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ORIGINAL RESEARCH ARTICLE

Effect of Multiple-Choice Question-Based Small-Group Teaching Versus Conventional Tutorials on Academic Performance in Pathology

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Abstract: Background: Active learning strategies may improve student engagement and academic performance in medical education. This study compared the effectiveness of multiple-choice question (MCQ)-based small-group teaching with conventional tutorials in undergraduate pathology.**Methods:** A quasi-experimental crossover study was conducted among 50 second-professional MBBS students at Venkateshwara Institute of Medical Sciences, Uttar Pradesh, during November–December 2024. Students participated in both teaching methods across two pathology topics. Academic performance was assessed through normalized viva-voce scores. Student and faculty perceptions were evaluated using structured Likert-scale questionnaires.**Results:** Mean viva-voce scores were significantly higher following MCQ-based teaching than conventional tutorials (67.5% versus 53.3%; mean difference 14.2 percentage points; 95% CI 6.4–21.9; $p<0.001$). Improved performance was observed in 62.0% of students. MCQ-based teaching received significantly more favourable student ratings for clinical reasoning (58.0% versus 40.0%; adjusted $p=0.019$) and examination preparedness (72.0% versus 58.0%; adjusted $p=0.049$). Faculty feedback showed no statistically significant differences.**Conclusion:** MCQ-based small-group teaching was associated with improved viva-voce performance and favourable perceptions of clinical reasoning and examination preparedness, supporting its use as a supplementary pathology teaching strategy.

Keywords: Multiple-choice questions; Small-group teaching; Pathology education; Academic performance; Active learning.

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INTRODUCTION

Active learning approaches in medical education are more and more focused on critical thinking, problem solving and meaningful application of theory. Pathology is a basic medical science subject which is related to both basic medical sciences and clinical medicine, and it is a subject that students need to link disease mechanisms, morphological changes and clinical manifestations. While traditional tutorials continue to be popular in undergraduate medical education, the success of the tutorial may be affected by the level of student participation and interaction. In a meta-analysis of 225 studies, Freeman et al. showed that active learning led to better examination performance and fewer failures than traditional learning [1]. Likewise, in a systematic review of team-based learning in health professions education, Fatmi et al. found that knowledge acquisition improved, but that the students' perceptions differed between studies [2].

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Multiple choice questions (MCQs) are frequently used to test medical knowledge, but can also be used for teaching purposes in structured group discussions. Well-crafted MCQs prompt students to recall what they have learned, consider different interpretations, and transfer knowledge to real-world scenarios. Smith et al. showed that students who collaboratively discussed questions were able to answer conceptual questions better than those who answered them individually, indicating that collaborative reasoning could help students to understand beyond the individual level [3]. Karpicke and Roediger also showed that retrieval practice is important for long-term knowledge retention [4], further confirming the educational benefits of retrieval practice. Larsen et al. [5] found that question-based instruction with feedback led to significantly better retention than repeated study in medical education, which demonstrates the possible benefits of question-based instruction.

Undergraduate pathology teaching has also provided evidence for interactive teaching. Alwahab et al. showed that team-based learning facilitated knowledge acquisition through collaboration, and there was a significant correlation between the scores of the readiness assessment and the final examination scores [6]. Grainger et al. reported that medical students could prepare cognitively demanding pathology MCQs, but there was some variation in acceptance of the MCQs by the students and interaction among students [7]. In a study conducted by Grover et al. on second-year MBBS students, they noted that assessment scores were significantly higher after interactive case-based pathology teaching than after conventional didactic teaching, and favorable perceptions of analytical thinking and student engagement were noted [8]. Findings indicate that the learning process of structured learning that is guided by questions can be used to improve conceptual understanding and make students active learners.

