Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Effectiveness of case-based learning compared to traditional didactic teaching in clinical clerkship case discussions: a randomized controlled trial

Qiong Yang
The First Affiliated Hospital of Guangzhou Medical University
Xiaorong Gong
The First Affiliated Hospital of Guangzhou Medical University
Siqi Wang
The First Affiliated Hospital of Guangzhou Medical University
Minyu Dong
The First Affiliated Hospital of Guangzhou Medical University
Kequan Chen
gyfyy_xhnk@163.com
The First Affiliated Hospital of Guangzhou Medical University

Research Article

Keywords: clinical clerkship, CBL, case discussion, traditional lecture-based teaching

Posted Date: July 31st, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9001401/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Background

Case-based discussion is a core educational activity in clinical clerkships, aiding medical students' transition to real practice by fostering clinical acclimatization and foundational diagnostic reasoning. While traditional didactic methods ensure efficient knowledge transfer, case-based learning is hypothesized to better promote clinical reasoning and self-directed decision-making. Direct comparative evidence on their effectiveness in clerkship case discussions, however, remains limited. This study thus compares the educational efficacy of case-based learning versus traditional didactic methods within this specific stage.

Methods

A randomized controlled design was adopted. A total of 75 specialty clerkship students who completed two rounds (four cases in total) of case discussions in the Department of Gastroenterology, the First Affiliated Hospital of Guangzhou Medical University between November 2024 and January 2025 were included as the study subjects. Based on the teaching methods used in the two case discussions, the students were divided into a control group (n=75) and an experimental group (n=75). The control group received traditional lecture-based teaching, while the experimental group was taught using the CBL approach. After the intervention, differences between the two groups in case discussion assessment scores, teaching effectiveness, and student satisfaction were compared.

Results

The experimental group achieved significantly higher case discussion assessment scores than the control group ($P < 0.001$). In terms of teaching effectiveness, the experimental group performed better in history-taking ability, interpretation of auxiliary examinations, and clinical thinking ability (all $P < 0.001$). Regarding student satisfaction, the experimental group scored higher than the control group in dimensions such as practicality, classroom interaction, self-directed learning ability, and teamwork ability (all $P < 0.001$), while no statistically significant difference was found between the two groups in satisfaction with teaching content.

Conclusion

The application of CBL in case discussion teaching during clinical clerkships effectively improves students' case analysis ability and assessment performance. It also helps cultivate their history-taking, interpretation of auxiliary examinations, and clinical thinking skills, while promoting classroom interaction, self-directed learning, and teamwork. The CBL approach demonstrates favorable practicality and teaching effectiveness.

Background

Clinical clerkship constitutes a pivotal transition in medical education, bridging theoretical knowledge with practical application and serving as the foundation for developing clinical competency [1, 2]. This phase marks students' first structured exposure to real patients and specific diseases, moving beyond core theoretical learning towards applied clinical practice[3].

While classroom discussions of authentic cases are instrumental in familiarizing students with clinical environments, traditional teacher-centered approaches may insufficiently develop higher-order clinical reasoning and active decision-making skills, potentially hindering efficient progression toward residency readiness[2, 4].

Since its development by Dr. James Lorrain Smith as the 'case method of teaching pathology' at the University of Edinburgh, Case-Based Learning (CBL) has been extensively implemented across medical education[5]. This pedagogical approach centers on the systematic analysis of clinical cases to facilitate clinical-pathological correlation exercises [6, 7]. As an innovative instructional strategy, CBL has demonstrated efficacy in stimulating and enhancing student learning.

The extent to which CBL can systematically improve objective clinical examination performance, instructor-evaluated diagnostic and therapeutic skills, and self-reported learning engagement and role adaptation confidence—compared to traditional methods—remains to be empirically established within the local educational context.

This study aims to systematically investigate the differential effects of traditional lecture-based teaching and CBL on enhancing the learning outcomes of clerkship students in classroom-based case discussions.

Methods

1.1 General Information

Students participating in the gastroenterology specialty clerkship at the First Affiliated Hospital of Guangzhou Medical University from November 2024 to January 2025 were selected. This included 178 students majoring in Clinical Medicine (Class of 2021), 57 in Pediatrics, and 99 in Integrated Chinese and Western Medicine. The inclusion criteria were: full participation in two rounds of case discussions (four cases in total); completion of the case discussion assessment and questionnaire survey. Ultimately, 30 students from Clinical Medicine, 9 from Pediatrics, and 36 from Integrated Chinese and Western Clinical Medicine were included, totaling 75 participants.

