

The application effects of problem-based learning (PBL) combined with multimedia technology teaching mode in the clinical practice teaching of the gastroenterology department: a comprehensive analysis

Xinli FENG, Ying CHANG, Yamei WANG*

Affiliated Hospital of Hebei University, Baoding 071000, China

Corresponding author.

Email address: wym870428@sina.com

Abstract: Objective: to investigate, analyze, and discuss the application efficacy of problem-based learning (PBL) combined with multimedia technology teaching mode in clinical practice education of the gastroenterology department. Methods: A total of fifty medical students who underwent training in the Department of Gastroenterology at our hospital from January 2023 to December 2023 were selected and divided equally into a control group and an experimental group. The control group received traditional teaching methods, while the experimental group was exposed to PBL combined with multimedia technology teaching mode. Skill scores, satisfaction ratings for skill instruction, and internship satisfaction levels were analyzed and compared between both groups. Results: Compared to the control group, the experimental group exhibited significantly higher skill scores ($P < 0.05$), greater satisfaction with skill instruction ($P < 0.05$), as well as increased internship satisfaction levels. Conclusion: The application of PBL combined with multimedia technology teaching mode in clinical practice education for gastroenterology demonstrates positive outcomes. This approach enhances interns' acquisition of fundamental theoretical knowledge and facilitates their development of practical abilities, which represents a more effective educational program that can be implemented within clinical gastroenterology education.

Key words: the problem-based learning (PBL) instructional approach; a randomized controlled study; a multimedia technology-based instructional model; instructional strategies in gastroenterology

1 Introduction

The problem-based learning (PBL) method is widely embraced in clinical practice and plays a pivotal role in medical education, offering interns an immersive experience through scenario simulation, fostering their critical thinking skills, and enhancing their ability to integrate theory with practice [1]. Multimedia teaching, as a novel pedagogical approach utilizing multimedia tools such as computers to provide visual data for interns, has not been extensively studied in the context of clinical teaching. Therefore, this study selected 50 medical interns from our hospital to investigate the effects of integrating PBL with multimedia technology in the teaching mode [2][3].

2 Data and methods

2.1 Clinical data

The study involved a total of fifty medical interns from the Department of Gastroenterology at our hospital, who were divided into a control group and an experimental group, with 25 participants in each group. Inclusion criteria: ① Medical interns must have planned internships in the Department of Gastroenterology at our hospital. ② The duration of the internship should not exceed two months. Exclusion criteria: ① interns unable to adhere to their original practice plans. ② poor level of cooperation among interns. ③ poor physical health condition of the interns. The control group consisted of ten male and fifteen female interns with an average age of (22.23±4.20) years old. The duration of their internship ranged from 8 to 12 weeks, with an average duration of (10.54±2.37) weeks. Similarly, the experimental group comprised individuals aged between 18 and 25 years old, with an average age of (22.20±4.25) years old, including eleven male and fourteen female interns. Their internship period ranged from eight to twelve weeks, with an average duration of (10.56±2.41) weeks. No significant differences were observed in baseline data between the two groups ($P>0.05$).

2.2 Methods

The control group received traditional instruction that encompassed active involvement of students in clinical routine activities including ward rounds, medical order processing, and physical examinations.

The experimental group adopted a teaching mode integrating problem-based learning (PBL) methodology with multimedia technology. ① A scientific approach was adopted, wherein a comprehensive assessment was conducted to evaluate interns' understanding and foundational knowledge of prevalent gastroenterological conditions, such as gastrointestinal bleeding and hepatic encephalopathy. Subsequently, tailored and specialized instructional strategies were devised accordingly, allowing for prompt adjustments based on individual intern circumstances. ② PBL teaching: The instructor guided the interns through ward rounds, during which students were questioned on fundamental knowledge and provided with explanations on relevant points. After the ward round, the interns would assist the teaching doctors in completing the documentation of the ward round medical records, issuing medical orders, and performing clinical operations. Then, the instructor would simulate the development of a comprehensive ward round plan, establish a standardized patient model, and facilitate intern doctors in conducting clinical operations such as patient assessment and treatment formulation. Subsequently, group discussions were conducted to foster active participation among members for collaborative consultation and standardized treatment plan formulation. Finally, a designated spokesperson would present the discussion outcomes while guiding doctors in summarizing and documenting post-class assignments. ③ Multimedia technology-enhanced instruction would integrate the standardized patient cases with various multimedia methods, such as computer-based approaches, which can effectively synthesize problem-based learning (PBL) teachings. The primary focus lies in the analysis of clinical reasoning and case analysis, as well as treatment procedures and disposal methods. This approach seamlessly combines theoretical knowledge with practical application while simultaneously fostering students' enthusiasm for learning.

