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ORIGINAL ARTICLE

COMPARISON OF THE EFFECTIVENESS OF PEER-ASSISTED LEARNING AND SMALL-GROUP DISCUSSIONS IN TEACHING FORENSIC MEDICINE IN AN UNDERGRADUATE MEDICAL PROGRAM

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ABSTRACT

Introduction: Forensic medicine requires the application of analytical reasoning and medico-legal principles rather than rote memorisation. With the shift to Competency-Based Medical Education (CBME), active learning strategies are increasingly emphasized. Small Group Discussion (SGD) and Peer-Assisted Learning (PAL) are widely used approaches; however, direct comparisons in forensic medicine remain limited.

Objectives: This study compared the effectiveness of PAL and SGD in achieving immediate learning outcomes and sustaining delayed knowledge retention among undergraduate medical students, while also evaluating student engagement and feedback.

Methods: A quasi-experimental crossover study was conducted among 60 MBBS Phase 3 Part 1 students in the Department of Forensic Medicine, P.K. Das Institute of Medical Sciences, Kerala, India. Participants were randomly assigned to two groups and exposed to both PAL and SGD across six modules using a crossover design with a washout period. Immediate post-tests and one-month delayed tests assessed knowledge gain and retention, while engagement and feedback were measured using a validated 5-point Likert-scale questionnaire. Data were analysed using independent sample t-tests and chi-square tests.

Results: Immediate post-test scores were significantly higher with PAL compared to SGD (7.90 ± 1.92 vs. 7.42 ± 2.46; p = 0.042), with a significant advantage in the "Age Estimation" module (p = 0.009), while other modules showed no significant differences. Knowledge retention at one month was comparable (p = 0.475). Engagement scores were high for both strategies, with PAL demonstrating higher proportions of strong agreement.

Conclusions: PAL improves immediate learning outcomes and engagement more than SGD, while both methods achieve similar delayed knowledge retention, supporting a blended approach in forensic medicine teaching.

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INTRODUCTION

Forensic medicine integrates medical knowledge with legal application, requiring students to apply concepts to real-life scenarios such as injury interpretation, age estimation, and medico-legal reporting. This transition from rote learning to application is often challenging, particularly when traditional lectures promote passive learning. With the shift toward Competency-Based Medical Education (CBME), there is increasing emphasis on active learning strategies that enhance participation, critical thinking, and problem-solving. Among these, Small Group Discussion (SGD) and Peer-Assisted Learning (PAL) have emerged as key approaches. SGD enables students to collaboratively analyse cases under faculty guidance, promoting teamwork and conceptual clarity, although its effectiveness may be influenced by unequal participation.

In contrast, PAL involves trained student tutors teaching their peers, creating a more approachable learning environment that encourages interaction while strengthening both learning and teaching skills. While PAL enhances confidence and engagement, SGD supports collaborative reasoning. Despite their complementary strengths, direct comparisons of these methods in forensic medicine remain limited, although structured active learning has been shown to improve knowledge retention and critical reasoning[1].

The evolution of medical education reflects a broader shift from passive didactic models to active, student-centred approaches that emphasise the application of knowledge. In forensic medicine, where bridging theory and legal practice is essential, such interactive methods are particularly relevant. Traditional teaching methods have been criticised for limited student participation, and comparative studies suggest that although lectures and SGD may yield similar objective test scores, small-group formats are more effective in improving motivation, doubt clarification, and self-confidence[2]. To enhance the effectiveness of small-group learning, structured frameworks such as the “Distribute, Discuss, and Develop” (3D) method have been introduced, demonstrating improved learning outcomes and communication skills compared to conventional formats[3].

Evidence from broader health professional education further supports the role of active learning. PAL, in particular, provides reciprocal benefits for both tutors and learners, contributing to the development of teaching, communication, and assessment skills[4]. Meta-analyses of randomized controlled trials indicate that PAL is superior to traditional teaching in improving theoretical knowledge transfer, practical skills, and student satisfaction[5], although some studies report comparable cognitive outcomes between PAL and faculty-led approaches[6]. The effectiveness of PAL is often attributed to “cognitive congruence,” where peer tutors share a similar level of understanding with learners, facilitating clearer communication. This is supported by findings from simulation-based education, where peer-led debriefing has been shown to be as effective as instructor-led sessions in terms of knowledge acquisition and student satisfaction, with some evidence of improved performance in peer-led groups[7].