1.2 Methods

All students were taught by the same attending gastroenterology physician with an associate chief physician title. This instructor had undergone systematic pedagogical training and assessment, possessed extensive clinical and teaching experience, was proficient in both traditional and CBL teaching methodologies, and was capable of independently guiding clerkship instruction. All included

students participated in two case discussion sessions, each employing a different teaching method, while maintaining consistency in teaching content and session duration.

1.2.1 Control Group

The traditional lecture-based teaching method was employed. The instructor provided the case materials and related questions one week in advance. During the session, the instructor led the discussion by first summarizing the patient's history, then explaining the pre-set questions one by one, and expanding on relevant theoretical knowledge.

1.2.2 Experimental Group

The case-based learning method was applied. Case materials were distributed in advance for students to independently analyze and formulate questions. In class, a group representative first presented the case history, followed by instructor commentary and correction. Students then discussed and shared insights based on their self-generated questions. Finally, the instructor summarized the discussion and provided in-depth analysis.

1.2.3 Observation Indicators (Additional file 1, 2, 3)

 Case discussion assessment scores: A written examination was conducted after the case discussions.

Teaching effectiveness evaluation: The instructor assessed students on history-taking ability, interpretation of auxiliary examinations, and clinical thinking skills using a 5-point scale (1: very poor, 5: very good).

 Student satisfaction survey: An anonymous questionnaire was used to evaluate satisfaction across five dimensions: teaching content, practicality, classroom interaction, self-directed learning ability, and teamwork ability, using the same 5-point scale.

1.3 Statistical Methods

Data were analyzed using SPSS 22.0 software. Normally distributed measurement data are presented as mean ± standard deviation ($\bar{x}$ ± s), with between-group comparisons conducted using the t-test. Count data were analyzed using the χ^2 test. A P-value < 0.05 was considered statistically significant.

Results

2.1 Analysis of Case Discussion Examination Scores for the Two Teaching Methods

The results are presented in Table 1. As shown, students majoring in Pediatrics, Integrated Chinese and Western Clinical Medicine, and Clinical Medicine achieved significantly higher theoretical scores under the CBL approach compared to traditional lecture-based teaching, with the differences being statistically significant.

Table 1 Case discussion examination Scores of two teaching methods

Major	Control Group (n=75)	Experimental Group (n=75)	*t* value	*p* value
Pediatrics	89.11±1.36	92.89±1.36*	8.02	<0.001
Integrated Chinese and Western Clinical Medicine	88.97±2.17	91.14±1.96*	2.07	<0.001
Clinical Medicine	89.5±2.11	93.40±1.98*	5.53	<0.001

Note: * p<0.05, compared with the control group.

2.2 Comparative Analysis of Teaching Effectiveness Between the Two Methods

As shown in Table 2, CBL group demonstrated significantly higher scores than the traditional teaching group across all assessed dimensions: history-summarizing ability, interpretation of auxiliary examinations, and clinical reasoning skills, with all differences reaching statistical significance.

Table 2 Teaching effectiveness between the two teaching methods

Teaching Effectiveness	Control Group (n=75)	Experimental Group (n=75)	*t* value	*p* value
History-taking Ability,	4.12±0.84	4.55±0.50*	1.58	<0.001
Interpretation of Auxiliary Examinations	4.01±0.79	4.41 ±0.49*	6.60	<0.001
Clinical Thinking Ability	3.991 ±0.94	4.47±0.53*	7.11	<0.001

Note: * p<0.05, compared with the control group.

2.3 Student Satisfaction with Two Teaching Methods

Most medical students (80%, 60/75) agreed that CBL was an effective teaching strategy. See Fig.1.

2.4 Student Feedback Scores for the Two Teaching Methods

Student feedback results are summarized in Table 3. The data indicate that respondents perceived CBL as superior to the traditional method in four key areas: practicality, classroom interaction, enhancement of self-directed learning ability, and improvement of teamwork skills. These perceived advantages were

statistically significant. In contrast, no statistically significant difference was found between the two groups regarding the assessment of teaching content.

Table 3 Student feedback scores for the two teaching methods

Feedback	Control Group (n=75)	Experimental Group (n=75)	*t* value	*p* value
Teaching Content	4.25±0.46	4.26±0.57	1.00	0.17
Practicality	4.13±0.53	4.53±0.50*	0.01	<0.001
Classroom Interaction	4.20±0.40	4.50±0.53*	0.03	<0.001
Self-directed Learning Ability	4.01±0.65	4.45±0.53*	0.03	<0.001
Teamwork Skills	4.01±0.46	4.24±0.57*	0.02	<0.001

Note: * p<0.05, compared with the control group.

