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Effectiveness of Rain Classroom combined with Case-Based teaching in the Gynecological nursing practice for undergraduate interns

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Abstract

[Aims] This study aimed to investigate the effectiveness of combining Rain Classroom with case-based teaching in improving the educational outcomes of undergraduate interns in gynecological nursing. [Methods] A total of 48 full-time undergraduate nursing interns in the gynecology department of the Seventh Affiliated Hospital of Sun Yat-sen University, from August 2023 to April 2025, were selected and divided into a control group (traditional lecture-based teaching, n = 24) and an experimental group (Rain Classroom combined with case-based teaching, n = 24) according to the chronological order of their internships. Teaching effectiveness was evaluated based on theoretical exam scores, nursing assignment scores, and student satisfaction. [Results] The results indicated that the theoretical exam and nursing assignment scores of the experimental group were significantly higher than those of the control group. Furthermore, the combined teaching model effectively stimulated students' interest in learning, improved their mastery of theoretical knowledge, enhanced their initiative and engagement, and increased overall teaching satisfaction. [Conclusions] Integrating Rain Classroom with case-based teaching proves to be an effective strategy for enhancing students' learning initiative, optimizing knowledge acquisition, and supporting the ongoing reform of nursing education.

Keywords Nursing interns; Rain Classroom; Case-based teaching; Teaching satisfaction
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1 Introduction

Nursing internships represent a pivotal stage in the transition from academic study to clinical practice. This phase enables interns to translate classroom-acquired knowledge into real-world clinical scenarios, validate theoretical principles, deepen their understanding of disease management and pharmacological applications, and develop both basic and specialized clinical skills. However, traditional teaching approaches are often limited by low interactivity, inflexible content delivery, repetitive instructional methods, and

insufficient student engagement[1-2], all of which impede the effectiveness of learning. In response to the growing trend of educational informatization, the integration of intelligent technologies and innovative pedagogical strategies has emerged as a key avenue for enhancing the quality of clinical education.

Rain Classroom is an innovative AI-powered teaching platform developed by Tsinghua University, and it has been increasingly applied in clinical education. Its key features include: (1) delivering educational materials to students via WeChat; (2) embedding quizzes into PowerPoint slides for real-time formative assessment; (3) enabling teacher-student interaction through randomized roll calls; (4) supporting a variety of question formats for assignments; and (5) providing regular analytics on teaching effectiveness. By integrating high-quality resources with interactive functionalities, Rain Classroom significantly enhances the learning experience and contributes to improved academic performance among interns [3-4].

The platform is user-friendly and accessible across multiple devices, including smartphones, computers, and tablets. Instructors can distribute teaching materials—such as slides, quizzes, videos, and audio files—directly to students' mobile devices. Students can access these materials in real time by scanning QR codes via WeChat or its embedded mini-programs. The system automatically records and analyzes learning data, allowing educators to track student engagement and learning progress before, during, and after class, and to adjust teaching strategies accordingly. This model of flexible and fragmented learning is particularly well-suited to the dynamic and time-constrained environment of clinical nursing education [5-6].

Gynecology wards are characterized by a wide spectrum of disease types, frequent emergencies, complex clinical presentations, and high workloads. In this context, the accumulation and application of typical clinical cases are essential components of nursing education. By analyzing multiple representative cases of common gynecological conditions, educators can effectively cultivate interns' clinical reasoning and problem-solving skills. Case-based teaching (CBT) encourages students to apply theoretical knowledge in practical scenarios, promoting deeper understanding through vivid, context-rich discussions. This approach not only enhances learning motivation but also bridges the gap between theory and practice, thereby fostering the development of clinical thinking abilities [7].

Against this backdrop, the present study investigates the effectiveness of integrating Rain Classroom with case-based teaching for undergraduate interns in gynecological nursing. The aim is to provide evidence-based insights for optimizing instructional strategies and improving the quality of clinical nursing education.

