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The BOPPPS Teaching Model Implemented in the Endocrinology Departments of University-Affiliated Hospitals Located in Underdeveloped Regions, with a Focus on Enhancing Specialized Knowledge and Skill Training for Nursing Interns

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Abstract

Objective: To evaluate the effectiveness of the BOPPPS teaching model in enhancing specialized knowledge and skill acquisition among nursing interns in the endocrinology department of affiliated hospitals located in underdeveloped regions. Method: A quasi-experimental historical control study was conducted in the endocrinology ward of a university-affiliated hospital in Youjiang District, Baise City, Guangxi Zhuang Autonomous Region, China. A total of 90 undergraduate nursing students undergoing clinical internships in the endocrinology and metabolism unit were recruited as participants. The control group comprised 45 nursing interns who completed their training from March 2024 to December 2024 and received traditional didactic instruction. The intervention group included 45 nursing interns who participated from January 2025 to October 2025 and were taught using the BOPPPS model delivered via the Tencent QQ Group Classroom platform. Primary outcome measures included formative assessment scores to evaluate academic performance and the Academic Self-Efficacy Scale to assess students' self-efficacy in learning. Result:

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The comprehensive academic performance and academic self-efficacy of students in the observation group were significantly higher than those in the control group. Conclusion: The BOPPPS teaching model effectively enhances academic self-efficacy among intern nurses in the endocrinology department of affiliated hospitals of universities located in underdeveloped regions, resulting in superior comprehensive academic outcomes compared to the traditional teaching approach. This model has received strong recognition from both faculty members and students.

Keywords

BOPPPS, Teaching Methodology, Teaching Reform Initiative, Intern, Endocrine and Metabolic Disorders

1. Introduction

The BOPPPS teaching model is a student-centered and goal-oriented instructional design framework comprising six components: Bridge-in, Objectives, Pre-assessment, Participatory Learning, Post-assessment, and Summary (Pat & Russell, 2006). In recent years, research has demonstrated its widespread application across diverse educational contexts (Guo et al., 2023), with substantial evidence supporting its effectiveness in enhancing teaching outcomes (Chu et al., 2024). Previous studies have indicated that clinical nursing instruction in university-affiliated hospitals located in underdeveloped regions predominantly follows a teacher-centered approach, while student-centered pedagogical models are infrequently implemented. This discrepancy may be attributed to disparities in teaching infrastructure, educational standards, instructors' pedagogical competencies, and students' self-directed learning abilities when compared to institutions in developed and moderately developed regions.

In parallel, there has been a growing consensus among healthcare educators on the need to strengthen the standardization of nursing practices in non-endocrinology clinical departments (Ren et al., 2021). Upon graduation, most nursing trainees are assigned to non-specialized wards, where patients with endocrine and metabolic disorders are commonly distributed across various units. These patients require consistent, high-quality care, necessitating standardized training in endocrine and metabolic disease management for pre-service nurses. Therefore, it is both imperative and urgent to enhance specialized knowledge and skill development for nursing interns within endocrinology departments. Such training will not only improve future clinical nursing performance but also support the establishment of standardized diabetes care management in non-endocrinology settings (Li et al., 2024).

Underdeveloped regions refer to areas characterized by relatively low levels of overall socioeconomic development. These regions exhibit lagging productivity and face systemic challenges across multiple domains, including economic growth, ed-

ucation, healthcare, employment, and social welfare—indicating a comprehensive developmental gap compared to more advanced regions.

This study focuses on affiliated teaching hospitals of medical colleges and universities in underdeveloped regions, where both the quality of clinical nursing education and the advancement of educational digitalization remain limited. During the teaching process, these institutions often encounter significant barriers related to digital education development, including gaps in technical skills, practical application, digital literacy, and pedagogical conceptual understanding (Zhao et al., 2024). To address these challenges and promote continuous improvement in clinical nursing education, the research team implemented the BOPPPS model in nursing teaching programs within these institutions. The intervention yielded positive outcomes, which are reported herein.

