



EFFECTIVENESS OF PROBLEM BASED LEARNING IN IMPROVING STUDENTS' ACADEMIC PERFORMANCE IN PATHOLOGY

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ABSTRACT **Background:** New learning strategies are being adopted to develop competent medical graduates through the acquisition of knowledge integrated with clinical and attitudinal skills. For this, various teaching learning methods (TLMs) are required to focus learner centric, multidisciplinary problem base approach towards learning. **Objective:** The objectives of the study were 1. To compare the learning outcomes of problem based learning (PBL) and tutorial learning methods in Pathology among phase II MBBS students. 2. To assess the students' perception towards PBL method. **Methods:** The study was conducted in the Department of Pathology in a tertiary care teaching institute for a period of four months from September to December 2024. A total of 77 students were divided in A, B and C batches. Each batch was divided into two groups as A1 and A2, B1 and B2 and C1 and C2, by convenient sampling. For topic 1, problem based learning was given to A1 batch and tutorial teaching to A2 batch. In the next weeks' session, crossover of the batches was done. A total of six topics were taught in a similar way for all A, B and C batches. Post-test evaluation scores were compared between the two groups. Feedback was obtained from students using a validated structured questionnaire. **Results:** The mean post test scores (PBL-18.2 and TL- 19.8) were significantly increased when compared to the pre-test scores [(PBL- 12.8 and TL-13.4)(p value < 0.001)] in both the TLMs. The post-test scores of the tutorial method was significantly higher than PBL (p value < 0.001), while there was no statistically significant difference in knowledge retention test scores. Majority of the students showed positive perception towards problem based learning method. **Conclusion:** It is recommended that both TLMs can be incorporated into traditional methods to reinforce and produce better academic results and carry equal weightage in curriculum.

KEYWORDS : Teaching learning methods, Problem based learning, Tutorial method, Pathology

INTRODUCTION

Problem based learning (PBL) is a student-centered, multidisciplinary approach to learning that can improve understanding, knowledge retention, and development of lifelong learning skills when compared to the traditional teaching model.^{1,3} This method of learning encourage students to get motivated, build on existing gaps in knowledge frameworks and thereby develop skills and attitudes such as teamwork, communication, critical thinking, self-directed learning and also use of resources for their future practice, rather than simply implanting knowledge and skills with the traditional tutorial teaching. With the introduction of Competency-Based Medical Education, newer teaching learning strategies are inevitable to improve students' performance with the changing assessment methods and applications in clinical practice. The purpose of this study was to assess the effectiveness of PBL over the tutorial learning (TL) method by comparing the learning outcome as measured by post test scores of students following PBL method of learning in Pathology among phase II MBBS students and to assess students' perception towards PBL as a new teaching learning method.

MATERIALS AND METHODS

A Comparative interventional study was conducted in the Department of Pathology, Sree Uthradom Thirunal Academy of Medical Sciences, Thiruvananthapuram, Kerala among Phase II MBBS students for a period of four months from September to December 2024 after obtaining approval from the institutional ethics committee. A total of 77 students were included in the study after excluding the students absent for post tests or knowledge retention tests. A written informed consent was taken from the students before the conduct of study.

There were a total of 77 students attending practical classes on 3 days in A, B and C batches. Each batch was divided into two groups as A1 and A2, B1 and B2 and C1 and C2, by convenient sampling. Faculty members were instructed about the two methodology of teaching, namely problem based learning and tutorial method of learning and a time table was prepared accordingly. For topic 1, problem based learning (PBL) was given to A1 batch and tutorial teaching to A2 batch. In the next weeks' session, crossover of the batches was done. Similarly a total of six topics was selected that was taught by both PBL and tutorial methods for all A, B and C batches. The schematic representation is given in Figure 1a.

Problem Based Learning (Figure 1b)

Each session of PBL guided by faculty in charge, started with a pre-test of multiple choice questions (MCQs) to assess the baseline knowledge of students regarding the assigned topic. The students were then given problem cases and case scenarios to identify and define their own learning objectives. A free time of 1 hour were given for independent, self-directed study using a variety of resources before returning to the

sessions to share, discuss, and refine their acquired knowledge. The students then wrote a post test of MCQs.

Tutorial Learning (Figure 1c)

In tutorial teaching, the same pre-test MCQs were given. An introduction followed by discussion on the topic was conducted by a faculty in charge. The faculty interacted with the students, asked questions, cleared doubts and promoted advanced learning in a 1 hour discussion which was followed by a post test MCQ exam. Attendance of students in each session were noted.

To assess knowledge retention, a MCQ based test was conducted after 2 weeks of completion of the classes. In all the tests, the highest score was 30 and the lowest score was 0. A score of 0–10 was interpreted as poor knowledge, while 11–20 as average and a score of 20-30 as good knowledge. Feedback questionnaire was given to assess students' perception and receptiveness towards PBL.