Discussion

Case discussion is a core component in cultivating clinical thinking and decision-making skills during clerkship[8]. Currently, traditional teaching methods and CBL represent two primary instructional models in medical education, each with distinct characteristics and suitable contexts[4, 9] .This study will employ a combined assessment of examination performance and a purpose-designed questionnaire to comprehensively evaluate the relative effectiveness of these two instructional approaches during clerkship training. The findings are expected to provide critical evidence for optimizing pre-clinical education and cultivating competent future physicians.

Traditional teaching emphasizes the instructor's role in knowledge transmission, helping beginners quickly establish a disease knowledge framework and grasp key diagnostic and therapeutic points through systematic and structured lectures[7, 10]. The classroom organization is relatively well - standardized, which facilitates the attainment of teaching objectives within a limited time frame. In this research, around 17.33% of the students indicated a preference for traditional teaching, stating that its systematic knowledge structure and regulated pace were in line with their learning expectations during the early clinical phase.

Conversely, CBL is driven by actual clinical problems, encouraging students to actively construct knowledge through exploration[5, 11]. In this survey, 80% (60/75)of students indicated greater approval for the CBL model, reporting that it significantly enhanced classroom engagement and fostered the development of self-directed learning and teamwork skills, consistent with documented advantages of CBL in the literature. By simulating clinical decision-making processes, this approach effectively

cultivates students' critical thinking and clinical reasoning abilities, thereby enhancing the contextual relevance and proactive quality of learning.

However, both methods have limitations. Traditional teaching may render students passive recipients of information, which is less conducive to developing higher-order thinking skills and may result in lower knowledge transfer efficiency [6, 9]. Although students have mastered theoretical knowledge, they find it difficult to apply it flexibly to the dynamic and changing clinical scenarios[12].

CBL places greater demands on case design, classroom facilitation, and students' prior knowledge, posing higher challenges for both teaching competence and student engagement[13].Furthermore, the implementation of Case-Based Learning (CBL) frequently encounters systemic barriers, including limited institutional support (e.g., funding and technological deficits) and the significant time investment required for instructional preparation—a concern reported by approximately 31% of educators[14].

In practical teaching, these approaches are not mutually exclusive but should be integrated organically based on students' learning stages and instructional objectives. In the initial phase of case discussions, traditional lectures can help students build a foundational knowledge base[4, 15]. As learning progresses, CBL can be gradually introduced to emphasize training in clinical thinking and decision-making. Research suggests that optimizing CBL quality may be achieved through strategic resource allocation, specifically by increasing the availability of classrooms, instructional groups, and faculty[16, 17]. This expansion facilitates a reduced student-to-instructor ratio, thereby fostering a more interactive and personalized learning environment conducive to effective case discussion[18].Teaching strategies such as the "flipped classroom" model and interspersed "micro-cases" can also be employed to optimize teaching pace and effectiveness, creating a "hybrid case discussion chain" that bridges knowledge transmission with competencydevelopment[19].

Conclusion

Ultimately, the goal of case discussion extends beyond knowledge dissemination to the shaping of clinical thinking. In this regard, CBL demonstrates significant advantages due to its close alignment with real clinical scenarios. Future medical education should increasingly focus on student-centered, competency-oriented teaching models. While consolidating foundational knowledge, active promotion of CBL as a core approach in case discussions—supported by faculty development and technological tools—can continuously refine teaching practices. This represents an essential evolution from "knowledge impartation" to "cultivation of thinking and competency" in medical education[6].

Abbreviations

CBL Case based learning

SPSS Statistical Package for the Social Sciences

Declarations

Acknowledgements

The authors are grateful to the students who provided their consent to participate in the study.

Author contributions

Xiaorong Gong formulated the research idea and supervised the whole work. Minyu Dong, contributed to data analysis and wrote the manuscript. Siqi Wang,contributed to data collection. Qiong Yang, contributed to data collection, did the statistical analysis and wrote the manuscript. Kequan Chen critically revised the initial and final manuscript. All authors read and approved the final version of the manuscript.

Ethics approval and consent to participate

This study was performed in line with the principles of the Declaration of Helsinki. According to the regulations of the Institutional Ethics Committee of the First Affiliated Hospital of Guangzhou Medical University, this study was granted an exemption from requiring formal ethics approval because it was conducted in an established educational setting (clinical clerkship case-based teaching) and involved the analysis of anonymized educational records and routinely collected clinical data. The research was determined to pose no more than minimal risk to participants.