2. Clinical Data and Methods

2.1. Research Subjects

To ensure fairness and prevent contamination between the control and intervention groups, this study employed a cluster sampling approach to select 90 undergraduate nursing students completing clinical internships in the Endocrinology and Metabolic Diseases Ward at the affiliated hospital of a higher education institution in an underdeveloped region. Participants were randomly assigned to groups during the research design phase. The control group comprised 45 nursing interns who completed their placements from March 2024 to December 2024 and received instruction through traditional classroom teaching methods. The intervention group included 45 nursing interns who undertook their internships from January 2025 to October 2025 and were taught using a BOPPPS model integrated with the Tencent QQ Group Classroom platform.

Inclusion criteria: 1) Full-time nursing students who provided informed consent and completed their clinical internship in the Endocrinology and Metabolic Diseases Ward between March 2024 and October 2025; 2) Holders of an associate degree or higher, aged 18 - 25 years; 3) Ability to attend all scheduled theoretical and practical sessions and complete assigned tasks on time; 4) To enhance comparability between groups and minimize confounding variables, all participants were selected from underdeveloped areas within the Guangxi Zhuang Autonomous Region, China.

Exclusion criteria: 1) Withdrawal from the study during its implementation; 2) Inability to continue participation due to sudden serious illness or other unforeseen circumstances; 3) Absence exceeding four weeks due to medical leave or personal/family reasons.

2.1.1. Establishing a Scientific Research Team

Establish a research team comprising eight members, including the head nurse of the ward, the chief clinical instructor, research group members, and experienced nursing instructors. All instructors participating in the clinical teaching component of this study must hold a valid college teacher qualification certificate, pos-

sess a bachelor's degree or higher, hold a professional title of nurse or above, have accumulated more than five years of clinical experience in the endocrinology department, and demonstrate competence in nursing research or exhibit proficiency in identifying and addressing clinical questions. The research team will undergo standardized training to develop, review, refine, and continuously improve the instructional plan and lecture materials based on the BOPPPS teaching model.

2.1.2. The Control Group Implemented the Conventional Clinical Nursing Teaching Model

1) Student Orientation Program

On the day of student registration, the head nurse of the endocrinology ward or the chief instructor conducted a standardized orientation session lasting 60 minutes. The session included: (1) a 20-minute overview of the department, covering its organizational structure, nursing team, teaching faculty, physical environment, workflow, shift responsibilities, scheduling policies, labor discipline, leave procedures, internship schedule, assessment methods for departmental exit examinations, and occupational exposure protocols; (2) a 30-minute didactic lecture on fundamental knowledge of endocrine and metabolic diseases and standard nursing practices; and (3) a 10-minute demonstration of the most frequently performed nursing procedure in the department—capillary blood glucose measurement.

2) Specialized Knowledge Instruction for the Control Group

Following orientation, students were assigned to individual instructors for one-on-one instruction over a four-week period under a three-shift system. Each week consisted of five working days, with no more than two night shifts scheduled per week, and each shift did not exceed eight hours. Typically, students completed three consecutive day shifts followed by two consecutive night shifts, then a two-day rest period, repeating this cycle throughout the internship. During this period, instructors provided one-on-one instruction on endocrine and metabolic disease care based on the department's standardized teaching syllabus and materials. The curriculum referenced "Internal Medicine Nursing, 7th Edition" published by People's Medical Publishing House and the "Chinese Guidelines for the Prevention and Treatment of Diabetes (2024 Edition)." Due to clinical workload constraints, dedicated time for theoretical instruction was limited. Therefore, specialized knowledge sessions were scheduled during morning shifts, held three times throughout the internship, each lasting 30 minutes, resulting in a total instructional time of 90 minutes.

3) Specialized Skills Training for the Control Group

Throughout the internship, students received individualized training in specialized nursing skills from their assigned instructors, following the department's unified syllabus and teaching resources. Key competencies included insulin pen injection techniques, insulin pump management, and functional assessment procedures. Instruction was delivered through instructor-led demonstrations, guided by "Fundamentals of Nursing" (People's Medical Publishing House) and the "Guidelines for Drug Injection of Diabetes in China (2016 Edition)." To facilitate

timely acquisition and clinical application of these skills, training sessions were scheduled during the first week's three day shifts. Each session lasted 30 minutes, totaling three sessions and accumulating 90 minutes of skill instruction. During clinical rotations, when relevant procedures arose, instructors allowed students to perform hands-on practice under direct supervision, ensuring active engagement and guided learning.