Statistical Analysis

The mean scores of the pre test, post tests and the knowledge retention tests between and within the groups was compared using Unpaired t-test and Students' paired t- test respectively. A p value < 0.05 was considered statistically significant. Jamovi Version 2.5 was used for statistical analysis. The feedback questionnaire form to assess students' perception towards PBL used,^{4,5} was assessed by a 5 point Likerts' scale.

RESULTS

Of the 77 students participated in the study, 58 were girls and 19 were boys. Distribution of students based on their level of knowledge in problem-based learning methods and tutorial methods is given in Table 1a. The mean scores of pre-test, post-test and knowledge retention test scores of TL and PBL are given in Table 1b. The post test scores (mean scores of PBL-18.2 and TL- 19.8) were significantly increased when compared to the pre-test scores [mean scores of PBL- 12.8 and TL-13.4)(p value < 0.001)] in both the teaching learning methods (TLMs; Figure 2A and 2B). When comparing the two TLMs, the post-test scores of the tutorial method was significantly higher than the PBL (p value < 0.001; Figures 3A and 3B). The knowledge retention test scores were however less than the post test scores of both the TLMs (p value < 0.001); there was no statistically significant difference in knowledge retention test scores when comparing the two TLMs. Comparison of post test scores for various topics following PBL and TL method are given in Figure 3c. Around eighty percent of the students positively agreed to the learning method of PBL (Figure 4).

DISCUSSION

This study was conducted to compare the learning outcomes of problem based learning (PBL) and tutorial learning (TL) methods.

Both TLMs were effective in improving the cognitive scores as seen in the statistically significant increase in the post test scores when compared to the pre-test scores. On comparing the two TLMs, the post-test scores of TL method was significantly higher than that of PBL and there was no statistically significant difference in knowledge retention scores between the two methods. However, the majority of the students agreed that PBL improved their learning motivation, critical thinking, understanding, and better communication skills with their peers.

The above observations are similar to that of Khan SP et al. where in the tutorial sessions were found very effective while at the same time found PBL more significant in understanding concepts of medical curriculum.⁶ A study conducted by Shruthy KM et al. in 2021 also reported knowledge acquired in both TL and PBL methods were significant.⁴ However, the knowledge gained in PBL was significantly higher ($P=0.001$) than from tutorials. In the same study, seventy six percent of students preferred and accepted PBL as a better teaching methodology.

Several studies have reported various differences between the two TLMs.⁷⁻¹² The open-ended nature of the PBL process makes PBL a less efficient way to learn, but it is precisely this quality that commends it for teaching the good scoring students, providing them with a rich context and great depth of knowledge.¹³ Norman and Schmidt, in their review, found several studies supporting improved retention of knowledge with PBL.⁸ In the present study, knowledge retention scores were comparatively less than the post test scores in both the methodologies but there was no statistical difference. Three other reviews found PBL students scored lower in basic sciences or knowledge.⁵⁻⁷ In the same study series, it was observed that PBL students scored comparably or better than traditionally taught peers in clinical skills, probably because clinical problems provide the basis for learning in PBL. There are other studies that have reported increased diagnostic skills, humanistic and psychosocial skills, and better relational skills with PBL.^{16,13} Berkson found no difference in her review. Thus there is no consensus of evidence to support the superiority of PBL over traditional methods of knowledge acquisition.¹²

In PBL sessions, real word problems are used to promote student learning of concepts and principles as opposed to direct presentation of facts and concept in traditional tutorial methods. By this method, students learn problem solving skills, increase their critical thinking and better communication through interacting with their peers. The origin of their thinking starts from doubts arising from specific case scenarios, activating their prior knowledge, find resources to understand the case scenario, evaluate research materials, and engage in life-long learning.

Tutorial sessions have been a beneficial teaching learning tool for basic sciences of medical education and these sessions impart better understanding of the topics in each module. By conducting tutorial sessions to a small group of students, students are taught to develop and assess their extent of background knowledge, which enables them to properly understand concepts which may not have been understood in lectures. One reason why TL methods get an upper-hand is that a faculty in-charge is available to guide the sessions. They direct the students towards the learning objectives and help the students to identify the important areas of learning. They impart the text book written information in a simpler, easier and effective way. Tutorial method ensure understanding of a specific concept or skill, particularly when there are significant gaps in prior knowledge. The disadvantage of TL over PBL is that TL sessions are less interactive, no communication between peers and the students have less opportunity for self directed learning and more teacher directed.