Active learning strategies are particularly relevant in forensic medicine, where critical thinking and applied reasoning are essential. Scoping reviews highlight that case-based and problem-based learning enhance teamwork and analytical skills required for medico-legal practice[8]. Similarly, challenge-based learning approaches in forensic medicine demonstrate high student acceptance, with learners reporting improved understanding of complex medico-legal scenarios[9]. The benefits of small-group learning extend to related disciplines such as family medicine, where they have been associated with improved attention, conceptual understanding, and overall satisfaction compared to traditional lectures[10]. Peer-assisted approaches have also proven effective in specialised areas such as medical English training, where they enhance confidence and practical application[11]. More broadly, the integration of active learning strategies, including flipped classrooms and early clinical exposure, aligns with contemporary educational goals by improving engagement, retention, and clinical reasoning skills[12].

Despite strong support for these approaches, there remains a need for direct comparative studies of PAL and SGD within forensic medicine to inform optimal curriculum design for undergraduate medical students.

OBJECTIVES

The primary objective of this study was to compare the effectiveness of PAL and SGD in achieving immediate learning outcomes and sustaining one-month knowledge retention among undergraduate medical students, while the secondary objectives were to evaluate and compare student engagement levels between PAL and SGD sessions using a validated scale and to assess and compare student feedback regarding the two different teaching-learning modalities in forensic medicine.

METHODS

The study was conducted in the Department of Forensic Medicine at P.K. Das Institute of Medical Sciences, Kerala, India, where all PAL and SGD sessions were carried out in departmental classrooms under supervised academic conditions. A quasi-experimental crossover design was employed to ensure that each participant was exposed to both PAL and SGD, thereby minimising individual learning style bias and enabling within-cohort comparison, and the methodological flow is illustrated in Figure 1. Participants were MBBS Phase 3 Part 1 students who had not undergone structured teaching in the selected modules and who provided written informed consent; students serving as peer tutors, those previously exposed to the modules, those unwilling to consent, and those unable to attend all sessions were excluded. A total of 60 eligible students were selected using simple random sampling (lottery method) and equally allocated into Group A and Group B. The sample size was calculated for comparison of two independent means with a two-sided significance level of 0.05 (Z_α=1.96) and 80% power (Z_β=0.84), based on an expected mean difference of 0.57 and standard deviations of 0.65 and 0.79 derived from Vijayan et al. (2025), yielding a required sample of 25 participants per group; allowing for 20% attrition, 30 participants were recruited per group[13]. Volunteers from Phase 3 Part 1 were screened for peer tutor roles using a structured checklist assessing clarity, confidence, and engagement, with a minimum score of 70% required to qualify for faculty-led training based on standardized lesson plans covering six modules: Injury Interpretation and Medico-Legal Classification, Alcohol Intoxication and Drunkenness Examination, Age Estimation, Sexual Offences including Examination and Documentation, Organophosphorus Poisoning including Clinical Features and Management, and Professional Misconduct. Training included mock teaching sessions with structured feedback, and competency was reassessed using a checklist evaluating content accuracy, communication, and facilitation skills, with only those scoring at least 80% selected as peer tutors; to ensure uniformity, all sessions followed faculty-prepared lesson plans with faculty observation and minimal intervention. Participants were divided into two groups of 30, each further subdivided into groups of 10 to facilitate active participation and individualised feedback. The six modules were divided into two sets, with Set 1 including Injury Interpretation, Alcohol Intoxication, and Age Estimation, and Set 2 including Sexual Offences, Organophosphorus Poisoning, and Professional Misconduct. During Period 1, Group A underwent PAL, and Group B underwent SGD for Set 1 modules, followed by a washout period of 3–7 days to minimise carryover effects; in Period 2, the interventions were crossed over, with Group A receiving SGD and Group B receiving PAL for Set 2 modules, ensuring that all participants were exposed to both teaching methods. Each session followed a standardized format comprising a 10–15 minute pre-briefing, a 60-minute teaching-learning activity (PAL or SGD), and a 10–15 minute consolidation phase, after which an immediate post-test of 15–20 minutes in Multiple Choice Question (MCQ) format and a 5-minute Likert-scale feedback questionnaire were administered; PAL sessions were conducted by trained peer tutors, while SGD sessions were facilitated by faculty. Sessions were conducted in separate classrooms to prevent contamination, with a tutor-to-student ratio of 1:10 maintained throughout; teaching materials and assessments were standardised,