4) Evaluation of Teaching Effectiveness in the Control Group

Instructors assessed students' mastery of specialized nursing knowledge through oral questioning and evaluated skill proficiency via direct observation. The chief instructor conducted random spot checks to further evaluate students' competence in both theoretical knowledge and practical skills. Any deficiencies identified were promptly addressed through real-time feedback and targeted guidance provided by both the primary instructor and the chief instructor.

5) Teaching Schedule for the Control Group

The detailed teaching schedule for the control group is presented in Table 1. Instructors had the flexibility to adjust the timing and sequence of instruction according to clinical demands. Prior to each session, students were encouraged to preview relevant materials, and post-session review and independent study were recommended to reinforce learning and promote the integration of theory and practice.

Table 1. The teaching content and allocated time for specialized nursing theoretical knowledge and practical skills in the control group.

Duration of Instruction	Teaching Content	Responsible Teacher	Teaching Methodology
Sixty minutes	Introduction to education, foundational knowledge of endocrine and metabolic disorders, standard nursing procedures, and demonstration of micro-blood glucose measurement techniques	Overall Mentoring Teacher	Group-based instructional approach
Thirty minutes	Insulin injection techniques, insulin pump installation procedures, and associated management strategies	Instructor	Individualized instruction model
Thirty minutes	Operative Techniques for Comprehensive Functional Assessments in Endocrine and Metabolic Disorders	Instructor	Individualized instruction model
Thirty minutes	Physical examination procedures for patients with hyperthyroidism and basic screening methods for diabetic foot	Instructor	Individualized instruction model
Thirty minutes	Nursing Protocols for Common Metabolic Disorders in Endocrinology	Instructor	Individualized instruction model
Thirty minutes	Interpretation of the 2024 Edition of the "Chinese Guidelines for the Prevention and Treatment of Type 2 Diabetes"	Instructor	Individualized instruction model
Thirty minutes	Nursing Management of Thyroid Storm, Diabetic Ketoacidosis, and Hyperglycemic Hyperosmolar Syndrome	Instructor	Individualized instruction model

2.1.3. The Observation Group Implemented the BOPPPS Teaching Model

1) Introductory Education

The content, frequency, and duration of the orientation program were identical to those provided to the control group. Additionally, the scheduling of teaching

sessions and shift arrangements were consistent with those of the control group.

2) Specific Implementation of the BOPPPS Teaching Model in the Observation Group

(1) Organization and Design of the BOPPPS Teaching Model for Endocrinology Interns

To achieve predefined instructional objectives, the BOPPPS teaching model was applied to divide the original teaching process into six sequential and interrelated components: Bridge-in, Objective, Pre-assessment, Participatory Learning, Post-assessment, and Summary. Each component typically lasted approximately 15 minutes, a duration considered optimal for maintaining student engagement and attention. While each segment functioned independently, they were designed to be logically connected, forming a structured and cohesive instructional framework. This approach established a standardized pathway for delivering instruction. For a detailed illustration of the implementation process, please refer to Figure 1.

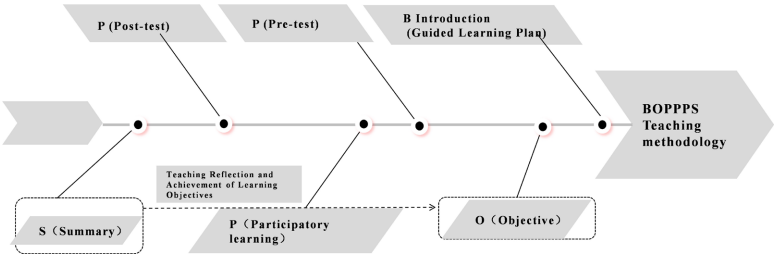

Figure 1. Structural diagram of the BOPPPS teaching model.