In PBL sessions, guided by a faculty in-charge, allow effective group dynamics to develop. The in-charge faculty facilitates the learning process, ensures that the student group achieves appropriate learning objectives, promotes self-directed learning, encourages students to check their comprehension of the case material, encourages the students to engage in open conversation with the faculty and with other members in the group. PBL discussions differ from other small groups by the fact that the faculty has to push the students to the edge of their knowledge, setting the scene for further relevant learning. Limitations with PBL is that this methodology is more applicable to clinical cases and less to basic sciences and here the TL has an advantage. PBL needs more preparatory material, time and learning resources compared to the tutorial method which needs only an expert facilitator.

Students report high satisfaction ratings for PBL,¹⁴ and prefer small group learning,^{1,15} and four reviews also suggest that it is more enjoyable.^{6,11} In the present study also, although the TL method was effective in better academic performance, students' satisfaction for PBL was commendable. Few studies have reported that similar satisfaction was not seen when faculties are asked for feedback.¹⁶ This may be because of more workload on faculties, more time for preparing teaching material, more number of faculties needed because of small groups, faculties not well trained or sensitized to the new teaching modality and lack of administrative support. PBL methodology implies more human and material resources. The lack of experience in guided self-learning by faculties requires more training. Other disadvantages reported are the clinical problem solving is less important for preclinical medical students, and self-directed learning may not be useful for preclinical students. Preclinical students need to be thorough with the basic sciences which need a proper guidance by faculties.

The limitations noted in the present study was, when the faculties prepare the MCQs, in TL methods the faculty in charge drive towards the important points of the topic which will increase the post-test scores. Researcher bias was also noted which can affect the post test scores of some topics. A blinded study where the faculties and researcher are not aware of which session of TLM is conducted can reduce this bias.

CONCLUSION

In the present study, both PBL and TL were effective in increasing the post test scores. Although TL was more effective than PBL, the majority of the students had a positive perception towards PBL. It is recommended that both methods can be incorporated into the traditional methods to reinforce and produce better academic results and carry equal weightage in curriculum. Knowledge, skill and communication acquired through both the TLMs are required in the medical profession. It is likely that in the future the new generation medical students and faculties, trained in schools with digital tools, technologies and methodologies, will feel more comfortable with methodologies more like PBL. Assessments of TLMs should include not only the test scores but also the students feedback on the process of learning.

Table 1a: Distribution Of Students Based On Their Level Of Knowledge In Problem-based Learning Method And Tutorial Methods

Level of knowledge	Problem based learning	Tutorial method
Poor (0-10)	0	2
Average (11-20)	46	48
Good (21-30)	31	27

Table 1b: Comparison Of Student's Knowledge In Problem-based Learning Group And Tutorial Group

Group	Mean scores			Knowledge retention test
	Pre-test	Post -test	p value	
Problem based learning	12.8 (Range: 2-26)	18.2 (Range: 6-28)	$p < 0.001$	15.6 (Range: 4-28)
Tutorial	13.4 (Range: 2-24)	19.8 (Range: 12-28)	$p < 0.001$	16.4 (Range: 8-28)

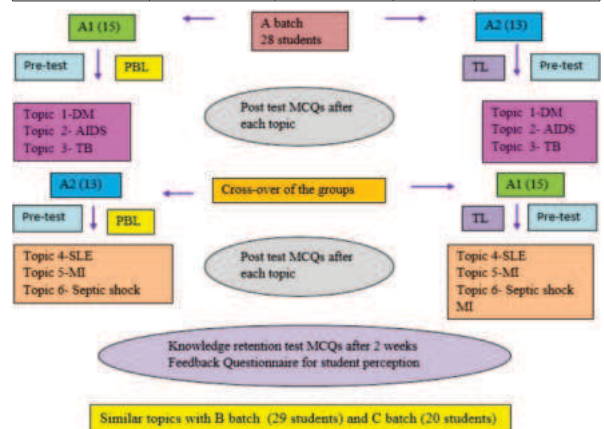


Figure 1a: Schematic Representation Of Methodology

Note: Topics 1- DM (Diabetes Mellitus), Topic 2-AIDS (Acquired

Immunodeficiency Syndrome), Topic 3-TB (Tuberculosis), Topic 4-SLE (Systemic Lupus Erythematosus), Topic 5-MI (Myocardial Infarction) and Topic 6- SS (Septic shock)