2 Materials and Methods

2.1 Study design

This study employed a comparative design. A total of 48 nursing interns from the gynecology department of the Seventh Affiliated Hospital of Sun Yat-sen University participated, with internships conducted between August 2023 and April 2025. Inclusion criteria were as follows: (1) full-time undergraduate nursing students; (2) provision of informed consent and a serious attitude toward the internship. Exclusion criteria included: (1) interns who violated hospital regulations and had their internship terminated prematurely; (2) those who did not attend in-person lectures; (3) those who missed the theoretical examinations.

Participants were assigned to a control group (n = 24) and an experimental group (n = 24) based on the chronological order of their internship rotation. There were no significant differences in baseline characteristics, such as age and gender, between the two groups ($P > 0.05$), indicating good comparability.

2.2 Intervention strategies

According to the requirements of the gynecology nursing curriculum, each intern completed a four-week clinical rotation. On the first day, the interns participated in a departmental orientation conducted by the

pediatric-gynecological teaching coordinator, followed by specialized training delivered by gynecology educators. Each intern was assigned a clinical mentor and required to complete weekly plans encompassing theoretical instruction, skills practice, and bedside teaching. In the second week, two instructors provided thematic lectures on topics such as perioperative care for cervical cancer and key management points in ectopic pregnancy. During the fourth week, interns' theoretical knowledge and nursing assignments were assessed by both educators and clinical mentors. The head nurse supervised the overall quality control process to ensure the consistency and fairness of evaluations.

The control group received traditional lecture-based instruction, while the experimental group was exposed to a combined teaching model incorporating Rain Classroom and case-based learning. (1) Pre-class Preparation: PowerPoint presentations (PPTs) were designed with 3 4 embedded multiple-choice questions per slide. Nursing educators distributed the materials to interns via the Rain Classroom platform. (2) Group Enrollment and Pre-class Engagement: New interns were invited to join the Rain Classroom group. They were instructed to preview the PPT content in advance, flag slides marked as "difficult to understand," and bookmark key slides for discussion. Pre-class self-assessments, consisting of single- and multiple-choice questions on topics such as clinical symptoms, common etiologies, and treatment modalities of ectopic pregnancy and cervical cancer, were completed to identify knowledge gaps [7-8]. (3) In-class Delivery: Instructors proficient in using Rain Classroom facilitated sessions in multimedia-equipped classrooms. Interns accessed the virtual classroom by scanning a QR code or entering a unique code via WeChat. (4) Adaptive Teaching Strategies: Based on the pre-class self-assessment results, instructors adjusted their teaching strategies to emphasize core concepts, address common misconceptions, and focus on challenging areas. (5) Interactive Case-Based Learning: Clinical case scenarios were integrated into lectures, supplemented by relevant images and video clips to expand and consolidate knowledge. Interactive approaches—including randomized Q&A, group discussions, and real-time feedback tools such as bullet-screen comments—were employed to increase engagement and foster active learning. (6) Post-class Reinforcement: Interns reviewed lecture materials and reinforced key knowledge points using Rain Classroom' s mobile mini-program or official WeChat account, supporting flexible, on-demand learning and promoting long-term retention. (7) Final Assessment: In the fourth week, clinical educators administered theoretical examinations and evaluated nursing assignments aligned with the instructional content to assess students' mastery of the material[9-10]] (Figure 1).

2.3 Measurements

The primary outcome indicator was academic performance. In the fourth week of the internship, clinical educators administered a theoretical examination and a nursing assignment, both aligned with the curriculum content. Each component was scored on a 0 100 scale, with higher scores indicating a greater mastery of knowledge among interns [11].

The secondary outcome indicator was student satisfaction. Upon completion of the rotation, the teaching coordinator of the obstetrics and gynecology department distributed an online questionnaire via the Wenjuanxing platform (WeChat-based) to assess interns' satisfaction with the theoretical teaching. The questionnaire covered four dimensions: (1) stimulation of learning interest, (2) mastery of theoretical knowledge, (3) enhancement of learning initiative and engagement, and (4) overall teaching satisfaction. Each dimension was rated on a 100-point scale, with higher scores reflecting greater perceived teaching effectiveness [12]. A total of 48 valid responses were collected, yielding a response rate of 100%.