post-test responses were anonymised, and reliability was assessed using Cronbach's alpha, while participants were instructed not to share materials until completion of the intervention, and full attendance was required for inclusion in analysis. Knowledge gain was assessed using immediate post-tests and a one-month delayed retention test in MCQ format, while engagement and feedback were measured using a validated 5-point Likert-scale questionnaire, and peer tutor competency was evaluated using structured checklists during training. Data were entered into Microsoft Excel and analysed using SPSS, with mean scores compared using independent sample t-tests and categorical variables analysed using chi-square tests, a p-value <0.05 considered statistically significant, and descriptive statistics used to summarise findings; although a crossover design was employed, independent t-tests were used due to unequal group sizes and attrition at follow-up, which limited the feasibility of paired analysis. Ethical clearance was obtained from the Institutional Ethics Committee of P.K. Das Institute of Medical Sciences, Kerala, India (Ref. No. IEC/03/151/25).

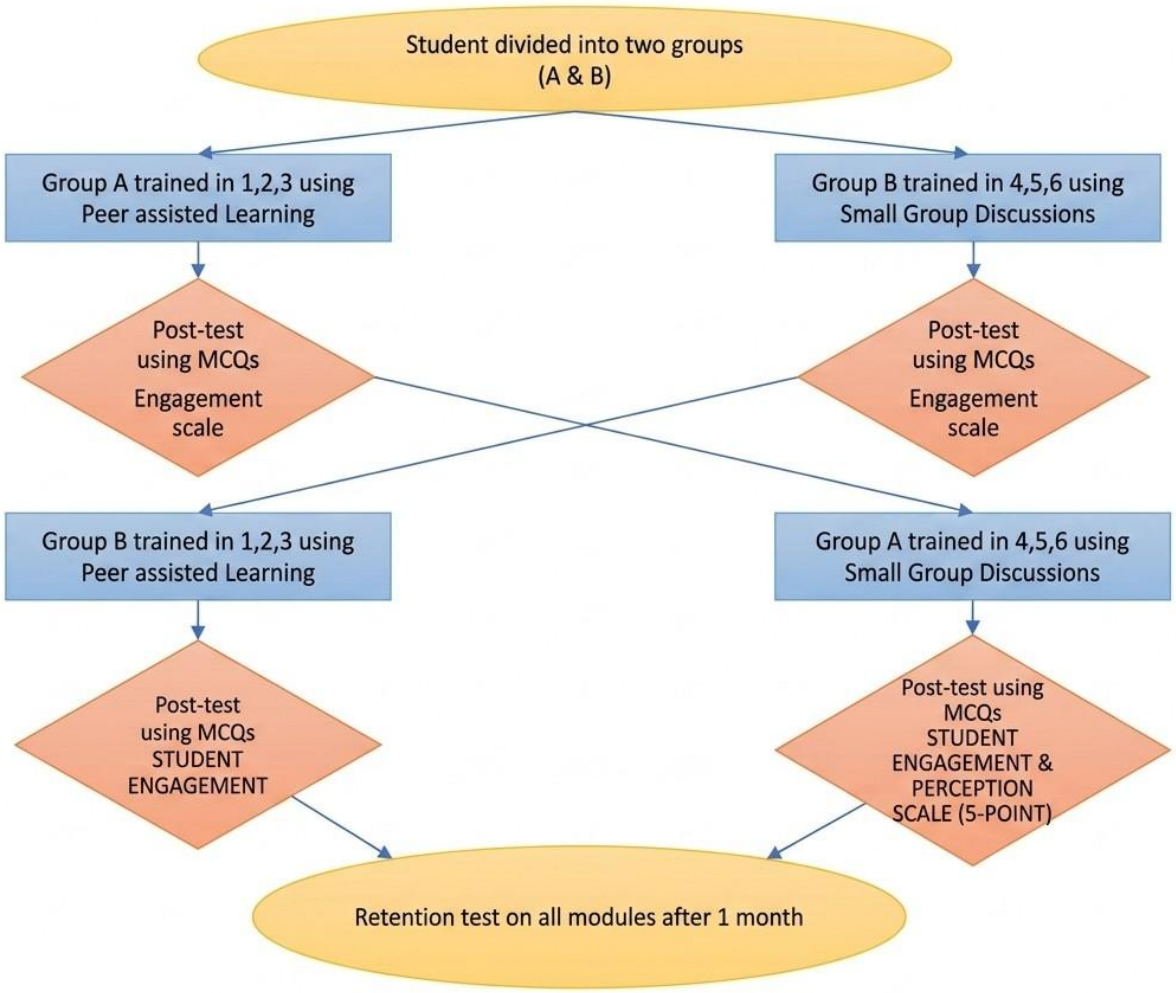

Figure 1: Flow diagram of the study methodology illustrating participant selection, grouping, intervention allocation and crossover design.

RESULTS

The distribution of participants across forensic medicine topics under PAL and SGD is presented in Table 1.

Table 1: Distribution of participants across forensic medicine topics under PAL and SGD

Topic	PAL	SGD
Age estimation in medico-legal practice	30	29
Alcohol intoxication and drunkenness examination	29	27
Injury interpretation and medico-legal classification	27	28
Organophosphorus poisons	33	26
Professional misconduct	33	26
Sexual offences	32	25