All procedures involving human participants (medical students and patients whose anonymized data were used) were performed in accordance with the ethical guidelines of the participating hospital. Written informed consent was obtained from all medical students involved in the case discussions. All patient data presented in the cases were rigorously anonymized, with all identifiers removed prior to analysis and publication, thereby ensuring patient confidentiality. The requirement for individual patient consent for publication was waived by the ethics committee due to the retrospective and anonymized nature of the data. Further documentation supporting the ethical framework of this study is available from the corresponding author upon reasonable request.

Funding

The study was funded by the First Affiliated Hospital of Guangzhou Medical University.

Data availability

Data generated in this study are available from the corresponding author upon reasonable request with a completed Materials Transfer Agreement, excluding the materials including personally identifiable information.

Clinical trial number

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors have no relevant financial or non-financial interest to disclose. The authors have no competing interests.

References

1. Chang C, Laird-Fick HS, Mitchell JD, Parker C, Solomon D: **Assessing the impact of clerkships on the growth of clinical knowledge**. *ANN MED* 2025, **57**(1):2443812.
2. Jacques LB: **Incremental change in student knowledge during a third-year family medicine clerkship**. *FAM MED* 1997, **29**(7):477-482.
3. Papanagnou D, Ankam N, Ebbott D, Ziring D: **Preparing Medical Students for Uncertainty in Clinical Practice: Recommendations for Clinical Clerkships**. *ACAD MED* 2021, **96**(11S):S210-S211.
4. Ghosh S: **Combination of didactic lectures and case-oriented problem-solving tutorials toward better learning: perceptions of students from a conventional medical curriculum**. *ADV PHYSIOL EDUC* 2007, **31**(2):193-197.
5. Williams B: **Case based learning--a review of the literature: is there scope for this educational paradigm in prehospital education?** *EMERG MED J* 2005, **22**(8):577-581.
6. Teherani A, Irby DM, Loeser H: **Outcomes of different clerkship models: longitudinal integrated, hybrid, and block**. *ACAD MED* 2013, **88**(1):35-43.
7. Taylor DC, Hamdy H: **Adult learning theories: implications for learning and teaching in medical education: AMEE Guide No. 83**. *MED TEACH* 2013, **35**(11):e1561-e1572.
8. Jeffery AD, Sengstack P: **Teaching Data Science through an Interactive, Hands-On Workshop with Clinically Relevant Case Studies**. *APPL CLIN INFORM* 2024, **15**(5):1074-1079.
9. McLean SF: **Case-Based Learning and its Application in Medical and Health-Care Fields: A Review of Worldwide Literature**. *J Med Educ Curric Dev* 2016, **3**.
10. Zaidi N, Kreiter CD, Castaneda PR, Schiller JH, Yang J, Grum CM, Hammoud MM, Gruppen LD, Santen SA: **Generalizability of Competency Assessment Scores Across and Within Clerkships: How Students, Assessors, and Clerkships Matter**. *ACAD MED* 2018, **93**(8):1212-1217.
11. Kaur G, Rehncy J, Kahal KS, Singh J, Sharma V, Matreja PS, Grewal H: **Case-Based Learning as an Effective Tool in Teaching Pharmacology to Undergraduate Medical Students in a Large Group Setting**. *J Med Educ Curric Dev* 2020, **7**:1485427136.
12. Jhala M, Mathur J: **The association between deep learning approach and case based learning**. *BMC MED EDUC* 2019, **19**(1):106.

13. McLean M: **Sometimes we do get it right! Early clinical contact is a rewarding experience**. *Educ Health (Abingdon)* 2004, **17**(1):42-52.
14. Gasim MS, Ibrahim MH, Abushama WA, Hamed IM, Ali IA: **Medical students' perceptions towards implementing case-based learning in the clinical teaching and clerkship training**. *BMC MED EDUC* 2024, **24**(1):200.
15. George T, Carey R, Abraham OC, Sebastian T, Faith MF: **Trainee doctors in medicine prefer case-based learning compared to didactic teaching**. *J Family Med Prim Care* 2020, **9**(2):580-584.
16. Liu SB, Peng B, Song YL, Xu QA: **[Application of case-based learning in clinical internship teaching of conservative dentistry and endodontics]**. *Shanghai Kou Qiang Yi Xue* 2013, **22**(6):711-714.
17. George T, Carey R, Abraham OC, Sebastian T, Faith MF: **Trainee doctors in medicine prefer case-based learning compared to didactic teaching**. *J Family Med Prim Care* 2020, **9**(2):580-584.
18. Riese A, Rappaport L, Alverson B, Park S, Rockney RM: **Clinical Performance Evaluations of Third-Year Medical Students and Association With Student and Evaluator Gender**. *ACAD MED* 2017, **92**(6):835-840.
19. Zhao W, He L, Deng W, Zhu J, Su A, Zhang Y: **The effectiveness of the combined problem-based learning (PBL) and case-based learning (CBL) teaching method in the clinical practical teaching of thyroid disease**. *BMC MED EDUC* 2020, **20**(1):381.