2.4 Statistical Analysis

Data were analyzed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation ($\bar{x} \pm s$) and compared using independent-samples t tests. Categorical

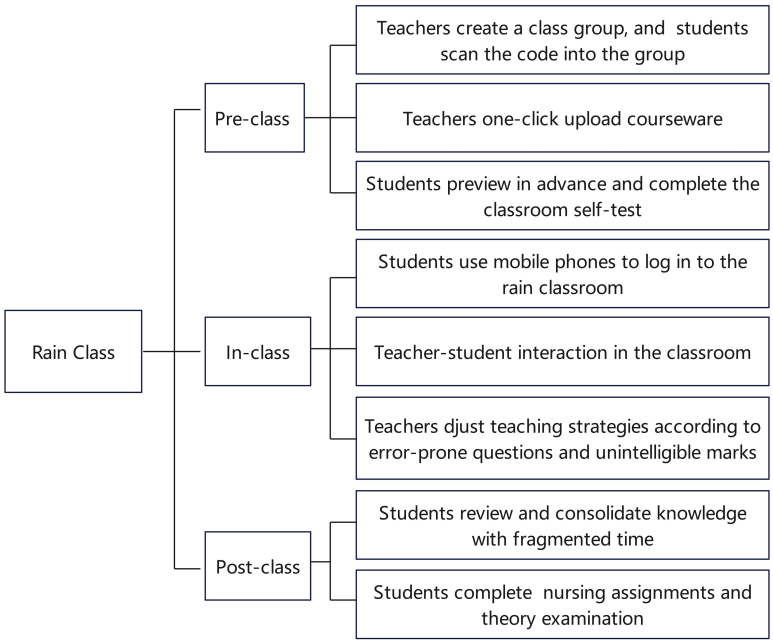

Figure 1: The process of Rain Classroom mode

variables were presented as frequencies and percentages (%) and analyzed using chi-square χ^2 tests. A P-value < 0.05 was considered statistically significant.

3 Results

3.1 Academic Performance

The experimental group performed significantly better than the control group in both the theoretical examination (85.96 ± 10.18 vs. 72.58 ± 10.01; $t = -4.589$, $P < 0.001$) and nursing assignment scores (90.50 ± 1.87 vs. 87.21 ± 3.75; $t = -3.848$, $P = 0.001$) (Table 1).

Table 1. Theoretical Exam and Nursing Assignment Scores of Participants ($N = 48$)

Evaluation index	Control group **($\bar{x} \pm s$)**	Experimental group **($\bar{x} \pm s$)**	t	*P*
Theoretical Exam Scores	72.58 ± 10.01	87.21 ± 3.75	-4.589	0.000**
Nursing Assignment Scores	85.96 ± 10.18	90.50 ± 1.87	-3.848	0.001**

*$P < 0.05$, **$P < 0.01$.

3.2 Teaching Satisfaction

Compared with the control group, the experimental group demonstrated greater effectiveness in stimulating students' interest in learning (95.83% vs. 62.50%), facilitating the mastery of theoretical knowledge (95.83% vs. 70.83%), enhancing learning initiative and engagement (91.66% vs. 66.66%), and improving overall teaching satisfaction (100% vs. 75%). The scores in the experimental group were significantly higher than those in the control group, and the differences were statistically significant ($P < 0.05$) (Table 2).

Table 2. Comparison of Teaching Satisfaction Between Control and Experimental Groups

Item	Control group (*n* = 24)		Experimental group (*n* = 24)		χ^2	*P*
	Satisfied [n (%)]	Dissatisfied [n (%)]	Satisfied [n (%)]	Dissatisfied [n (%)]		
Stimulate Interest	15（62.50）	9（37.5）	23（95.83）	1（4.17）	8.084	0.005**
Mastery of theoretical knowledge	17（70.83）	7（29.17）	23（95.83）	1（4.17）	5.400	0.024*
Enhance initiatives and engagement	16（66.66）	8（33.33）	22（91.66）	2（8.33）	4.547	0.033*
Overall teaching Satisfaction	18（75）	6（25）	24（100）	0（0）	6.857	0.011*

*$P < 0.05$, **$P < 0.01$.