This study compared the effectiveness of PAL and SGD using post-test scores across six forensic medicine topics. Overall, students exposed to PAL demonstrated significantly higher post-test scores compared to those taught using SGD, with a mean score of 7.90 (SD=1.92) versus 7.42 (SD=2.46), and a mean difference of 0.48 that was statistically significant (t=2.038, p=0.042), indicating superior immediate learning outcomes with PAL.

Topic-wise analysis showed a statistically significant advantage of PAL in Age Estimation in Medico-Legal Practice, where students scored higher (mean=5.72, SD=2.03) compared to the SGD group (mean=4.14, SD=2.39), with a mean difference of 1.59 (t=2.724, p=0.009), representing the largest effect size among all topics. In Alcohol Intoxication and Drunkenness Examination, the PAL group showed a marginally higher mean score (7.29±2.18) than the SGD group (6.93±1.94), though the difference was not statistically significant (t=0.647, p=0.521). Similarly, in Injury Interpretation and Medico-Legal Classification, PAL students achieved higher mean scores (8.65±1.13) compared to SGD (8.18±1.44), without statistical significance (t=1.342, p=0.186). In Organophosphorus Poisoning, both groups demonstrated comparable performance, with mean scores of 8.03 (SD=1.49) for PAL and 7.85 (SD=2.15) for SGD (t=0.386, p=0.701). In Professional Misconduct, the SGD group showed slightly higher scores (9.46±0.65) compared to PAL (9.13±1.07), though this difference was not statistically significant (t=−1.407, p=0.165). For Sexual Offences, mean scores were nearly identical between PAL (8.42±1.32) and SGD (8.32±1.57), with no statistically significant difference (t=0.274, p=0.785). Comparison of immediate post-test scores between PAL and SGD across topics is shown in Table 2.

Table 2: Immediate post-test scores: Comparison between PAL and SGD.

