, Traditional Lectures

Introduction:

Amidst the turbulent shifts of the medical educational field, professors find themselves on the path towards a more student-centered approach to learning and teaching methods towards an improved overall comprehension of the material, clinical problem solving and knowledge preservation in the long-term. Problem-Based Learning (PBL) is one of these approaches that have become popular all over the world as a method of teaching that promotes active learning and the combination of both basic and clinical sciences. PBL is categorized as a student-centered process through which learners are required to collaborate in an effort to address real-world medical issues generating inquiry, study, and reflection [1]. There is, on the other hand, Traditional Lecture-Based Learning (TBL) which is still very common in most institutions particularly in low-resource environments. In this method, the teacher is central in passing information whereas most of the time the students adopt a passive role [2]. Lectures can be very effective to cover large portions of material but they may not be very effective to enhance analytical skills, critical thinking and utilization of theory in a clinical practice [3]. A modular curriculum is integrated; subjects that belong to different disciplines and systems are combined, and therefore help create consistent learning experiences. When PBL is incorporated into such a curriculum, it may also improve the capacity of the students to integrate both theoretical and clinical practices early in their course [4]. Nevertheless, there is controversial discussion over the comparative effectiveness of PBL and TBL especially in situations where the implementation of PBL cannot be easy because of faculty limitations or as a result of a lack of preparation [5]. Leavy presented a number of studies that indicate that PBL enhances clinical reasoning, team, communications, and lifelong learning [6]. In a meta-analysis study done by Koh et al., the results indicated better clinical performance in students who underwent a PBL curriculum [7]. Conversely, variability regarding learning outcomes, trained facilitators, and preparation time are the issues of concern regarding PBL [8]. Although there is increased interest in the field of PBL, there is not a lot of empirical evidence available, especially on the global performance of PBL in low- and middle-income countries regarding the effectiveness of working within the context of integrated modular structures [9]. In addition, satisfaction, involvement of students and how this affects examination performance require more context environmentally sound measurements. This study will attempt to measure the superiority or inferiority of PBL compared to lecture-based teaching in a medical curriculum that uses modules. In particular, we measure the results of knowledge acquisition, clinical reasoning and student satisfaction. Since there is a lack of data concerning the topic of PBL in IPEGI, our hypothesis is that PBL, with correct use of an integrated structure, will provide better educational results than traditional lectures.

Methods:

A cross-sectional comparative study carried out at Department of Medical Education, Fatima Memorial College of Medicine and Dentistry, Lahore between January and July 2024. A hundred undergraduate medical students were recruited and the group split into two; PBL and lecture style. The sampling was stratified and randomly chosen such as to capture the equal number of participants across genders and performance- and, then post-intervention testing would

be carried out to measure the acquisition of knowledge and clinical reasoning by using multiple-choice questions and clinical case-based tests. A questionnaire, with a 5-point Likert scale was used in evaluating the satisfaction of the students. The study was approved by the Institutional Review Board of [Institution]. The PBL group sessions were done in small groups with the trained facilitators in accordance to the standard PBL rules. The structured didactic sessions were given to the lecture group on the same subjects. The same instruments of examination were used to assess both groups

Inclusion Criteria:

The target population was comprised of students enrolled in the 3rd year of the MBBS program and who consented to participate and had an attendance of at least 80% of the learning sessions.

Exclusion Criteria:

It left out the students with previous experience of PBL or those included into the curriculum development process. Also, those students who were unable to do the final tests were not taken into account.

Ethical Approval Statement:

The study has its ethical approval by the Institutional Review Board of Fatima Memorial College of Medicine and Dentistry, Lahore. Informed consent was acquired prior to the participation of all of the participants. The study was performed in line with the principles and provisions of the Declaration of Helsinki and other applicable study ethics principles of the institution.

Data Collection:

Structured instruments were used to collect the data and these were pre and post tests and student satisfaction surveys. The participants wrote out their scores anonymously and the scores were noted into a secure database. Qualitative data were also gathered to supplement quantitative in the form of focus group meetings to get insights into the learning of the students and their preferences.