Figures

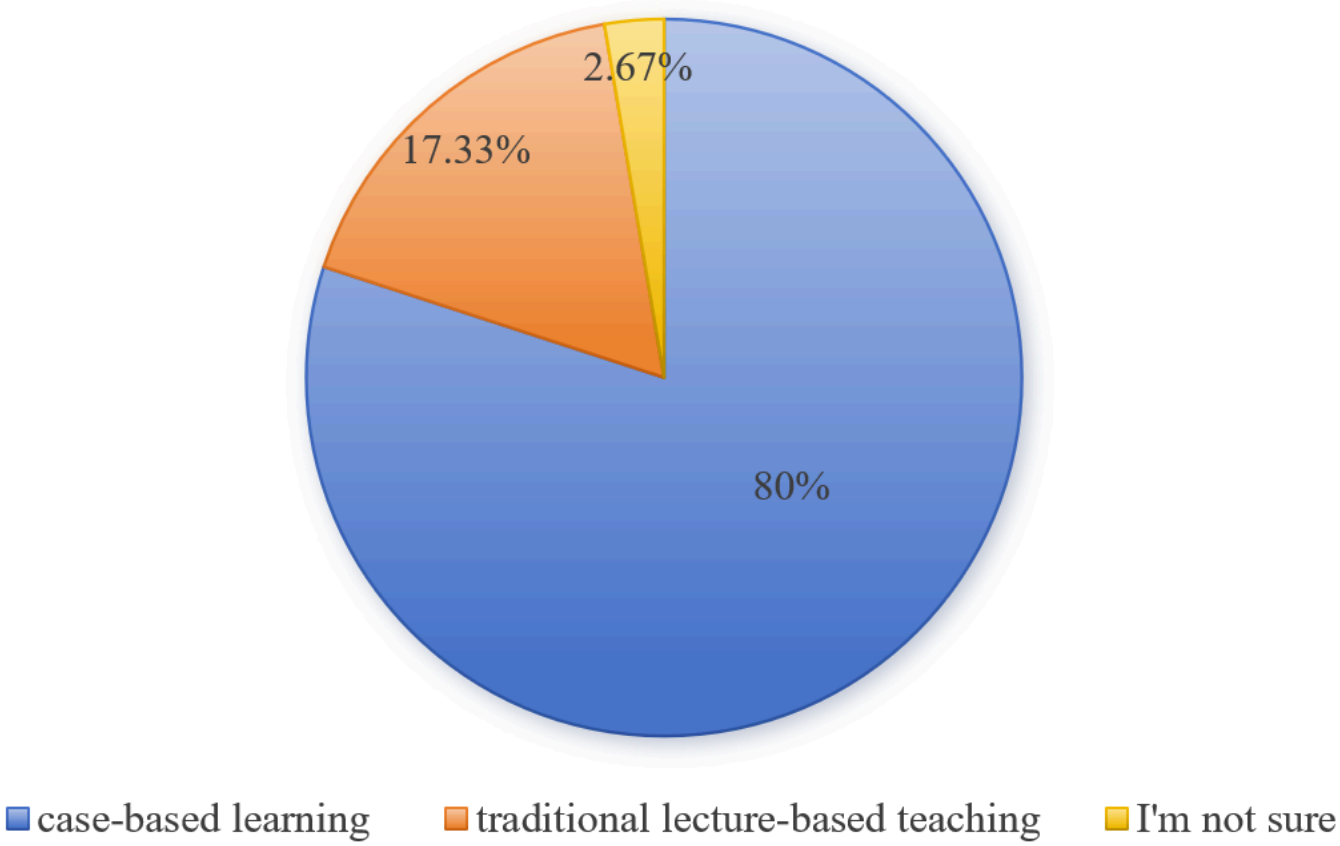


Figure 1

Medical student satisfaction with two teaching methods

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Questionnairefeedback.pdf
- Additionalfile1.pdf
- Additionalfile2.png
- Additionalfile3.png
- Testresults.png
- Teacherevaluationscore.png