Topic	PAL (N)	PAL (Mean±SD)	SGD (N)	SGD (Mean±SD	Mean Difference	p-value
Overall	180	7.90±1.91	161	7.42±2.46	0.484	0.042*
Age Estimation	29	5.72±2.03	29	4.14±2.39	1.586	0.009*
Alcohol Intoxication	28	7.29±2.18	27	6.93±1.94	0.360	0.521
Injury Interpretation	26	8.65±1.13	28	8.18±1.44	0.475	0.186
Organophosphorus Poisoning	32	8.03±1.49	26	7.85±2.15	0.185	0.701
Professional Misconduct	32	9.13±1.07	26	9.46±0.65	−0.337	0.165
Sexual Offences	33	8.42±1.32	25	8.32±1.57	0.104	0.785

*Significant at p-value <0.05

Knowledge retention assessed one month after the intervention showed no statistically significant differences between PAL and SGD across all six modules. The overall mean retention score for PAL was 7.75 (SD=1.86), compared to 7.59 (SD=2.11) for SGD (p=0.475), indicating comparable delayed-term retention between the two teaching–learning methods. Topic-wise analysis across Age Estimation, Alcohol Intoxication, Injury Interpretation, Organophosphorus Poisoning, Professional Misconduct, and Sexual Offences similarly demonstrated no statistically significant differences, with retention scores remaining comparable between both groups.

High levels of student engagement were reported for both teaching methods. However, across all engagement domains—attention, participation, comfort in asking questions, and peer interaction—a higher proportion of students in the PAL group reported strong agreement compared to the SGD group. Neutral responses were consistently more frequent among SGD participants. Student engagement under PAL and SGD is summarised in Table 3.

Table 3: Student engagement of learning effectiveness under PAL and SGD.

Item	PAL (%)	SGD (%)
Attentive and focused	88.6	75.3
Actively participated	84.8	69.0
Comfortable asking questions	82.1	66.4
Engaged with peers	82.6	63.9

Feedback related to interest, understanding, and stimulation of critical thinking demonstrated a similar trend. Although both methods were positively perceived, PAL was associated with higher levels of strong agreement, indicating greater perceived engagement and motivation. Student feedback regarding learning effectiveness is presented in Table 4.

Table 4: Student feedback on learning effectiveness under PAL and SGD

Item	PAL (%)	SGD (%)
Interested and motivated	82.1	67.7
Better understanding	83.1	69.6
Encouraged critical thinking	78.8	66.5

DISCUSSION

The results of this study suggest that while both PAL and SGD are effective active learning strategies, they offer distinct advantages in the context of forensic medicine. The overall superiority of PAL in immediate post-test scores, particularly in the analytically demanding module of Age Estimation, indicates that peer-led environments may be more effective for achieving immediate learning outcomes in complex topics.

The significant improvement in immediate performance under PAL raises the question of whether the benefit stems from the pedagogy itself or the facilitator. It is likely that social congruence, the comfort and relatability provided by a peer, mitigates the "intimidation factor" often associated with faculty-led sessions. This facilitates a more open dialogue and higher engagement, which may explain the higher scores in the PAL arm. These findings are consistent with broader evidence suggesting that PAL surpasses traditional methods in theoretical knowledge transfer and practical skill acquisition[5,7].

However, the lack of significant difference in overall scores for other modules suggests that the choice between PAL and SGD may be less critical for less complex topics. This is supported by previous research indicating that while interactive methods are highly preferred by students, they do not always result in significantly higher test scores compared to other structured formats[2,6]. The "3D" method (Distribute, Discuss, Develop) has shown that structured frameworks in small groups can significantly improve comprehension, suggesting that the session's organization is as vital as the facilitator[3].

Regarding delayed retention, the finding that both methods resulted in comparable scores after one month reinforces the idea that active learning, regardless of the facilitator, supports the consolidation of knowledge into memory. Previous syntheses have noted the reciprocal benefits of PAL for both tutors and tutees, highlighting its role in skill development[4]. Furthermore, the application of interactive strategies in forensic medicine, such as problem-based and case-based learning, is crucial for developing the clinical reasoning and critical thinking required for medico-legal practice[8,11]. Our observation of high achievement in the PAL arm for context-rich topics like Age Estimation is further supported by evidence that students benefit immensely from multidisciplinary and authentic settings[9].
A critical distinction maintained in this study is the separation between student engagement and student feedback. In the present study, while both modalities recorded high satisfaction levels and were preferred over traditional didactic formats[10], engagement, defined by the depth of participation and cognitive involvement, was notably more robust in the PAL sessions. This suggests that while students may "satisfy" easily in a faculty-led SGD due to the perceived authority of the teacher, they "engage" more actively in PAL as the peer-led environment necessitates their direct contribution to the learning process. This distinction aligns with modern educational frameworks that caution against using satisfaction as a sole proxy for learning engagement[12].