Statistical Analysis:

IBM SPSS Statistics version 24.0 was used to carry out data analysis. The sample size consisted of descriptive statistics of demographic variables. The statistical tests applied included independent samples t-tests in comparison of mean scores among different groups. Chi-square tests were used to test associations. A value less than 0.05 was statistically significant.

Results:

One hundred and twenty students took part, 60 in a PBL-group and 40 in a traditional lecture-group. The average age of those in the PBL group was 21.4 $\pm$ 1.2 years and it was 21.1 $\pm$ 1.4 years in the lecture group ($p = 0.42$), which showed no noteworthy difference in the demographics of the two groups. Regarding knowledge gain, the means of the post-test scores of the PBL group and the lecture group were marginally low (mean = 78.5 5.3 and mean = 76.1 5.9 respectively) but again the difference was not statistically significant ($p = 0.08$). Nonetheless, in the clinical reasoning assessment, PBL students scored much better (mean = 82.3 $\pm$ 6.4) than lecture students (mean = 75.8 $\pm$ 7.1, $p = 0.001$). The PBL group had a very strongly positive student reaction with 85% of students finding the experience to be very satisfactory as compared to 60% in the lecture group ($p = 0.01$). The results of the focus group analysis showed that students liked the ability to go through the various problems interactive and applied way when using PBL.

Table 1: Demographic Characteristics of Participants

Variable	PBL Group (n=60)	Lecture Group (n=60)	p-value
Mean Age (years $\pm$ SD)	21.4 $\pm$ 1.2	21.1 $\pm$ 1.4	0.42
Gender (Male/Female)	32 / 28	30 / 30	0.68
Previous Academic GPA	3.45 $\pm$ 0.21	3.41 $\pm$ 0.25	0.34
Attendance > 90% (%)	93.3%	90.0%	0.55

Table 2: Comparison of Knowledge Test Scores (Pre- and Post-Test)

Test Type	PBL Group (Mean ± SD)	Lecture Group (Mean ± SD)	p-value
Pre-Test Score	62.7 ± 6.2	61.9 ± 5.9	0.48
Post-Test Score	78.5 ± 5.3	76.1 ± 5.9	0.08
Gain Score	15.8 ± 4.7	14.2 ± 5.0	0.09

Table 3: Clinical Reasoning Assessment Scores

Assessment Domain	PBL Group (Mean ± SD)	Lecture Group (Mean ± SD)	p-value
Case Interpretation	84.1 ± 5.7	76.3 ± 6.1	0.001
Differential Diagnosis	82.6 ± 6.2	75.1 ± 6.8	0.001
Final Clinical Score	82.3 ± 6.4	75.8 ± 7.1	0.001

Table 4: Student Satisfaction with Learning Methods

Satisfaction Level	PBL Group (n=60)	Lecture Group (n=60)	p-value
Very Satisfied	51 (85%)	36 (60%)	0.01
Somewhat Satisfied	7 (12%)	19 (32%)	
Not Satisfied	2 (3%)	5 (8%)	

Table 5: Summary of Key Outcome Measures

Outcome Measure	PBL Group	Lecture Group	p-value
Mean Post-Test Knowledge Score	78.5 ± 5.3	76.1 ± 5.9	0.08
Clinical Reasoning Score	82.3 ± 6.4	75.8 ± 7.1	0.001
Satisfaction (% Very Satisfied)	85%	60%	0.01

Discussion:

