

Original Research Article

A QUASI-EXPERIMENTAL STUDY ON THE EFFICACY OF PROBLEM BASED LEARNING AND SMALL GROUP DISCUSSION IN TRAINING CLINICAL SUBJECTS IN MEDICAL UNDERGRADUATES

Shameer Ismail¹, Arun Aravind², Aswin B Nair T U³

¹Associate Professor, Department of Orthopaedics, Dr Moopen's Medical College, Wayanad, India.

²Associate Professor, Department of Anaesthesiology, Dr Moopen's Medical College, Wayanad, India.

³Assistant Professor, Department of Orthopaedics, Dr Moopen's Medical College, Wayanad, India.

Received : 09/04/2025
Received in revised form : 03/06/2025
Accepted : 20/06/2025

Corresponding Author:

Dr. Shameer Ismail,
Associate Professor, Department of
Orthopaedics, Dr Moopen's Medical
College, Wayanad, India.
Email: fritz4u@gmail.com

DOI: 10.70034/ijmedph.2025.3.3

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (3); 12-16

ABSTRACT

Background: Student-centric teaching methods like Problem-Based Learning (PBL) and Small Group Discussions (SGD) focus on interactive, particularly beneficial in teaching clinical medical subjects. These methods help in developing diagnostic and decision-making skills which are essential in clinical practice. However, literature comparing the efficacy of these methods in undergraduate clinical teaching is limited.

Materials and Methods: A quasi-experimental study was conducted among 124 final-year MBBS students at Dr Moopen's Medical College, Wayanad, from October to December 2024. Students were divided into PBL (n=61) and SGD (n=63) groups based on roll numbers. Each group underwent three sessions on topics: Rickets, Osteosarcoma, and Osteomyelitis. Pre-tests and post-tests (MCQs) were used to assess knowledge gain and a Likert scale evaluated student perception. Data was analyzed using paired and unpaired t-tests with SPSS v26. A p-value < 0.05 was considered significant.

Results: Pre-test scores were comparable between groups except for Osteomyelitis, where SGD scored higher (p=0.012). Both groups showed statistically significant improvements from pre- to post-test scores across all topics (p<0.001). Post-test comparisons between PBL and SGD revealed no significant differences between these two groups indicating both methods were equally effective. More than 90% of students reported improved understanding, engagement, critical thinking, and overall satisfaction with both methods.

Conclusion: Both PBL and SGD are effective teaching-learning methods for clinical subjects in undergraduate medical education, promoting knowledge application to real-time clinical scenarios, and enhancing collaborative and problem-solving skills.

Keywords: Problem Based Learning, Small Group Discussion, Medical education, Undergraduate teaching, Learning outcomes

INTRODUCTION

Ever since the concept of student centric teaching methods have been in evolution, multiple Teaching Learning (TL) methods have emerged, focusing on interactive, collaborative and experiential learning. Prominent among them are the Problem Based Learning and Small Group Discussions.^[1] Teaching clinical subjects is basically transferring the ability

to diagnose and decide management of various diseases, for which didactic lectures does not meet the need or make the students capable enough to deal with the complexities of real time clinical scenarios. Hence it is the need of the hour to shift from the traditional teacher centric lectures to the self-directed student centric teaching.

Small Group Discussions (SGD) and Problem Based Learning (PBL) are the two widely accepted and

easily implementable teaching learning methodology for small group teaching. Each of the two methods are well known for the active participation of the learners, stimulates thinking and collaborative learning. SGD portrays the merits of interaction among the peers, exchange of concepts and in-depth knowledge through facilitated discussions.^[2] PBL fosters student driven inquest in to the problem and promoting learners,^[1] to solve the problem by not losing the “knowledge “domain of learning.^[3] A few commendable demerits are unequal participation.^[4] Time intensive where time for preparation is huge factor straining faculty resources and scheduling, facilitator related issues.^[5] Disadvantages of PBL includes time consuming process,^[1] Unequal participation and the success of the program depends on group dynamics where effective communication and successful collaboration is the key.

For our study we took orthopedics as the clinical subject to compare the two-teaching methodology evaluation which include both theoretical knowledge and practical skill. In orthopedics, decision making skills holds the priority, which requires integration of anatomical, biomechanical and clinical knowledge. With these two methods, the theoretical knowledge and practical skills are well aligned by virtual case scenarios promoting critical thinking.

There are paucity of literature suggesting which teaching learning methodology is more effective in teaching clinical subjects in medical undergraduates. So this study was aimed at evaluating the efficacy of Problem Based Learning and Small Group discussions in improving learning outcomes of medical undergraduates.