In conclusion, the findings suggest that a blended approach, utilizing PAL for technically complex topics and faculty-led SGD for broader principles, may optimize the undergraduate forensic medicine curriculum.

LIMITATIONS

Limitations include the use of independent sample t-tests despite a crossover design, due to unequal group sizes and attrition during follow-up. Additionally, the study was conducted in a single institution, which may limit generalizability.

CONCLUSIONS

PAL demonstrated greater effectiveness than SGD in improving immediate learning outcomes and student engagement, while both methods were comparable in sustaining delayed knowledge retention, indicating that each approach contributes differently to forensic medicine teaching. A blended approach incorporating both PAL and SGD may therefore represent an optimal strategy for competency-based forensic medicine education.

RECOMMENDATIONS

Based on the findings of the present study, PAL may be incorporated as a complementary teaching–learning strategy in undergraduate forensic medicine within a competency-based curriculum. It appears particularly suitable for topics that require structured reasoning, stepwise analysis, and application of medico-legal principles, such as age estimation and injury interpretation. Integrating PAL into routine teaching can enhance immediate learning outcomes while promoting active student engagement.

Rather than replacing faculty-led methods, a blended instructional approach is recommended. Combining PAL with SGD allows each method to serve a distinct purpose within the learning process. PAL can facilitate initial concept clarification and foundational understanding, whereas SGD can support consolidation, reflection, and deeper analytical engagement, thereby utilizing the strengths of both strategies in a complementary manner.

Institutions implementing PAL should ensure a structured process for selection, training, and evaluation of peer tutors. Systematic preparation through standardized lesson plans, structured discussion guides, and continued faculty supervision is essential to maintain academic rigor, consistency, and alignment with curricular objectives.

PAL may also be strategically employed to enhance student participation and improve the overall learning climate. It can increase learner comfort in asking questions and foster constructive peer interaction, particularly in

areas where students may hesitate to actively engage during traditional faculty-led sessions.

Given the comparable delayed-term knowledge retention observed with SGD, faculty-facilitated small group sessions should continue to play a significant role in reinforcing key concepts and encouraging reflective learning over time. This ensures that foundational knowledge is revisited and strengthened beyond immediate post-session gains.

Both PAL and SGD align well with the principles of CBME by promoting active participation, communication skills, teamwork, and analytical reasoning. Session objectives and assessment strategies should be explicitly mapped to the relevant competencies to ensure curricular coherence and meaningful outcome measurement.

Faculty development remains central to the effective implementation of these approaches. Educators should be oriented toward understanding PALas a structured pedagogical strategy rather than an informal academic activity. Training initiatives focusing on facilitation skills, supervision of peer tutors, and evaluation of active learning sessions are essential for sustainability.

Finally, further multi-institutional research with larger sample sizes is warranted to validate these findings and enhance generalisability. Future studies may also examine the influence of PAL on higher-order competencies, clinical reasoning ability, and performance in summative assessments, thereby contributing to stronger evidence for curriculum design decisions.

LIST OF ABBREVIATIONS

CBME – Competency-Based Medical Education
PAL – Peer-Assisted Learning
SGD – Small Group Discussion
MCQ – Multiple Choice Question
SD – Standard Deviation

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CONFLICTS OF INTEREST

The authors declared no conflicts of interest.

ETHICAL ISSUES

Ethical clearance for this study was granted by the Institutional Ethics Committee of P.K. Das Institute of Medical Sciences, Kerala, India (Ref. No. IEC/03/151/25).

SOURCES OF SUPPORT

None.