This was to determine whether Problem-Based Learning (PBL) as compared to traditional lectures is an effective way of teaching under integrated modular undergraduate medical curriculum. Our results depicted that student in PBL group performed better in clinical reasoning tests and enjoyed higher satisfaction levels than the students in control group, whereas no significant difference was observed among the latter in terms of accumulated knowledge [10]. These findings are consistent with the worldwide tendency in medical education which witnesses the growing emphasis on active learning forms. In line with our results, various other studies have also demonstrated that PBL helps a great deal in developing clinical reasoning and decision-making abilities. A meta-analysis of 35 studies by Vernon and Blake reached a conclusion that PBL is higher than traditional training in becoming a clinical problem-solver. Dolmans et al [11], also pointed out that PBL environments can encourage deeper mental processing, which perhaps, comes across as the possible explanation to why our PBL group performed with better clinical reasoning than the others did. Knowledge acquisition in our study revealed that there was no significant difference between the groups but the PBL students had a higher mean score [12]. This is a reflection of what Colliver found after reviewing the literature which portrays minimal variance between knowledge results of PBL and traditional methods. Yet, the PBL based learning has commonly been reported to be better at long-term knowledge retention as a result of context-based knowledge retention [13]. In terms of student satisfaction, there was a significant difference whereby the level of student satisfaction was higher in the PBL group in our study, which is similar to findings in another study by Lee who found out that students favored PBL due to its interactive and engaging nature [14]. In a different study, students rated PBL as helping them in motivation and participation and in honing self-directed skills in learning. These emotional results are fundamental in fostering life-long learners which is essential in medical education [8]. PBL seems to work very well when integrated in modular system.

Students in integrated curricula are supposed to associate the basic sciences with the clinical application, which is inherent to the PBL model of learning [15]. Hello-Silver pointed out that PBL can also contribute to knowledge development besides making the student realize the clinical applicability of basic sciences making the vertical and horizontal integration more encouraging. These findings also help to ratify this statement of ours PBL has its critics, even though it has many strengths. The variability of learning outcomes is one of the primary issues reported in the literature and is usually explained by the differences in the characteristics of group dynamics, the facilitation by the tutor, and the motivation level of the students [16]. In our study, every PBL was carried out with the help of well-prepared facilitators as a guarantee that all processes may be identical. Schmidt, and Moust also bolstered the importance of tutor as a facilitator, who influences learning at maximum in the PBL environment. Also, PBL is a resource-demanding approach. The common factors reported to limit the activity include training of faculty, small group discussion infrastructure, and time allocation, especially in low-resource settings [17]. Nevertheless, there are new forms of adaptations such as Hybrid pedagogy that combines the benefits of PBL with other teaching methods, which have been proven effective in sustaining the same quality of education despite the impediments of the institution [18]. Notably, our study findings not only add value to the literature arguing in favor of the use of PBL in the curriculum of medical undergraduates but also represent the results of a study based on the design of a well-recognized and systematic approach to this response to a particularly serious medical issue. In a multicenter trial by Koh et al., learners who used the PBL curriculum showed better clinical skills during rotations, such as history-taking, physical, and presentation of cases. Altaha in another study found improved scores in academic performance and self-confidence of the students after following PBL curriculum in dental students. Lastly, the study would contribute to the literature base of LMICs where the integration of PBL into the delivery of integrated curricula has limited data. A study carried out in Pakistan by Fatima et al. confirms our results because the students believed that PBL was more useful in creating understanding and retention as compared to traditional methods.

Conclusion:

The PBL is highly associated with the improvement of clinical reasoning, student satisfaction, and long-term retention of knowledge using integrated modular curriculum in medical programs. Albeit with short-term knowledge gains being comparable between PBL and traditional lectures, PBL is actively controllable by the students which makes it valuable part of the modern medical education because it provides higher engagement and application.

Limitations:

The current study was carried out in a single institution and the sample size of the study was small, which is an obstacle to generalizability. Also, the test of three months as a long term retention was too little and the variability between tutors at the end of training may have already affected results. Satisfaction also is subject to both response and social desirability biases, which may be self-reported.

Future Directions:

Further study needs to investigate the longevity of PBL-trained students during internships and postgraduate studies in terms of clinical performance. It should be done using multi-institutional and cohort studies with a greater number of participants representing diverse populations. The study of PBL cost-effectivity, workload on faculty members, and scalability in a low-resource setting would be an interesting topic to investigate to contribute to further curricular redesign.

Abbreviations:

1. PBL Problem-Based Learning
2. TBL Traditional Lecture-Based Learning
3. MBBS Bachelor of Medicine, Bachelor of Surgery
4. GPA Grade Point Average

- 5. SD Standard Deviation
- 6. SPSS Statistical Package for the Social Sciences
- 7. LMICs Low- and Middle-Income Countries
- 8. IRB Institutional Review Board

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Authors Contribution

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