While there is increasing evidence for the benefits of active learning, there is limited direct comparison of small-group teaching using MCQs and traditional tutorials in undergraduate pathology, especially if the assessment of academic performance is by viva-voce. Moreover, the relationship between objective academic achievement and students' perceptions of engagement, clinical reasoning and exam preparation needs to be further assessed. The present quasi-experimental crossover study was thus conducted to compare the effectiveness of MCQ-based small-group teaching and conventional tutorials on second-professional MBBS students. The study was designed to compare the performance of the students in viva-voce and to find out the perception of the students and faculty about both the teaching methods.

MATERIALS AND METHODS

Study Design and Setting

The study was conducted in the Department of Pathology, Venkateshwara Institute of Medical Sciences (VIMS), Gajraula, Uttar Pradesh, as a quasi-experimental, two-sequence crossover study between November and December 2024. This study compared small-group teaching by using multiple-choice questions (MCQs) with conventional tutorials on performance in viva-voce examination and perceptions of second-professional MBBS students.

Study Participants

Eligibility was determined for the second-professional MBBS students who gave informed consent. Those who failed to complete both teaching sessions or the viva-voce assessment were dropped out. Of 56 students screened, two did not provide consent and four were partially involved, resulting in 50 students being analysed. The students were divided into two sequences A and B with 25 students in each sequence. Each of the included students was involved in both teaching methods.

Teaching Intervention

In consultation with the departmental faculty, two topics in pathology were chosen. The topics were first introduced with a didactic lecture and then the small-group teaching activity was set. In the first session, sequence A was taught using a small-group approach with the use of MCQs and sequence B was taught in a conventional tutorial. In the second session, the teaching methods were switched and both sequences had the chance to apply each of the teaching methods to different topics.

In the MCQ-based teaching, 10 questions were selected that were used to encourage discussion and clinical reasoning. The students were divided into smaller groups (about five to six students) and were provided with 30 minutes to discuss the questions and come up with explanations. Mobile devices and textbooks were allowed to be used as learning resources. Selected students then presented their answers, which were then clarified and discussed by the faculty members. The conventional tutorials were conducted in the traditional teacher-centered teaching approach. Two different teaching methods were delivered by two different facilitators.

Assessment of Academic Performance

Academic achievement was assessed by an individual viva-voce after completion of teaching sessions. Each student was given five questions

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from a question bank prepared by the faculty. Two questions were linked to the first teaching topic and three to the second, allowing for assessment of the teaching methods linked to the topics. All answers were marked out of 2 and the scores for each method were expressed as percentages of the maximum possible method score. These normalized scores were used to make a comparison between the paired MCQ-based teaching and conventional tutorials. The students' previous block-end assessment scores were also noted to describe their prior academic performance.

Student and Faculty Feedback

The perceptions of the students regarding both the teaching methods were measured by using structured questionnaires with a 5-point Likert scale ranging from strongly disagree (1) to strongly agree (5). The six domains assessed were: engagement, conceptual clarity, clinical reasoning, participation, examination preparedness, and overall satisfaction. Favourable responses were rated as 4 or 5. The perceptions of the faculty were assessed separately from six respondents with regard to student engagement and encouragement of active learning. Feedback was sought after the teaching and assessment activities were completed.

Statistical Analysis

Categorical variables were presented as number (%). Continuous variables were presented as mean ± standard deviation. The paired Student's t-test was used to compare the normalized viva-voce scores after MCQ-based teaching and conventional tutorials. Mean paired differences, 95% confidence intervals, t statistics and p-values were reported. Comparisons were also investigated separately in the two teaching sequences.

The paired Wilcoxon signed-rank test was used to compare student and faculty Likert-scale ratings. Results of favourable responses were summarized as n (%). Holm's adjustment was used for the six exploratory comparisons of student feedback. The faculty feedback comparisons were treated as exploratory and reported with the Wilcoxon statistics and p-values. All statistical tests were two-sided, and $p < 0.05$ was considered statistically significant.

Results

Participant flow and baseline characteristics

The screening framework included 56 second-professional MBBS student records, of which 50 contributed complete assessments. Both teaching sequences contained 25 students; sequence A received MCQ-based small-group teaching for the first pathology topic followed by a conventional tutorial for the second, whereas sequence B received the reverse allocation. Each included student completed both sessions and the viva-voce assessment (Table 1).

