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Application of Modified Peyton's Four-Step Teaching Method in Bridge Experimental Courses for Undergraduate Medical Students

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Abstract: *Objective:* To explore the application value of the modified Peyton's four-step teaching method in bridge experimental courses for undergraduate medical students. *Methods:* 100 undergraduate medical students from Bethune Hospital of Shanxi from July 2023 to July 2024 were selected and grouped using a random number method. The control group received a conventional training program, while the observation group received a modified Peyton's four-step teaching and training program. The DOPS scores and teaching satisfaction scores of the two groups of undergraduate medical students were compared. *Results:* After intervention, the scores of each dimension of the DOPS for the undergraduate medical students in the observation group were higher than those in the control group. The teaching satisfaction scores of the undergraduate medical students after teaching were lower in the control group than in the observation group. The differences between the two groups were statistically significant ($P < 0.05$). *Conclusion:* The modified Peyton's four-step teaching program developed in this study can promote teaching and learning methods for undergraduate medical students, improve teaching satisfaction levels, and help administrators stabilize the medical team.

Keywords: Undergraduate medical students; Satisfaction; Undergraduate; Medical students

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1. Introduction

Practical teaching is a crucial component for cultivating students' clinical skills and their ability to integrate theory with practice [1]. As medical education reform continues to deepen, exploring efficient and practical teaching methods to optimize the overall quality of medical students has become a significant topic in the education sector [2]. Bridge experimental courses serve as an important link for undergraduate medical students to transition from theoretical learning to clinical practice, and their teaching outcomes directly impact students' future performance and growth in clinical practice [3]. The Peyton four-step teaching method is a classic skill training format consisting of "demonstration - decomposition - attempt - feedback" to facilitate learners'

mastery and improvement of skills [4,5]. However, with the development of medical education and society's demands on physicians' abilities, the traditional Peyton four-step teaching method has become inadequate in certain aspects, such as cultivating students' self-learning ability, critical thinking, and decision-making skills in complex clinical situations [6,7]. This study intends to explore and validate the application effects of the modified Peyton four-step teaching method in bridge experimental courses for undergraduate medical students.

2. Materials and methods

2.1. Subjects

From July 2023 to July 2024, the study subjects were 100 undergraduate medical students. They were randomly divided into an observation group and a control group, with 50 students in each group. The inclusion criteria were: (1) Participants in this study were medical students undergoing internship training at our hospital from July 2023 to July 2024; (2) Participants voluntarily signed the informed consent form and participated in the entire arrangement proposed by the study; (3) They had no previous clinical work experience.

Exclusion criteria: (1) Interns who have engaged in clinical work before internship, including internships, part-time jobs, etc. (2) Interns who withdraw from training due to leave or other reasons during the internship or cannot fully comply with the teaching plan. Observation group: 24 males and 26 females; age range 22–25 years old, average age (23.42 ± 1.15) years old; control group: 28 males and 22 females; age range 22–25 years old, average age (23.75 ± 1.08) years old. The baseline data of the two groups were comparable ($P > 0.05$).

2.2. Research methods

Control group: Classic Peyton's four-step teaching method: a: Demonstration - The teacher explains and demonstrates the action at a normal speaking speed without procedural explanation, and the students watch the teacher's movements to learn and reflect; b: Deconstruction - The teacher demonstrates the skill action again and provides detailed descriptions and explanations of the necessary sub-steps, without answering students' questions during the process; c: Comprehension - The teacher demonstrates the action for the third time, and the students describe and explain each sub-step. In this process, students can guide the teacher to operate, and the teacher provides timely feedback; d: Presentation/Execution - Students independently complete the entire action, and the teacher provides timely feedback.

Observation group: Implementation plan of the improved Peyton's four-step teaching method, see **Table 1**.

Table 1. Implementation plan of improved Peyton's four-step teaching method

Module	Specific Content	Measures/Instructions
I. Preparatory phase		
1. Theoretical Learning	Lecture format	2-3 hour special lectures by medical education experts on Peyton's 4-step method. Case analysis: Compare traditional vs modified Peyton method with intubation video clips.
	Standardization & Humanistic integration	Develop "Standardized Medical Skills Guide" with visual aids (e.g. disinfection range for venipuncture). Mark "communication checkpoints" in procedures with scripted phrases (e.g. "Please relax"). Humanistic elements account for 15% scoring (privacy protection, patient comfort).
2. Implementation Planning	Skill decomposition	Break "catheterization" into 6 steps with detailed actions (e.g. "inside-to-outside" disinfection sequence). Create "Phase-Specific Competency Objectives."
	Interdisciplinary collaboration	Involve clinicians, nurses, and ethics teachers to integrate sterile techniques and ethical considerations.

Table 1 (Continued)

Module	Specific Content	Measures/Instructions
II. Implementation process		
1. Group Allocation	Grouping principle	Heterogeneous grouping (balancing technical & communication skills). Each group receives practice kits (simulation models, patient scripts).
	Instructor roles	Each instructor supervises 3 groups (6 students), mastering guided questioning and immediate feedback. Document common errors (Instructor Log).
2. 4-Step Teaching Method	a. Demonstration	Standardized videos (8-10 mins) with panoramic/close-up shots + quick-reference cards. Students submit pre-study notes for Q&A.
	b. Deconstruction	Slow-motion demo with interactive questions (e.g. "Needle depth adjustment for obese patients"). 3D anatomy software for dynamic visualization.
	c. Comprehension	Peer evaluation (10-item Checklist), timed improvements. Video-aided self-reflection with improvement plans.
	d. Performance	Scoring: 70% technical (accuracy/fluency) + 30% communication. Trainees scoring < 80% receive one-on-one coaching.
3. Scenario Specifics	Simulation design	Patient bank: hearing-impaired elderly, pediatric cases etc. Scripted responses (e.g. moaning) requiring appropriate reactions. Emergency scenarios (e.g. sudden hypotension).
	Discussion topics	Debates like "Balancing protocol compliance with humanistic care" during emergencies.
III. Evaluation & feedback		
1. Outcome Assessment	Multi-dimensional evaluation	Practical exam: High-fidelity simulators (SimMan 3G) with complex scenarios (shock patient + family communication). Case reports on complication management (e.g. hematuria).
	Data tracking	Individual competency portfolios with pre/post-training metrics (procedure time, error rate), visualized as radar charts.
2. Quality Improvement	Feedback collection	Anonymous student surveys (quantitative + qualitative). Instructor-compiled error analytics (e.g. 50% failing sterile draping).
	Continuous improvement	Term-end "Teaching Innovation Forum" with clinical experts to update content (e.g. new device training).