(2) Curriculum Design for the Application of the BOPPPS Teaching Model in Clinical Nursing Education (refer to Table 2 for detailed information).

(3) Pre-class Phase

This phase comprises B (Introduction), O (Objective), P (Pre-test), and the Tencent QQ Group Classroom platform.

① Preparation of teaching resources: This includes classrooms, multimedia equipment, and digital teaching platforms. The lead instructor establishes a dedicated QQ group for teaching management. Upon joining the department, all students are required to join the internship teaching group uniformly, with the Tencent QQ Group Classroom serving as the primary online teaching platform.

② Instructor preparation: Upon students' enrollment in the course, instructors are responsible for ensuring their timely entry into the QQ group, distributing guided learning plans, course objectives, and the teaching schedule. Instructors convert pre-class assessment questions into QR codes and require students to complete both the guided learning tasks and pre-class assessments within three working days of course entry.

③ Student preparation: Upon enrollment, students receive orientation training, join the designated QQ group, download the shared study guide, and preview each topic in accordance with the guide's instructions to become familiar with the learning objectives. Students are expected to independently complete the guided learning plan and pre-class test within three working days.

Table 2. Teaching curriculum design based on the BOPPPS model in clinical nursing education.

Link	Teaching Methodologies	Teacher Activities	Student Activities
Before class	B (Introduction)	Upload teaching objectives and guided study plans via QQ groups, and distribute pre-class self-study materials—including short videos, popular science questions, and micro-lessons—to stimulate students' curiosity.	Join the QQ group within the specified timeframe to access teaching objectives and guided study plans, view instructional short videos, popular science materials, micro-lessons, and other resources, and complete all necessary pre-class preparations.
	O (Objectives)	Please upload the teaching objectives to the QQ group.	Review and thoroughly comprehend the instructional objectives.
	P (pre-test) + Utilization of the QQ Group Classroom as the instructional platform	1) Oversee the completion of students' assignments prior to class. 2) Distribute pre-class assessment materials in a timely manner.	1) Peer review among students and collaborative monitoring by student groups regarding the progress of the guided learning plan implementation. 2) Following the completion of the pre-class session, the teacher provides feedback on the effectiveness of students' preview activities.
During the class session	P (Participatory Learning) integrated with QQ Group-based Classroom Instruction	1) Supervise students during practical exercises and conduct random on-site assessments of individual student performance. 2) Provide constructive feedback on students' procedural execution and acknowledge their progress. 3) Focus on key and challenging aspects of professional knowledge, while monitoring students' learning outcomes and skill acquisition in real time.	1) Collaborate in groups to discuss and share individual learning experiences. 2) Conduct podium-style presentations: each group will designate a representative to deliver their findings on stage, showcasing learning outcomes through diverse formats. 3) Identify and clarify the key concepts and challenging aspects of the subject matter.
	Post-test P combined with QQ Group Classroom	1) After-class test questions are posted on the QQ platform, and students complete the tests under the supervision of their instructors. 2) Analyze problems and provide feedback on students' tests.	1) Students actively completed the assessments and engaged in reflective analysis of their learning process by maintaining structured reflection journals. 2) Students provide systematic feedback on their learning outcomes and conduct self-evaluations to monitor their academic progress.
	Summary of QQ Group Classroom	1) Summarize the essential professional knowledge and conduct an analysis of technical challenges utilizing the platform. 2) Assess students' overall performance comprehensively.	1) Summarize the learning process and outcomes, and provide feedback on challenges encountered during the learning period. 2) Conduct a self-assessment and review the instructor's evaluation.
Following the conclusion of the class	Enhance and broaden expertise	1) Assign extracurricular homework via QQ groups, such as creating mind maps and recording educational videos. 2) Review and evaluate student submissions promptly, providing timely and constructive feedback.	1) Complete the after-school extended learning assignments through various channels and submit the supplementary coursework to the designated platform in a timely manner. 2) Maintain regular communication with the instructor to ensure ongoing academic support and feedback.