Comparative viva-voce performance

On the five-item normalized viva assessment, the mean MCQ-based teaching score was 67.5% compared with 53.3% following conventional tutorials. The paired mean difference was 14.2 percentage points (95% CI 6.4–21.9; paired $t(49) = 3.66$, $p < 0.001$). Scores were higher after MCQ-based teaching for 31 (62.0%) students, lower for 13 (26.0%), and equal for 6 (12.0%). Sequence-specific comparisons are presented in Table 2 and individual paired observations in Figure 1.

Student perceptions

Paired five-point Likert ratings were available for all 50 students. The clearest positive differences for MCQ-based teaching concerned perceived clinical reasoning and examination preparedness. Comparisons for engagement, conceptual clarity, participation, and overall satisfaction were more variable; detailed favorable-response counts, paired Wilcoxon statistics, and multiplicity-adjusted exploratory p-values are provided in Table 3 and Figure 2.

Faculty perceptions

Feedback from six faculty respondents suggested broadly favorable perceptions of both approaches. Differences in ratings for student engagement and active learning were not statistically established in the exploratory paired comparisons (Table 4).

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Table 1. Student characteristics by allocated sequence

Characteristic	Overall (n=50)	Sequence A (n=25)	Sequence B (n=25)
Number of students	50	25	25
Age, mean ± SD, years	20.8 ± 0.9	20.8 ± 0.9	20.7 ± 0.9
Female, n (%)	30 (60.0)	15 (60.0)	15 (60.0)
Previous block-end score, mean ± SD, %	62.0 ± 12.4	59.1 ± 12.2	64.9 ± 12.1
Completed both teaching sessions, n (%)	50 (100.0)	25 (100.0)	25 (100.0)
Completed viva assessment, n (%)	50 (100.0)	25 (100.0)	25 (100.0)

Table 2. Normalized viva-voce performance by teaching method

Sequence	n	MCQ mean (%)	Tutorial mean (%)	Difference (pp)	95% CI lower	95% CI upper	Paired t	df	p
Overall	50	67.500	53.330	14.170	6.390	21.940	3.660	49	<0.001
Sequence A	25	67.000	54.670	12.330	0.920	23.750	2.230	24	0.035
Sequence B	25	68.000	52.000	16.000	4.640	27.360	2.906	24	0.008

Viva scores were normalized by the number of topic-specific items (two items for Topic 1, three for Topic 2); pp, percentage points. Sequence comparisons are exploratory.

Table 3. Paired student perceptions (five-point scale)

Domain	MCQ n	MCQ %	Tutorial n	Tutorial %	Wilcoxon W	p	Holm p
Engagement	33	66.000	30	60.000	66.500	0.021	0.084
ConceptClarity	32	64.000	25	50.000	150.000	0.195	0.390
ClinicalReasoning	29	58.000	20	40.000	57.500	0.003	0.019
Participation	27	54.000	25	50.000	145.000	0.052	0.157
ExamPreparedness	36	72.000	29	58.000	67.000	0.010	0.049
OverallSatisfaction	25	50.000	23	46.000	197.000	0.422	0.422

Favorable rating: score ≥4 on the five-point Likert scale. Holm-adjusted p-values are exploratory across the six feedback domains.

Table 4. Faculty feedback (n = 6)

Domain	Faculty n	MCQ mean	Tutorial mean	MCQ favorable n	Tutorial favorable n	Wilcoxon W	p exploratory
Engagement	6	4.000	3.670	5	4	5.000	0.750
ActiveLearning	6	4.000	3.670	4	4	2.500	0.625