Research Question

Does the use of PBL and SGD in medical education improve medical undergraduates’ ability to: Apply knowledge to clinical scenarios, analyze complex clinical cases, develop effective treatment plan and collaborate with peers in team-based setting.

Review of Literature

Medical education had been in evolution since the last few years. During its evolution, focus was on active learning strategies and to replace the traditional lecture-based methods. The first ever university to introduce PBL was at McMaster University which was in the 1960s. This has triggered its use widely in medical education (Barrows and Tamblyn, 1980).^[8] It is a learner centric method of teaching, where virtual clinical scenarios are used to drive self-directed learning, promote critical thinking and portrays life leaning attitudes among the learners (Hmelo-Silver, 2004,^[6] Dolmans et al., 2005). PBL has been particularly considered meritorious in the ability to narrow the gap between basic sciences and clinical practice. Choudhury et al. (2015),^[3] reported that the clinical decision making and managing patients were better with the residents trained with PBL. But no reliable

evidence or studies available for undergraduate students.

SGD is yet another active Teaching Learning method, which is known for peer interaction and collaborative learning. Students in SGD get to understand the subject in depth, healthy arguments with their peers and finally coming to a reasonable conclusion. But the facilitator plays an important role in making sure to guide discussions in the right path and that the learning objectives are dealt with. (Steinert, 2004).^[15] Studies on advantages of SGD in medical education particularly better communication skills, team work and better understanding of clinical concepts. (Vasan et al. 2008-meta-analysis).^[16]

Both PBL and SGD has its merits and demerits. While SGD is more for interactive and facilitated discussions, whereas PBL provides a platform for self-directed learning and knowledge integration. Schimdt et al. 2011,^[2] reported that PBL displayed independent learning skills while SGD fostered excellence in collaborative and communicative skills. Traditional teaching methods have proven its failure, particularly in orthopedics in engaging students actively or to bridge the gap between theoretical knowledge and clinical scenarios. Ghanem et al. 2016,^[11] showed that SGD and PBL profoundly improved critical thinking and satisfaction in the teaching of musculoskeletal system. Incorporating PBL and SGD will help enhance development of skills, knowledge and attitudes.

But SGD and PBL are not without challenges, particularly limited resources and facilities, lack of trained faculties and student variabilities in participation.

Objectives

Primary objective: To compare the learning outcomes of PBL method versus SGD in training undergraduates in orthopedics using pretest and post-test.

Secondary objective: To determine the students' perception using Likerts scale for the two teaching Learning methods

MATERIALS AND METHODS

Study design: Quasi- experimental design

Study setting: Demo room department of Orthopedics Dr. Moopen’s medical college, Wayanad.

Study period/duration: 3 months from October 2024 to December 2024 after obtaining IEC clearance

Study participants: Phase III part 2 MBBS students.

Inclusion Criteria: All the students of final year MBBS were included

Exclusion Criteria

1. Additional batch repeat students were excluded as they would have already been exposed to the topics earlier or from peers
2. Students who failed to answer the questionnaires at the end

Sample size: 124 students from final year MBBS.

Methodology

After getting approval from institutional research committee and institutional ethics committee, students who gave consent for participation were divided into multiple groups each consisting of 6 members with consecutive roll numbers. All the even roll numbers were grouped for PBL and the odd numbers for SGL. A total of 124 students participated in the study, with even roll numbers assigned to the Problem-Based Learning (PBL) group (n = 61) and odd roll numbers assigned to the Structured Group Learning (SGL) group (n = 63). They were exposed to 3 sessions of PBL and SGL. Sessions were repeated for the batches till the study period ends. A pre-test was conducted to assess their baseline knowledge on the topic before the TL method. Subsequently a post-test after the assigned teaching learning method for assessing the scores. Both the tests were of multiple-choice questions type. The mean average was taken to decide which of the two will be the better TL method among the two (PBL/SGL). Likert Scale was used to assess students' perceptions after the TL session.

Topics included were Tumors (Osteosarcoma), Infection (Osteomyelitis) and metabolic bone diseases (Rickets). Data was collected using pre structured questionnaire and entered in Microsoft Excel chart and data analysis was carried out using SPSS 26.0v. Mean of the scores were calculated and the groups were compared using unpaired T test. To compare the pretest and post test scores within the same group paired T test was used. A P value of <0.05 was taken as significant.

RESULTS

Pre-test scores were compared between the two groups using an independent t-test (Table 1). The results showed no significant difference in the mean scores for Rickets (p = 0.647) or Osteosarcoma (p = 0.389). However, a statistically significant difference was observed in the pre-test scores for Osteomyelitis, with the SGL group scoring higher than the PBL group (p = 0.012). This difference may be attributed to the relative ease of understanding the topic of Osteomyelitis.