(4) In-Class Phase

This phase includes P (Participatory Learning), P (Post-test), and S (Summary).

Aligned with the official teaching schedule, the teaching team delivers theoretical instruction and practical skill training through an integrated approach combining theory and practice.

① Theoretical instruction is organized and delivered by the head nurse and lead instructor via the QQ Group Classroom in an online format.

② Specialized nursing skill demonstrations and routine nursing procedures are recorded as instructional videos by the lead instructor, uploaded to the QQ group, and assigned for student review. In conjunction with daily clinical activities, instructors provide individualized, one-on-one guidance on skill execution.

③ Throughout the teaching process, instructors actively guide students in applying theoretical knowledge to daily nursing practice. They regularly observe students' performance, particularly focusing on academic discipline and professional attitude, and conduct periodic questioning to reinforce theoretical understanding.

④ Teaching staff conduct random assessments of students' proficiency in specialized nursing procedures. These evaluations aim to help students identify gaps in their theoretical knowledge or clinical techniques, encourage exploration of clinical issues, and further guide them in transforming observed clinical challenges into potential research topics. This process supports the development of nursing research capabilities and contributes to advancing the nursing profession through innovative theoretical and practical insights.

(5) Post-Class Phase

Instructors may assign supplementary homework and extended learning materials on the platform, including recommended readings, journals, summaries of recent domestic and international research advancements, updated nursing guidelines, expert consensus statements, and emerging technologies, methodologies, and concepts within the specialty field. Students are encouraged to complete these extended learning tasks and are reminded of the importance of maintaining continuous professional development and staying current with evolving practices. Examples of such tasks include creating knowledge mind maps or producing educational short videos. Instructors monitor progress by reviewing and grading submitted assignments on the platform and promptly addressing student inquiries. Students engage in post-class knowledge and skill enhancement through diverse resources, upload completed assignments, and maintain ongoing communication with instructors.

3) Teaching Plan Schedule of the Observation Group

The teaching plan schedule for the observation group is outlined in **Table 3**. Teachers may adjust the timing and sequence of instruction flexibly according to their respective work schedules. Prior to class, instructors are encouraged to guide students in collaborative preparation activities based on the BOPPPS model, thereby promoting the effective integration of theoretical knowledge and practical application.

Table 3. The teaching content and the corresponding time requirements for specialized nursing theoretical knowledge and practical skills in the observation group.

Duration of Instruction	Teaching Content	Responsible Teacher	Teaching Methodology
Sixty minutes	Introduction to education, foundational knowledge of endocrine and metabolic disorders, standard nursing procedures, and demonstration of micro-blood glucose measurement techniques	Overall Mentoring Teacher	Group-based instructional approach
Thirty minutes	Insulin injection techniques, insulin pump installation procedures, and associated management strategies	A clinical mentor holding the position of Deputy Chief Nurse	Group-based instructional approach
Thirty minutes	Operative Techniques for Comprehensive Functional Assessments in Endocrine and Metabolic Disorders	A clinical mentor holding the position of Deputy Chief Nurse	Group-based instructional approach
Thirty minutes	Physical examination procedures for patients with hyperthyroidism and basic screening methods for diabetic foot	A clinical mentor holding the position of Deputy Chief Nurse	Group-based instructional approach
Thirty minutes	Nursing Management Guidelines for Common Metabolic Disorders in Endocrinology	Overall mentoring by the teacher	Group-based instructional approach
Thirty minutes	Interpretation of the 2024 Edition of the "Chinese Guidelines for the Prevention and Treatment of Type 2 Diabetes"	Overall mentoring by the teacher	Group-based instructional approach
Thirty minutes	Nursing Management in Thyroid Storm, Diabetic Ketoacidosis, and Hyperglycemic Hyperosmolar Syndrome	Overall mentoring by the teacher	Group-based instructional approach

4) Confirmation of the Teaching Effect in the Observation Group

Instructors employ a questioning approach to evaluate students' mastery of specialized nursing knowledge related to endocrine and metabolic diseases. Additionally, students' performance in executing specialized nursing procedures is assessed through direct on-site observation. The chief instructor conducts random spot checks and other evaluation methods to further examine students' competence in both theoretical knowledge and practical skills. Both instructors and the chief instructor provide timely feedback and targeted guidance to address any identified deficiencies.