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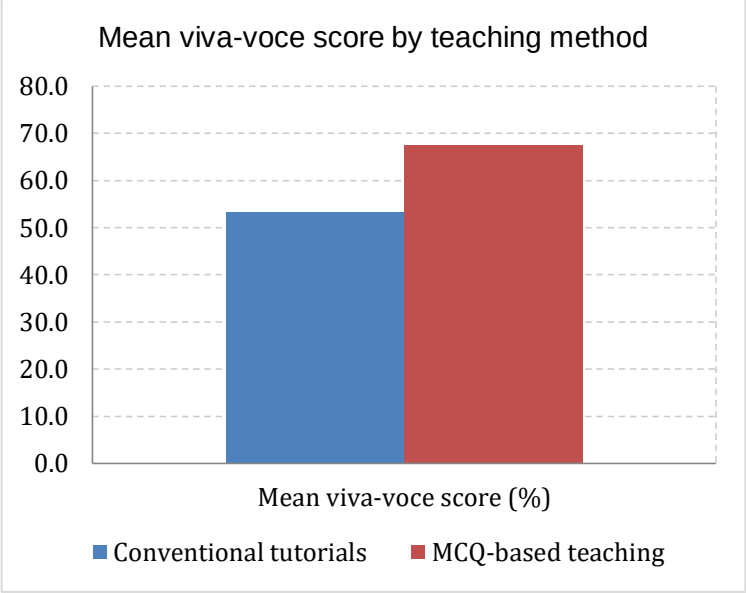


Figure 1. Comparison of Viva-Voce Performance Between Teaching Methods

Bar chart showing the mean normalized viva-voce scores of 50 second-professional MBBS students following conventional tutorials and multiple-choice question (MCQ)-based small-group teaching. The mean scores were 53.3% and 67.5%, respectively. MCQ-based teaching was associated with significantly higher viva-voce performance, with a paired mean difference of 14.2 percentage points (95% CI: 6.4–21.9; paired $t(49) = 3.66$, $p < 0.001$).

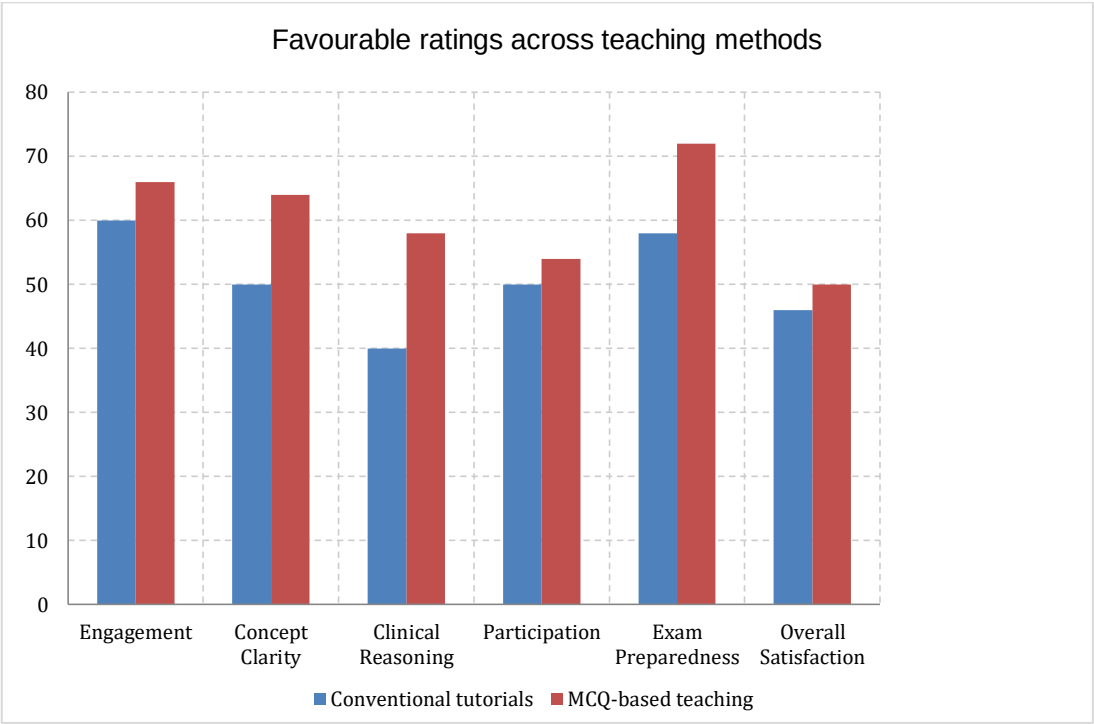


Figure 2. Student Perceptions of MCQ-Based Small-Group Teaching and Conventional Tutorials