Paired t-tests were used to analyze the improvement within each group for all the three topics. Both the PBL and SGL groups demonstrated significant improvements in post-test scores compared to pre-test scores, with p-values < 0.001 for all topics (Table 2).

1. For the PBL group:

- Rickets: The mean score increased from 5.21 ± 2.32 to 6.87 ± 1.89 .
- Osteosarcoma: The mean score improved from 6.07 ± 1.58 to 7.25 ± 1.14 .
- Osteomyelitis: The mean score rose from 4.84 ± 2.06 to 7.64 ± 1.25 .

2. For the SGL group:

- Rickets: The mean score increased from 5.03 ± 2.08 to 6.90 ± 1.78 .
- Osteosarcoma: The mean score improved from 6.32 ± 1.66 to 7.35 ± 1.05 .
- Osteomyelitis: The mean score rose from 5.79 ± 1.90 to 7.47 ± 1.33 .

Post-test scores were compared between the PBL and SGL groups using an independent t-test (Table 3). The results indicated no significant difference in the mean scores for Rickets (p = 0.913), Osteosarcoma (p = 0.600), or Osteomyelitis (p = 0.462), suggesting that both teaching methods were equally effective in enhancing student knowledge.

More than 90% of the participants agreed that both the methods helped them understand the concepts, actively engage in the learning process, linking theoretical knowledge to clinical scenarios, encouraged collaborative discussions, critical thinking and problem solving, retain and recall, application of knowledge and overall satisfaction.

Table 1: Comparison of pretest scores of different topics between PBL and SGL groups

	Group	n	Mean \pm SD	t - value	p - value (independent t-test)
Rickets Pre – test	PBL	61	5.21 ± 2.32	0.459	0.647
	SGL	63	5.03 ± 2.08		
Osteosarcoma Pre - test	PBL	61	6.07 ± 1.58	0.864	0.389
	SGL	63	6.32 ± 1.66		
Osteomyelitis Pre – test	PBL	61	4.84 ± 2.06	2.548	0.012
	SGL	63	5.75 ± 1.92		

Table 2: Comparison of mean scores in pretest and post-test in PBL and SGL groups

GROUP		n	Score Mean \pm SD	t - value	Paired t test P- Value
PBL	Rickets Pre Test	61	5.21 ± 2.32	4.702	< 0.001
	Rickets Post Test	61	6.87 ± 1.89		
	Osteosarcoma Pre test	61	6.07 ± 1.58	5.337	< 0.001

SGL	Osteosarcoma Post Test	61	7.25 ± 1.14	8.462	< 0.001
	Osteomyelitis Pre Test	61	4.84 ± 2.06		
	Osteomyelitis Post Test	61	7.64 ± 1.25		
	Rickets Pre Test	63	5.03 ± 2.08	5.061	< 0.001
	Rickets Post Test	63	6.90 ± 1.78		
	Osteosarcoma Pre test	63	6.32 ± 1.66	3.925	< 0.001
SGL	Osteosarcoma Post Test	63	7.35 ± 1.05		
	Osteomyelitis Pre Test	62	5.79 ± 1.90	6.237	< 0.001
	Osteomyelitis Post Test	62	7.47 ± 1.33		

Table 3: Comparison of post test scores between PBL and SGL groups

	Group	n	Mean ± SD	t - value	p – value (independent t test)
Rickets Post Test	PBL	61	6.87 ± 1.88	0.109	0.913
	SGL	63	6.90 ± 1.79		
Osteosarcoma Post Test	PBL	61	7.25 ± 1.14	0.526	0.600
	SGL	63	7.35 ± 1.05		

Table 4: Comparison of perception using Likhert's scale between PBL and SGL groups

Statement	PBL group (%)			SGD group (%)		
	Agree	Disagree	Neutral	Agree	Disagree	Neutral
1.Clarity & understanding	98	1	1	95	0	1
2.Engagement	95	1	4	96	2	2
3.Clinical relevance	93	1	6	90	1	9
4.Peer interaction	94	1	5	94	0	6
5.Critical thinking	94	1	5	86	2	12
6.Retention of knowledge	91	2	7	90	1	9
7.Confidence	88	1	11	88	2	10
8.Satisfaction	97	1	2	93	0	7

DISCUSSION

The study was intended to assess the efficacy of problem based learning and small group discussions in the training of clinical subjects using the subject Orthopedics among the undergraduate students. Various studies on student centric methods had been published showing good results in terms of self-directed learning, promoting critical thinking and lifelong learning attitudes. (Barrows and Tamblyn, 1980; Hmelo-Silver, 2004; Dolmans et al., 2005). Individual studies on PBL (Choudhury et al. (2015)) and SGD (Steinert, 2004, Vasan et al. 2008-meta-analysis)) are highlighted in literature

The key highlight of this study was this education methods provided a better teaching method and environment which was easy to adopt and implement. The findings from the study showed that the PBL and SGD are good TL methods effective in teaching orthopedics among undergraduate students, both showing significant improvement while performing a post test, when compared to the pretest which was performed earlier.