2.2. Evaluation Indicators

2.2.1. Graduation Comprehensive Score

A formative assessment approach is implemented to comprehensively evaluate students' final graduation scores. The proposed evaluation framework for interns upon completion of the program is structured as follows: theoretical knowledge (30%), specialized skills operation (30%), labor discipline (20%), and routine performance (20%). Final comprehensive performance is categorized into the following: excellent (total score ≥ 90), good (80 - 89), qualified (70 - 79), borderline qualified (60 - 69), and unqualified (below 60).

Theoretical assessments are developed by the chief instructor and teaching staff holding associate senior professional titles or higher, who are also responsible for organizing and uniformly grading the examinations. Practical skill evaluations focus on key nursing procedures, including capillary blood glucose measurement, subcutaneous insulin injection using an insulin pen, and insulin pump operation. These competency assessments are conducted and scored by designated teaching instructors.

2.2.2. Academic Self-Efficacy

Issue:
1. I am confident in my ability to achieve strong academic performance.
2. When encountering academic challenges, I believe in my capacity to effectively
3. Compared to my peers, I possess a relatively strong aptitude for learning.
4. I am able to promptly grasp the knowledge presented by instructors during class.
5. I am capable of applying the knowledge I have acquired to relevant contexts.
6. My understanding of subject matter is broader compared to that of my classmates.
7. I prefer engaging in learning tasks that are intellectually challenging.
8. I can thoroughly comprehend both textbook content and instructional material
9. I frequently choose difficult learning tasks that promote knowledge acquisition, even
10. Following an unsuccessful examination, I remain composed and conduct a careful
11. Regardless of my academic outcomes, I maintain confidence in my learning abilities.
12. To assess my mastery of learned material, I regularly employ self-questioning and
13. I am able to think critically by integrating new knowledge with previously acquired
14. At times, I experience difficulty fully comprehending the meaning of textual material
15. While reading, I actively relate new information to my existing knowledge base.
16. Occasionally, I find it challenging to maintain focus in class due to a tendency to
17. I sometimes struggle to accurately summarize the core ideas of the material I have
18. I use annotation strategies, such as highlighting or marking key points in books and
19. When preparing for exams, I systematically review by connecting related concepts
20. During lectures, I tend to record every word spoken by the instructor without
21. When completing assignments, I make a conscious effort to recall and apply
22. Even in the absence of formal requirements, I proactively complete end-of-chapter exercises to evaluate my understanding and reinforce learning.

Figure 2. Screenshots of 22 specific items from the academic self-efficacy scale (Note: The four items highlighted with a standard yellow background are reverse-scored items).

The Academic Self-Efficacy Scale was employed to assess and compare the academic self-efficacy levels between the two groups of students. Developed by Liang Yusong and Zhou Zongkui from Central China Normal University (Zhang, 2022), this instrument comprises two dimensions: learning ability self-efficacy and learning behavior self-efficacy, encompassing a total of 22 items. The learning ability self-efficacy dimension pertains to students' beliefs regarding their capacity to achieve high academic performance and successfully complete academic tasks. In contrast, the learning behavior self-efficacy dimension reflects individuals' judgments about the effectiveness of their learning strategies and their ability to attain set academic goals through specific approaches. Items 1 to 11 measure learning ability self-efficacy, while items 12 to 22 assess learning behavior self-efficacy. Re-

sponses are rated on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Four items are reverse-scored, with scoring reversed from 5 (strongly disagree) to 1 (strongly agree) to minimize response bias. The overall academic self-efficacy score is derived from the sum of the two subscales, yielding a total score range of 22 to 110, with higher scores indicating stronger academic self-efficacy. In this study, the scale demonstrated acceptable internal consistency, with Cronbach's α coefficients of 0.802 for the learning ability subscale, 0.724 for the learning behavior subscale, and 0.803 for the full scale. The detailed items of the Academic Self-Efficacy Scale are presented in **Figure 2** (Note: Items marked with a yellow background are reverse-scored).