2.3. Observation metrics

The evaluation methods include two forms: DOPS scoring and teaching satisfaction questionnaires.

(1) DOPS scoring is a structured assessment for procedural skills, consisting of 11 evaluation metrics: procedural indications, understanding of anatomy and procedural techniques, informed consent, preparation before the procedure, procedural skills, asepsis, seeking assistance, post-procedure handling, communication, humanistic care, and overall procedural performance during the entire process. The total score is 100 points.

(2) The teaching satisfaction questionnaire anonymously surveys students' subjective experiences, covering six dimensions: basic knowledge, clinical skills, learning interest, communication skills, humanistic qualities, and teaching methods. Each question provides three options: satisfied, average, and dissatisfied. The questionnaire is distributed, and the "overall satisfaction rate" is calculated. A satisfaction rate where the proportion of satisfied and average responses is ≥ 85% is considered satisfactory.

2.4. Statistical methods

Data were processed using SPSS 27.0 software. For categorical data, frequency and percentage (%) were used, and the chi-square (χ^2) test was applied for group comparison. For continuous data that followed a normal distribution, mean ± standard deviation (SD) was used for description, and Student's t-test was applied for comparison. When the *P*-value was less than 0.05, the difference was considered statistically significant.

3. Research results

3.1. Comparison of DOPS scores

In terms of the DOPS scoring questionnaire, the post-intervention scores of the observation group were significantly higher than those of the control group ($P < 0.05$), as shown in **Table 2**.

Table 2. Comparison of DOPS scores (scores, mean ± SD)

Group	n	Pre-intervention	Post-intervention	*t*-value	*p*-value
Study	50	72.19 ± 3.07	93.21 ± 3.33	32.817	< 0.001
Control	50	72.68 ± 3.05	87.51 ± 3.43	22.847	< 0.001
t-value		0.801	8.431	-	-
p-value		0.425	< 0.001	-	-

3.2. Teaching satisfaction survey

After the intervention, the teaching satisfaction survey showed that the observation group had significantly higher scores than the control group ($P < 0.05$), as seen in **Table 3**.

Table 3. Comparison of teaching satisfaction survey (People, %)

Group	Satisfied, *n* (%)	Neutral, *n* (%)	Dissatisfied, *n* (%)	Overall satisfaction rate
Study	38 (60.0%)	10 (33.3%)	2 (6.7%)	93.3%
Control	29 (30.0%)	12 (40.0%)	9 (30.0%)	70.0%
χ^2/*p*-value				5.005/0.025

4. Discussion

The results of this study indicate that the DOPS score of the observation group after intervention (93.21 ± 3.33) was significantly higher than that of the control group (87.51 ± 3.43) ($P < 0.001$). Analyzing the reasons, the increase in scores for operational skills and sterile concepts may be due to the detailed control of operations triggered by phased disassembly (slow motion demonstration) and peer review mechanisms [8]. The improvement in communication skills and humanistic care is related to the "communication nodes" and standardized scripting practices included in the teaching, which also reflects the effectiveness of situational simulations such as communication scripts for elderly patients [9]. These findings align with those of Wang *et al.* [10]. The Peyton method, through structured step-by-step disassembly, can significantly reduce skill mastery time and enhance operational safety, especially for complex skills such as internal jugular vein puncture [11,12].

The "overall satisfaction rate" (60.0%) of the observation group towards the teaching model was significantly higher than that of the control group (30.0%) ($P = 0.022$). Possible reasons include: Role switching

and peer evaluation: students strengthened their critical thinking during the role switching process between "operator" and "evaluator", and instant feedback (Peer Evaluation Form) reduced the consolidation of errors [13]. Immersion in simulated scenarios: Sudden scenarios (such as a patient's blood pressure dropping suddenly) and diverse patient databases (such as fear reactions among children) increased interest in learning and clinical adaptability. Traditional "cramming" teaching is teacher-centered, ignoring students' active participation, resulting in low interest in learning and irregular operations. The improved Peyton method identifies the finer points of steps (such as disinfection range) through the Standardized Guide for Medical Skills Operations, incorporates doctor-patient communication nodes, and improves the traditional "boring" teaching demonstration. The classic Peyton method relies on a 1:1 teacher-student ratio, which is difficult to adapt to the domestic college teacher situation. This study achieves universal improvement with the help of video assistance and intelligent tools, recording "panoramic + close-up" operation videos, and using 3D anatomy software to solve the problem of lack of detailed guidance caused by insufficient teachers, ensuring homogeneity of skill mastery and eliminating the disadvantage of the classic Peyton method, which is "too time-consuming" in complex operations.

In summary, the improved Peyton four-step teaching program developed in this study can promote teaching and learning methods for undergraduate medical students, improve teaching satisfaction levels, and help managers stabilize the medical team.

Disclosure statement

The authors declare no conflict of interest.

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