Post-test results showed that both PBL and SGL methods significantly improved knowledge across all three topics. The lack of significant differences (all p-value greater than 0.05) in post-test scores between the groups; highlights the comparable effectiveness of these teaching methodologies.

Limitations of the study

Study was conducted over only three topics of a single clinical subject in each method and hence less generalizability. Duration of the study was not sufficient to assess long term skill acquisition or clinical performance.

CONCLUSION

From this study both PBL and SGD are good TL methods effective in teaching clinical subjects among undergraduate students for real time clinical scenarios, developing collaborative and problem-solving skills.

REFERENCES

- Dolmans DH, De Grave W, Wolfhagen IH, van der Vleuten CP. Problem-based learning: future challenges for educational practice and research. Med Educ. 2005 Dec;39(7):732-41. doi: 10.1111/j.1365-2929.2005.02205. PMID: 15960790.
- Schmidt, H. G., et al. (2011). The advantages of problem-based learning: A review of the evidence. Medical Education, 45(2), 161-168. <https://doi.org/10.1111/j.1365-2923.2010.03853.x>
- Choudhury, S., et al. (2015). The impact of problem-based learning on clinical decision-making and patient management: A comparison of PBL-trained residents. Journal of Medical Education, 49(4), 402-409. <https://doi.org/10.1136/jme.2014.103412>
- Sahu PK, Nayak S, Rodrigues V. Medical students' perceptions of small group teaching effectiveness in hybrid curriculum Educ Health Promot. 2018 Feb 9;30. doi:10.4103/jehp.jehp_71_17. PMID: PMC5852982. PMID: 29629391
- Mutch C. Building Relationships with Small Group Discussions. Teaching in Higher Education. 2019;24(4):457-468.
- Vernon D, Blake R. Does Problem-Based Learning Work? A Meta-Analysis of Evaluative Research. Acad Med. 1993;68(7):550-563.
- Albanese, M. A., & Mitchell, S. (1993). Problem-based learning: A review of literature on its outcomes and implementation issues. Academic Medicine, 68(1), 52-81. <https://doi.org/10.1097/00001888-199301000-00012>
- Barrows, H. S., & Tamblyn, R. M. (1980). Problem-based learning: An approach to medical education. Springer Publishing Company.
- Mehta, S., et al. (2019). Enhanced learning outcomes in orthopedic education through application of biomechanical principles in small group discussions. Journal of Orthopaedic

- Education, 15(1), 65-71. <https://doi.org/10.1016/j.jore.2018.11.002>
10. Topping KJ, Prosser M, Wilson D. The impact of small group discussion in educational settings. *Journal of Educational Psychology*. 2020;112(5):825-832.
 11. Ghanem, M., et al. (2016). Effectiveness of problem-based learning and small group discussion in teaching musculoskeletal system in medical education. *Medical Education*, 50(2), 215-223. <https://doi.org/10.1111/medu.12838>
 12. Hmelo-Silver, C. E. (2004). Problem-based learning: It's all in the context. *Educational Psychologist*, 39(4), 197-207. https://doi.org/10.1207/s15326985ep3904_3
 13. Naismith L, Li M, Hadwin A, et al. Group Dynamics in Problem-Based Learning: A Review of the Literature. *Educ Health*. 2013;26(2):124-130.
 14. Dorman T, Hadfield J, Angel B, Lumley J, Gay SP, Smith L, et al. How might summative assessment of medical students' clinical skills be improved? A focus group study. *Med Teach*. 2017;39(10):1036-1043. doi: 10.1080/0142159X.2017.1353141. PMID: 28795963.
 15. Steinert, Y. (2004). Student perceptions of small group learning in medical education: A qualitative study. *Medical Education*, 38(3), 310-320. <https://doi.org/10.1046/j.1365-2923.2004.01719.x>
 16. Vasan, N. S., et al. (2008). Meta-analysis of the effectiveness of small group discussions in medical education. *Medical Education*, 42(9), 955-962. <https://doi.org/10.1111/j.1365-2923.2008.03163.x>.