Grouped bar chart comparing the percentages of students reporting favourable perceptions of MCQ-based small-group teaching and conventional tutorials across six feedback domains. Favourable responses were derived from a five-point Likert scale, with ratings of 4 (agree) and 5 (strongly agree) classified as positive responses. Each teaching method was evaluated by the same 50 students. Higher percentages indicate more favourable student perceptions of the respective teaching method.

DISCUSSION

In the present quasi-experimental crossover study,

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the academic performance of second-professional MBBS students was significantly better after multiple-choice question (MCQ)-based small-group teaching than after conventional tutorials. The mean normalized viva-voce scores for the MCQ-based teaching and conventional tutorials were 67.5% and 53.3%, respectively, with a mean difference of 14.2 percentage points (95% CI 6.4–21.9; $p<0.001$). In 62.0% of the students, higher scores were seen after MCQ-based teaching, while similar advantages were seen in both teaching sequences. Other domains showed less consistent differences, with student feedback also showing significantly more positive perceptions of clinical reasoning and examination preparation. The results indicate that the use of structured question-based discussions could improve the application of knowledge in practice and performance in oral examinations in undergraduate pathology education.

The observed improvement is in line with Singh [9] who studied patient-oriented problem solving with traditional lecture method in 150 second-year MBBS students. The mean improvement in assessment scores was significantly higher after problem-oriented teaching than after traditional lectures (15.98 compared to 7.79; $p<0.0001$). In addition, 93.19% of students reported positive attitudes towards the interactive approach. Likewise, Desai et al. [10] assessed 149 second-year MBBS students with patient-oriented problem-based pathology teaching. The interactive tutorials resulted in a higher percentage of students achieving scores above 75% (87.92%) than the traditional tutorials (53.02%), and attendance was greater during problem-based tutorials (94.14%) than during traditional tutorials (76.12%). The results of this study provide support for the educational benefits of structured student involvement but cannot be directly compared due to the differences in the content of instruction and assessment.

The importance of collaborative teaching in pathology was also substantiated by Vaishnav and Garg [11] who did a quasi-experimental study with 42 second-year MBBS students. Peer-assisted teaching was evaluated in comparison to conventional faculty-led teaching with 10-item MCQ assessment followed by independent assessment using spotters and viva-voce examination. The peer-assisted group had significantly higher formative and summative assessment scores ($p<0.05$). The results of this study are similar to the present study in terms of the use of active discussion and oral assessment. In a similar study, Rajeswarie et al. [12] studied team-based learning in second-year MBBS students with a crossover design with four topics of teaching. The assessment performance was significantly better in team-based learning, and the students' perceptions were also more positive than in conventional didactic lectures ($p=0.001$). The findings from these studies indicate that active participation and collaborative explanation could be beneficial for short-term academic achievement in various medical fields.

Similar results have been reported in larger numbers of students. Salih et al. [13] compared the examination scores of 378 medical students in Sudan after team-based learning and lecture-based learning, and found that the mean difference was 5.1 points ($p<0.001$) in favor of team-based learning. The mean scores of 77.2 and 70.2 respectively favoured team-based learning among senior students ($p<0.001$). Habib et al. [14] compared problem-based learning, case-based discussion, seminars and team-based learning in the field of pathology with 512 undergraduate medical students. The most preferred method and the one that yielded the highest assessment scores in the evaluated teaching strategies was problem-based learning ($p<0.001$). The observations suggest that the impact of small-group teaching may be related to how much students actively analyze problems, share explanations and use prior knowledge.