2.3 Observation indicators

The skill score, satisfaction score of skill teaching, and practice satisfaction of the two groups of medical interns were analyzed and compared. Among them, the skill score primarily encompasses six aspects: interns' active engagement in learning after instruction, teamwork abilities, problem-solving skills, etc. The evaluation of teaching satisfaction among interns mainly focuses on their overall contentment with the instructional process. Specifically, the satisfaction score for

skill teaching evaluates and analyzes six key areas including active learning participation, teamwork collaboration, and problem-solving proficiency.

2.4 Statistical methods

The dataset was inputted into SPSS 21.0 software for processing and analysis. Measurement data were represented as ($x \pm s$) and analyzed using a T-test, while counting data were expressed as percentages and analyzed using a χ^2 test. Statistical significance was determined at $P < 0.05$.

3 Results

3.1 Comparison of the skill scores between the two cohorts of interns

The comparison of skill scores between the two groups indicated that interns in the experimental group demonstrated significantly higher levels of skill proficiency than those in the control group ($P < 0.05$). A detailed breakdown of results can be found in Table 1.

Table 1. Comparison of skill scores between the two groups ($\bar{x} \pm s$)

Groups	Number of cases (examples)	Active learning (points)	Teamwork (points)	Problem solving (points)	Clinical practice (points)	Communication (points)	Overall rating (points)
Control group	25	66.37 +/- 4.28	66.31 +/- 4.20	67.18 +/- 4.69	66.65 +/- 4.39	67.26 +/- 4.52	66.43 +/- 4.29
Experimental Group	25	87.12 +/- 3.35	86.79 +/- 3.25	89.23 +/- 3.22	87.45 +/- 3.21	88.66 +/- 3.34	87.90 +/- 3.65
t	-	19.089	19.282	19.379	19.123	19.038	19.059
P	-	0.000	0.000	0.000	0.000	0.000	0.000

3.2 A comparative analysis of teaching satisfaction among two cohorts of interns

The interns in the experimental group demonstrated a significantly higher level of teaching satisfaction compared to the control group ($P < 0.05$), as indicated by the findings presented in Table 2.

Table 2. Comparison of teaching satisfaction of interns in the two groups (n, %)

Groups	Number of cases (examples)	Full satisfaction (%)	Mostly satisfied (%)	Generally satisfied (%)	Not satisfied (%)	Overall satisfaction rate (%)
Control group	25 (100.00%)	11 (44.00%)	5 (20.00%)	4 (16.00%)	5 (20.00%)	20 (80.00%)
Experimental group	25 (100.00%)	20 (80.00%)	4 (16.00%)	1 (4.00%)	0 (0.00%)	25 (100.00%)
χ^2	-	6.876	0.136	2.000	5.556	5.556
P	-	0.009	0.713	0.157	0.018	0.018

3.3 Comparative analysis of satisfaction scores pertaining to skill teaching among two cohorts of interns

The interns in the experimental group exhibited significantly higher satisfaction scores in skill teaching compared to the control group ($P < 0.05$). Detailed results can be found in Table 3.