2.3. Statistical Methods

In this study, valid questionnaires were coded and processed, then independently double-checked by two researchers to ensure data accuracy before being entered into an Excel database. Data analysis was performed using SPSS 25.0 software. All statistical tests were two-sided, with a significance level set at $\alpha = 0.05$. Normality and homogeneity of variance were assessed prior to analysis, and the results indicated that all data met the assumptions of normal distribution and equal variances. The specific analytical procedures are as follows:

1) Descriptive statistics: For general demographic characteristics, normally distributed continuous variables were summarized using means ± standard deviations, while categorical variables were presented as frequencies and percentages.

2) Group comparisons of demographic variables between the two student groups were conducted using the chi-square test for categorical data and the independent samples t-test for continuous variables.

3) Academic performance and academic self-efficacy between the observation group and the control group were compared using independent samples t-tests.

3. Results

3.1. Baseline Characteristics of the Two Study Groups

Control group: This group included 3 male students (6.7%) and 42 female students (93.3%), with a mean age of (22.29 ± 0.99) years. In terms of educational background, 15 students held associate degrees (33.3%) and 30 held bachelor's degrees (66.7%). Observation group: This group consisted of 4 male students (8.9%), 42 female students (91.1%), with a mean age of (22.29 ± 0.92) years. Regarding academic qualifications, 14 students had associate degrees (31.1%) and 31 had bachelor's degrees (68.9%). No statistically significant differences were observed between the two groups in terms of gender, age, or educational background (all $P > 0.05$).

3.2. Comparison of Graduation Scores between the Two Groups

Significant differences were found between the two groups in overall graduation scores, including theoretical knowledge scores, practical skills scores, labor disci-

pline scores, and daily performance scores (all $P < 0.05$). Detailed results are presented in Table 4.

Table 4. Comparison of graduation scores between the two groups of research subjects.

Team	Number of Cases	The overall score for the final examination	Theoretical knowledge score	Operational skills assessment score	Labor discipline	Standard performance
Control Group	45	92.97 ± 1.17	26.38 ± 0.99	27.37 ± 0.45	19.79 ± 0.14	19.44 ± 0.36
Observation Group	45	93.98 ± 1.10	26.75 ± 0.79	27.64 ± 0.60	19.85 ± 0.14	19.74 ± 0.36
t-value	—	−7.317	−4.101	−3.025	−3.162	−4.967
p-value	—	<0.001	<0.001	<0.05	<0.05	<0.001

3.3. Comparison of Academic Self-Efficacy Scale Scores between the Two Groups of Research Subjects

Statistically significant differences were observed in the total academic self-efficacy score, as well as in the subscale scores for learning ability efficacy and learning behavior efficacy, between the two groups of research subjects ($P < 0.05$). Detailed results are presented in Table 5.

Table 5. Comparison of academic self-efficacy assessments between the two groups of research subjects.

Group	Number of Cases	Overall Score of Academic Self-Efficacy	Learning Ability Efficiency Score	Learning Behavior Effectiveness Score
Control Group	45	61.38 ± 9.59	30.73 ± 5.89	30.64 ± 6.92
Observation Group	45	66.0 ± 9.29	34.13 ± 6.54	31.87 ± 6.77
t-value	—	−4.007	−4.104	−2.363
p-value	—	<0.001	<0.001	<0.05

4. Conclusion

4.1. The BOPPPS Teaching Model Enhancing the Comprehensive Academic Performance of Nursing Interns

As shown in Table 4, the exit examination scores of the observation group were significantly higher than those of the control group. This finding aligns with previous studies conducted in China, such as that by Wang Zhaoyan (Wang, 2021), and is further supported by the research of Bingshu Wu et al. (Wu et al., 2025), who reported that students in the intervention group—taught using the BOPPPS model—achieved higher summative assessment and overall scores compared to their counterparts in the control group. These results suggest that the BOPPPS teaching model offers distinct advantages over traditional teacher-centered instruction in enhancing students' comprehensive academic performance. The ef-

fectiveness of the BOPPPS model may be attributed to its structured framework comprising six interrelated components: Bridge-in, Objectives, Pre-assessment, Participatory Learning, Post-assessment, and Summary. This systematic design facilitates a more standardized and holistic teaching process, enabling continuous monitoring of learning outcomes. Additionally, findings from Jing Zhu et al. (Zhu et al., 2025) highlight the potential of the BOPPPS model in improving multiple aspects of clinical education, including academic achievement, student engagement, and satisfaction.