The findings of the present study gave further insight into the potential educational value of MCQ-based teaching as perceived by the students. Favourable ratings for clinical reasoning were reported by 58.0% of students following MCQ-based sessions compared with 40.0% following conventional tutorials (Holm-adjusted $p=0.019$). The preparedness for examination was rated favourably by 72.0% and 58.0% respectively (adjusted $p=0.049$). No differences in engagement, conceptual clarity, participation or overall satisfaction were significant, however, when adjusted for multiple comparisons. The study by Nawabi et al. [15] included 147 dentistry students, of which 120 responded (81.6%) with a mean team-based learning perception score of 3.29 ± 0.94. Students also had significantly better grades in team-based assessments compared to lecture-based assessments ($p<0.05$). These results support the acceptance of interactive learning, but the relative gains in our study indicate that academic achievement does not necessarily lead to overall higher satisfaction in all learning domains.

Educational questions can also be designed to impact learning outcomes. Hernandez et al. [16] looked at 125 questions from medical students' pathology assessments answered by 417 medical students, for a total of 52,125 responses. MCQs were associated with greater difficulty ($p=0.02$), while questions that required interpretation instead

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of simple recall had lower mean scores (p=0.003). Specimen images were added, which increased item discrimination (p=0.04). The results indicate that the educational effectiveness of MCQs is not only related to the question format but also to the cognitive complexity and clinical relevance of the questions. The present intervention included group discussion and explanation of answers, which may have led to more in-depth processing than question solving alone.

However, interactive learning is not always more effective than conventional learning. Samra et al. [17] studied the effectiveness of online peer-assisted teaching, faculty-led teaching and no intervention among medical students. There were no significant differences in short-answer examination performance (p=0.650), but faculty-led teaching was rated higher in terms of learning quality (p=0.017) and group interaction (p=0.036). The differences in these results suggest that the learning outcomes can be influenced by the way the learning is presented, the competence of the facilitator, the assessment method and the characteristics of the learners. The results of our study indicated that faculty responses from six respondents did not significantly differ in their perceptions of the advantages of the teaching methods for engagement (p=0.750) or active learning (p=0.625), suggesting that the advantages of the teaching methods were more salient to students than faculty.

The major strength of the present study was the use of a crossover design, which enabled all students to be taught both types of instruction and to be compared in pairs. However, there are a number of caveats to consider. The study might not be generalizable because of the single centre design, small sample size, and the roll-number allocation. The different sessions in the study may have influenced the performance separately from the teaching method, due to the different pathology topics and the facilitators used in the different sessions. The viva-voce assessment was not reliable because there were only five questions, and the distribution of the questions across the topics was unequal, and the scores were normalized. There was no delayed testing to assess long-term knowledge retention, and favourable perceptions of clinical reasoning are not evidence of improvement in objectively measured clinical reasoning. To validate the long-term educational benefits of MCQ based small group teaching, further multicentre research with random allocation of topics, uniform facilitators, validated assessment tools and delayed assessment is needed.

CONCLUSION

The second-professional MBBS students who were taught using MCQ-based small group teaching had significantly higher viva voce scores than those taught by conventional tutorials. Students also reported more positive perceptions of clinical reasoning and examination preparation, but there were no statistically significant differences in other feedback domains after adjustment. The results indicated that the small group teaching method based on multiple choice questions is a suitable auxiliary teaching method for undergraduate pathology teaching, which can stimulate students' learning enthusiasm and help them apply knowledge. Further research with larger samples of children and standardized assessments and longer follow-up is warranted to assess its long-term educational impacts.