4 Discussion

4.1 Rain Classroom combined with Case-Based teaching enhances academic performance

A comparative analysis of the two groups revealed that the nursing interns in the experimental group achieved significantly higher scores in both theoretical examinations and nursing assignments compared to those in the control group ($P < 0.05$). These findings are consistent with the experimental results reported by Trullàs[13].

Compared to the traditional teaching model, the integration of Rain Classroom with case-based teaching offers distinct advantages. It effectively identifies core knowledge and skill points, fosters a dynamic and interactive classroom environment, and stimulates students' motivation for inquiry-based learning. This innovative pedagogical model can be implemented through three interconnected phases: (1)Pre-class preparation: The model leverages online resources to enable knowledge preposition and creates a personalized learning space for students with weaker cognitive foundations.(2)In-class interaction: Through functions such as real-time feedback and bullet-screen interactions (barrage), it establishes deep teacher-student dialogue, thereby addressing key limitations of traditional classrooms, including low participation and lack of evaluative feedback.(3)Post-class reinforcement: Digital resource iteration supports knowledge consolidation and promotes higher-order thinking development[14].

This study demonstrated that the experimental group scored significantly higher in the theoretical examination (85.96 ± 10.18) compared to the control group (72.58 ± 10.01; $P < 0.001$). Similarly, nursing assignment scores were significantly higher in the experimental group (90.50 ± 1.87) than in the control group (87.21 ± 3.75; $P < 0.05$). These findings suggest that this blended teaching model not only improves teaching effectiveness in clinical nursing practice but also serves as a reproducible and scalable paradigm for nursing education reform.

4.2 Rain Classroom combined with Case-Based teaching enhances satisfaction

As society rapidly evolves, so too do educational models. In the context of clinical nursing practice teaching, traditional methods exhibit several limitations: (1) the teaching approach is monotonous and lacks innovation; (2) standardized teaching schedules and content fail to accommodate the diverse learning abilities of students; (3) teacher-centered instruction often devotes excessive time to explaining knowledge points, causing students to passively receive information, take notes mechanically, and miss opportunities for critical thinking and interaction.

The case-based teaching method is not merely a tool for knowledge transmission in nursing education; it is also a fundamental strategy for cultivating competency-oriented nursing professionals. Through situ-

ational learning, nursing students can integrate fragmented knowledge into systematic clinical capabilities, develop professional values, and build a strong foundation for navigating the complexities of real-world clinical environments[15].

Traditionally, Rain Classroom and case-based teaching were used separately, often resulting in one-way knowledge transmission, with students passively receiving information. This study introduced an innovative integration of the Rain Classroom platform with the case-based teaching method. By leveraging technology-enhanced instruction, this approach significantly improved both learning efficiency and student satisfaction.

Aligned with the modern "student-centered" educational philosophy, this model offers a novel and dynamic teaching experience for both instructors and learners, creating an engaging classroom atmosphere. It effectively stimulates nursing interns' interest in learning, enhances their capacity for active learning, and improves their theoretical performance. Moreover, it fosters the development of clinical thinking skills, strengthens knowledge retention, and elevates overall teaching satisfaction.

This integrated model addresses the shortcomings of traditional teaching approaches and has yielded promising outcomes. It contributes new momentum to the reform of clinical nursing education and provides a replicable framework for future educational innovation.

5 Conclusion and implications for practice

In this study, the integration of Rain Classroom with case-based teaching led to several notable advancements in clinical nursing education. First, dynamic interaction was achieved by enhancing classroom engagement through interactive features such as real-time comments and group discussions. Second, precision instruction was made possible by analyzing preview data to tailor content and focus on key learning areas. Third, the cultivation of clinical thinking was promoted through real-case simulations, which facilitated the integration of theoretical knowledge with practical application. The findings suggest that combining Rain Classroom with case-based teaching can effectively improve the theoretical knowledge and teaching satisfaction of gynecological nursing interns, demonstrating its potential for broader clinical application. Moving forward, this dual-mode instructional approach may be further developed and enriched by integrating cutting-edge educational theories, enabling it to better meet the evolving needs of nursing professionals in modern healthcare settings.

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