4.2. The BOPPPS Teaching Model Enhancing Students' Academic Self-Efficacy

Data presented in **Table 5** indicate that both the total score and subscale scores of academic self-efficacy in the observation group were significantly higher than those in the control group. This outcome is consistent with the findings of Ni Xiaofei (Ni, 2022), suggesting that the BOPPPS model is more effective than traditional teaching methods in fostering students' academic self-efficacy. Enhanced self-efficacy contributes to greater confidence in learning, which in turn positively influences academic performance. As a student-centered approach, the BOPPPS model emphasizes active participation, thereby strengthening learners' belief in their academic capabilities. A reciprocal relationship exists between academic performance and self-efficacy, with each reinforcing the other and ultimately improving the quality of both teaching and learning processes. Supporting this, Ningning Xia et al. (Xia et al., 2025) reported that students exposed to the BOPPPS model exhibited significantly higher levels of academic self-efficacy and learning engagement, lower levels of learning burnout, improved test performance, and greater course satisfaction.

4.3. Summary

The BOPPPS teaching model has been widely applied across various educational contexts, demonstrating consistent effectiveness. For instance, in a study by Dingchang Wang et al. (Wang & Chen, 2025), the model was implemented in English reading instruction for junior high school students in Fujian, China. Results showed that students in the BOPPPS group outperformed those in the control group in reading proficiency, indicating the model's suitability for enhancing language learning at the secondary level. Similarly, Jiaxuan Lu et al. (Lu et al., 2025) found that integrating the BOPPPS model with Case-Based Learning (CBL) in pediatric dentistry education promoted knowledge acquisition, encouraged active learning, and improved the quality of clinical training. These findings collectively underscore the adaptability and efficacy of the BOPPPS model in diverse educational settings.

5. Limitations of This Study

Due to constraints in teaching resources and other practical limitations, this study

was unable to adopt a randomized controlled design. Future research should include more rigorous randomized controlled trials to generate stronger evidence for application in clinical nursing education.

6. Recommendations from the Author

Based on the practical experience of our research team, several insights have been obtained. First, the BOPPPS instructional model has demonstrated effectiveness in achieving high-quality teaching outcomes. A critical factor in its success lies in the thorough preparation conducted by both instructors and students prior to class. The extent of this pre-class preparation significantly influences classroom performance; therefore, continuous monitoring and support of preparatory efforts are essential. Second, when delivering clinical nursing knowledge and skills, the BOPPPS model places increased demands on instructors' foundational teaching competencies, including classroom management, assessment of students' practical abilities, evaluation of post-class learning retention, and responsiveness to unexpected situations. It is thus recommended that instructors with more than ten years of specialized experience in nursing education be assigned to implement this model. Third, the implementation of the BOPPPS model relies heavily on a dedicated teaching platform for disseminating notifications and organizing instructional activities. Consequently, it is imperative to select a platform characterized by comprehensive functionality and stable technical performance before initiating any course.

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Authorship Contribution Statement

Yijuan Li, Shuxian Wang: Proposed research ideas and designed research schemes; Yijuan Li, Chen Yan: Conducting experiments and investigations; Weiping Xie, Chen Yan: Data collection, data sorting and statistical analysis; Yijuan Li, Shuxian Wang, Liuxue Lu, Weiping Xie: Paper writing. Liuxue Lu, Yanzhen Lu, Ting Meng, Meiyan Ou: Overall check and review papers.

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Conflicts of Interest

None of the authors have a conflict of interest.

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