Table 3. Comparison of satisfaction scores for skill teaching between the two groups ($\bar{x}\pm s$)

Groups	Number of cases (examples)	Active learning (points)	Teamwork (points)	Problem solving (points)	Clinical practice (points)	Communication (points)	Overall satisfaction (points)
Control group	25	56.32 +/- 5.53	56.19 +/- 5.65	57.25 +/- 5.59	58.16 +/- 5.08	55.35 +/- 5.41	56.38 +/- 5.44
Experimental group	25	89.22 +/- 4.25	87.13 +/- 4.23	88.63 +/- 4.32	89.16 +/- 4.43	87.37 +/- 4.48	88.22 +/- 4.12
t	-	23.586	21.918	22.209	22.996	22.792	23.329
P	-	0.000	0.000	0.000	0.000	0.000	0.000

4 Discussions

In addition to acquiring and mastering theoretical knowledge, medical students at the university are required to complete at least one year of hospital practice and rotation. Through rotations in various departments, they can effectively integrate the theoretical knowledge acquired in school with real-life medical scenarios, thereby bridging the gap between theory and practice upon graduation. Gastroenterology holds significant importance in clinical practice due to the increasing societal pressures faced by Chinese residents and the prevalence of unhealthy habits, resulting in a growing number of patients seeking treatment. Moreover, this department deals with diverse diseases and complex cases, making it an indispensable practical training ground for most medical interns. Apart from their regular clinical duties, some clinicians also have teaching responsibilities; however, traditional clinical teaching methods tend to be intricate and ineffective when it comes to achieving the goal of integrating theory with practice [4].

Problem-based learning (PBL) and multimedia teaching modes have emerged as innovative approaches for clinical education in recent years. PBL is a problem-oriented instructional method that incorporates standardized patients and cases to stimulate students' independent learning abilities, as well as their capacity for problem analysis and discussion, thereby significantly enhancing teaching effectiveness [5][6]. The multimedia teaching method integrates clinical data while presenting intuitive displays of research findings for students' contemplation and reflection [7]. This study implemented PBL alongside multimedia teachings on gastroenterology trainees, which demonstrated that the combination of these two methods resulted in improved scores on their clinical skills during practice sessions, as well as enhanced overall satisfaction levels.

The integration of problem-based learning (PBL) with multimedia technology teaching mode in the clinical practice teaching of gastroenterology produces positive results by significantly augmenting interns' foundational theoretical knowledge and fostering the acquisition of practical skills. This pedagogical approach demonstrates greater effectiveness and can be easily incorporated into clinical gastroenterology education.

Conflicts of interest

The author declares no conflicts of interest regarding the publication of this paper.

References

[1] Liu JM, Zheng LP, Xie YY, et al. 2023. Exploring the PBL teaching model of virtual reality technology combined with the WeChat platform in teaching nursing students in cardiac surgery practice. *Health Vocational Education*, 41 (15): 95-98.

- [2] Zhang B, Liang JM. 2023. Studying the application effect of the PBL teaching method combined with a standardized case teaching model in pediatric clinical practice teaching. *Chinese Journal of Experimental Diagnostics*, 27(11): 1386-1387.
- [3] Li R, Peng JW, Xiao LJ, et al. 2018. Applying a dual-track teaching model based on a network environment in clinical practice teaching of rehabilitation therapy. *Chinese Journal of Rehabilitation Medicine*, 33(06): 718-720.
- [4] Zhang MM, Ilham K, Huo Q. 2021. Examining the application effect of PBL combined with multimedia technology in clinical practice teaching of cardiac surgery. *Modern Vocational Education*, 20: 226-227.
- [5] Li R, Sun LN, Su B. 2023. Applying the PBL teaching model combined with Mini-CEX and DOPS formative evaluation system in pediatric practice teaching. *Clinical and Education in General Medicine*, 21(07): 633-636.
- [6] Hou H, Liu HM, Liu J. 2019. Evaluating the application effect of PBL combined with multimedia technology teaching mode in clinical practice teaching of gastroenterology. *World Latest Medical Information Digest*, 19(60): 356-358.
- [7] Wei LX, Wu HQ, Xu C, et al. 2023. Assessing the application effect of systematic teaching method combined with PBL and CBL methods in spinal surgery clinical education. *Chinese Community Physician*, 39(19): 163 -165.