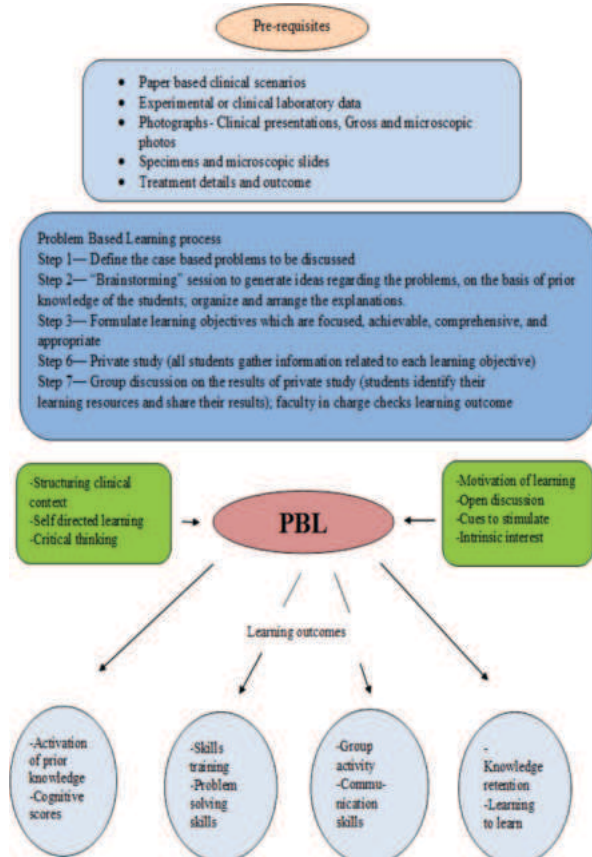


Figure 1b: Schematic Representation Of Problem Based Learning

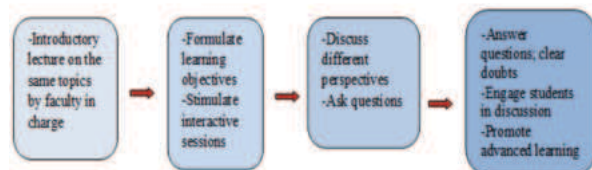
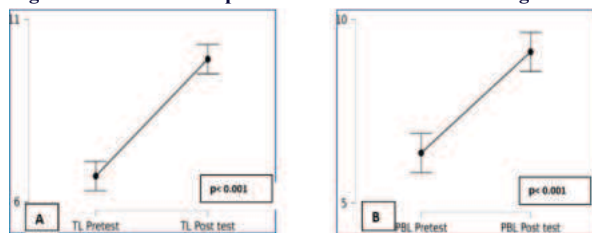
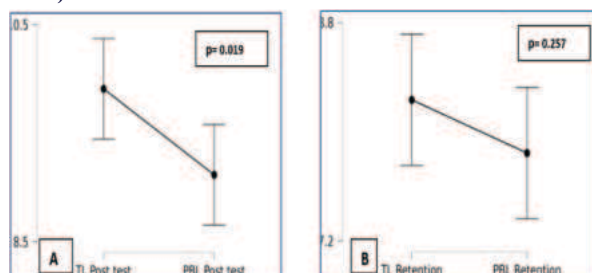


Figure 1c: Schematic Representation Of Tutorial Learning



Figures 2a And 2b:- The Post Test Scores Were Significantly Increased When Compared To The Pre-test Scores (p Value < 0.001) In Both The TLMs.



Figures 3a And 3b:- When Comparing The Two TLMs, The Post-test Scores Of The Tutorial Method Was Significantly Higher Than The PBL (p value < 0.001) And The Difference In The Knowledge Retention Test Score Was Not Statistically Significant.

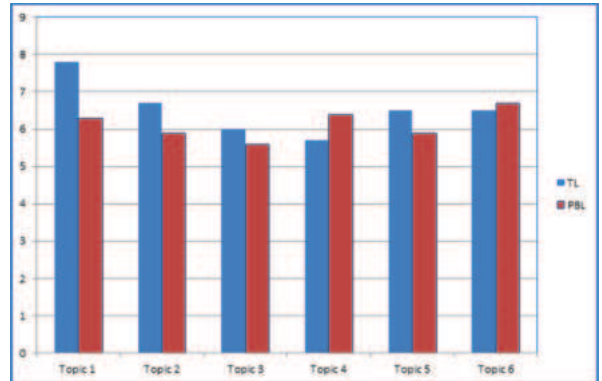


Figure 3c: Comparison Of Post Test Scores For Various Topics Following PBL and TL Method

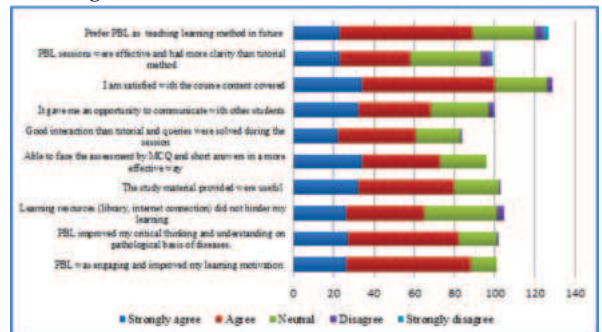


Figure 4: Distribution Of Study Subjects On The Basis Of Perception Towards PBL Using Likert's Scale

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