REFERENCES

1. Freeman S, Eddy SL, McDonough M, Smith MK, Okoroafor N, Jordt H, et al. Active learning increases student performance in science, engineering, and mathematics. *Proc Natl Acad Sci U S A.* 2014;111(23):8410–8415. doi:10.1073/pnas.1319030111.
2. Fatmi M, Hartling L, Hillier T, Campbell S, Oswald AE. The effectiveness of team-based learning on learning outcomes in health professions education: BEME Guide No. 30. *Med Teach.* 2013;35(12)–e1624. doi:10.3109/0142159X.2013.849802.
3. Smith MK, Wood WB, Adams WK, Wieman C, Knight JK, Guild N, et al. Why peer discussion improves student performance on in-class concept questions. *Science.* 2009;323(5910):122–124. doi:10.1126/science.1165919.
4. Karpicke JD, Roediger HL III. The critical importance of retrieval for learning. *Science.* 2008;319(5865):966–968. doi:10.1126/science.1152408.
5. Larsen DP, Butler AC, Roediger HL III. Repeated testing improves long-term retention relative to repeated study: a randomised controlled trial. *Med Educ.* 2009;43(12):1174–1181. doi:10.1111/j.1365-2923.2009.03518.x.
6. Alwahab A, Abdulqader S, Nugud A, Nugud S, Cyprian F, Shaikh AA, et al. Team-based learning in an undergraduate pathology curriculum and its effects on student performance. *J Taibah Univ Med Sci.* 2018;13(5):496–501. doi:10.1016/j.jtumed.2018.03.010.
7. Grainger R, Dai W, Osborne E, Kenwright D. Medical students create multiple-choice questions for learning in pathology education: a pilot study. *BMC Med Educ.* 2018;18:201. doi:10.1186/s12909-018-1312-1.
8. Grover S, Garg B, Sood N. Introduction of case-based learning aided by WhatsApp messenger in pathology teaching for medical

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students. *J Postgrad Med.* 2020;66(1):17–22. doi:10.4103/jpgm.JPGM_2_19.
9. Singh A. Student performance and their perception of a patient-oriented problem-solving approach with audiovisual aids in teaching pathology: a comparison with traditional lectures. *Adv Med Educ Pract.* 2011;2:9–15. doi:10.2147/AMEP.S15251.
10. Desai KN, Satapara VK, Rathod GB, Maru AM. Development and evaluation of the POPBL (patient-oriented problem-based learning) module in pathology: a comparative analysis of performance and perception among second-year pathology students. *Cureus.* 2022;14(9). doi:10.7759/cureus.28885.
11. Vaishnav MV, Garg S. Effectiveness of peer-assisted learning in pathology: a quasi-experimental study among second-year medical students. *Natl J Lab Med.* 2025;14(4)–PO09. doi:10.7860/NJLM/2025/81233.2940.
12. Rajeswarie S, Praveen K, Sangam MR, Vinay G, Bokan RR, Deka R, et al. Comparison of team-based learning over conventional didactic lecture among second-year MBBS students. *Cureus.*2022;14(1). doi:10.7759/cureus.21792.
13. Salih KEMA, El-Samani EFZ, Bilal JA, Hamid EK, Elfaki OA, Idris MEA, et al. Team-based learning and lecture-based learning: comparison of Sudanese medical students' performance. *Adv Med Educ Pract.* 2021;12:1513–1519. doi:10.2147/AMEP.S331296.
14. Habib M, Mudassir G, Bhatti MM, Ahmad RN. Comparison of performance and perception of undergraduate medical students towards different small group teaching strategies. *J Rawalpindi Med Coll.* 2024;28(3). doi:10.37939/jrmc.v28i3.2608.
15. Nawabi S, Bilal R, Javed MQ. Team-based learning versus traditional lecture-based learning: an investigation of students' perceptions and academic achievements. *Pak J Med Sci.* 2021;37(4):1080–1085. doi:10.12669/pjms.37.4.4000.
16. Hernandez T, Magid MS, Polydorides AD. Assessment question characteristics predict medical student performance in general pathology. *Arch Pathol Lab Med.* 2021;145(10):1280–1288. doi:10.5858/arpa.2020-0624-OA.
17. Samra GS, Gaddu K, Wong Sik Hee JR, Brahmbhatt K, Bowrey D, Seabrook M. Comparison of online peer-assisted learning and faculty-led teaching for short answer questions. *Clin Teach.* 2025;22(3). doi:10.1111/tct.70069

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