AUTHOR CONTRIBUTIONS

NG: Conception and design of the work; the acquisition, analysis, and interpretation of data for the work; drafting the work or revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. **TDC:** Design of the work; the analysis, and interpretation of data for the work; drafting the work and revising it critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. **RKS:** The acquisition, analysis, and interpretation of data for the work; revising the work critically for important intellectual content; final approval of the version to be published; and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Prajapati HG, Oza B, Modi NY, Amaliyar JN, Patel P. From Passive to Active: A Comparative Evaluation of Flipped Classroom and Didactic Methods in Phase III Part I MBBS Students. *Global Journal of Medical Pharmaceutical and Biomedical Update*. 2025;20:15. https://doi.org/10.25259/GJMPBU_33_2025.

2. Desai A, Banzal N. Comparison of small group discussions and didactic lectures in pharmacology for medical undergraduate students. *International Journal of Basic & Clinical Pharmacology*. 2021;10(11);1245–1249. https://doi.org/10.18203/2319-2003.ijbcp20214088.

3. Jagzape AT, Kumar M, Ghritlahre N. Enhancing Medical Education through the "Distribute, Discuss, and Develop" method: A comparative study of Small-Group Discussions. *Cureus*. 2024;16(4): e59012. https://doi.org/10.7759/cureus.59012.

4. Feng H, Luo Z, Wu Z, Li X. Effectiveness of Peer-Assisted Learning in health professional education: a scoping review of systematic reviews. *BMC Medical Education.* 2024 Dec 18;24(1):1467. https://doi.org/10.1186/s12909-024-06434-7.

5. Li Z, Wang Q, Wu J. Effectiveness of Peer-Assisted Learning in medical education: A meta-analysis study. *PLoS One*. 2025;20(9):e0329605. https://doi.org/10.1371/journal.pone.0329605.

6. Fatima SN, Ahmed Z, Rehman A, Muhammad A, Siddiqui MK, Farrukh GM. Comparison of peer assisted learning versus conventional teaching system among undergraduate Medical students in terms of knowledge, skill and attitude. *The Professional Medical Journal. 2025*. 32(2):235-239. https://doi.org/10.29309/TPMJ/2025.32.02.8827.

7. He X, Rong X, Shi L, et al. Peer-led versus instructor-led structured debriefing in high-fidelity simulation: a mixed-methods study on teaching effectiveness. *BMC Medical Education*. 2024;24(1):1290. https://doi.org/10.1186/s12909-024-06262-9 Erratum in: *BMC Medical Education*. 2024;24(1):1406. https://doi.org/10.1186/s12909-024-06391-1.

8. Abouzahir H, Belhouss A, Benyaich H. Learning Clinical Reasoning in Forensic Medicine: A Scoping Review. *Medical Science Educator*. 2024 Mar 1;34(3):695-703. https://doi.org/10.1007/s40670-024-02013-z

9. Eraña-Rojas IE, Cabrera MVL, Barrientos ER, Membrillo-Hernández J. A challenge based learning experience in forensic medicine. *Journal of Forensic and Legal Medicine*. 2019 Nov;68:101873. https://doi.org/10.1016/j.jflm.2019.101873.

10. Roshni M, Rahim A. Small group discussions as an effective teaching-learning methodology for learning the principles of family medicine among 2nd-year MBBS students. *Journal of Family Medicine and Primary Care*. 2020;9(5):2248-2252. https://doi.org/10.4103/jfmpc.jfmpc_1228_19.

11. Al Shihabi A, Mardini H, Alkhaledi AN, et al. Effectiveness of peer-assisted teaching of medical English skills to non-native English-speaking medical students. *MedEdPublish.* 2023;13:36. https://doi.org/10.12688/mep.19694.2.

12. Rangareddy H, Govinda Swamy KSG, Ashakiran S, Petimani MS. Enhancing Student Engagement Through Active Teaching-Learning Approaches Among First-Year Medical Undergraduates. *Cureus*. 2025;17(6):e85921. https://doi.org/10.7759/cureus.85921.

13. Vijayan ST, Kattuparambil JJ, Mani PT, Chirukandath R, Antony M. Juxtaposing pedagogical paradigms: the efficacy of peer-assisted learning (PAL) versus faculty-assisted learning (FAL) in the refinement of surgical proficiency. *BMC Medical Education*. 2025 Feb 21;25(1):290. https://doi.org/10.1186/s12909-025-06827-2.