Macrothink Institute™

Journal of Biology and Life Science
ISSN 2157-6076
2026, Vol. 17, No. 1

An Empirical Study on the Application of Discipline-Integration Oriented "Escape Room Teaching Method" to Enhance Clinical Reasoning Ability of Undergraduate Intern Nurses in Neurology

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Received: August 3, 2025 Accepted: September 10, 2025 Published: September 16, 2025

doi:10.5296/jbls.v17i1.23158 URL: https://doi.org/10.5296/jbls.v17i1.23158

Abstract

To investigate the application of a Discipline-Integration Oriented "Escape Room Teaching Method" in enhancing the clinical reasoning abilities of undergraduate nursing students interning in the Department of Neurology of Deyang People's Hospital, a total of 80 undergraduate nursing students interning in the Department of Neurology from January 2024 to January 2025 were selected as the study subjects with a six-week internship period. They were randomly divided into a control group (n=40) and an observation group (n=40). The control group received conventional clinical nursing education, while the observation group received the disciplinary integration-oriented escape room teaching method in addition to the conventional method. The effectiveness of the two teaching methods was compared thereafter. The results show that among the three testing scores, the theoretical and practical scores, the scores on the Nurse Clinical Reasoning Scale (NCRS), the scores on the Utrecht Work Engagement Scale for Students (UWES-S) of the observation group interns were all significantly higher than those of the control group interns ($P < 0.05$). The conclusion could be thus drawn as implementing a Discipline-Integration Oriented "Escape Room Teaching Method" could effectively improve undergraduate nursing students' theoretical and practical skills, cultivate their clinical reasoning abilities, and enhance their learning engagement levels. This teaching method is worthy of further promotion and application in clinical education in a larger scale across mainland China and even around the world.

Keywords: discipline integration, escape room teaching method, nursing student education, neurology nursing, clinical reasoning ability

1. Introduction & Literature Review

Clinical nursing education is a core component of nursing education and practice, which not only enables nursing students to apply theoretical knowledge from the classroom to practical settings and refine their operational skills but also allows them to learn how to dynamically assess patients' conditions in real clinical environments, provide timely and appropriate interventions, thereby enhancing their clinical comprehensive management capabilities and facilitating a smooth transition from nursing students to professional nurses (Zhao et al., 2024). In China, undergraduate nursing students are required to complete at least eight months of clinical nursing internships to help them adapt to the clinical work environment and gain practical experience. However, during clinical nursing education, instructors often solely focus on imparting theoretical knowledge and basic nursing procedures but neglect to cultivate students' ability to engage in active learning and critical thinking process (AlThiga et al., 2017; Ding et al., 2024). Unlike clinical nursing education for conditions such as cardiovascular and respiratory diseases, clinical teaching in neurology is often challenging due to the complexity of anatomical and pathological mechanisms, making it difficult for interns to connect theoretical knowledge with specific diseases. Additionally, the high technical difficulty and precision requirements of specialized procedures, coupled with the pressure of patient-nurse relationships, contribute to a disconnection between clinical nursing skills and textbook knowledge. Interns may develop a fear of difficulty in clinical practice, while the severity and rapid progression of patients' conditions, along with multiple complications, further complicate neurology nursing education (Lee & Sim, 2020; Min Zhi & Dan, 2016). Therefore, changing the current clinical nursing teaching methods and enhancing the active learning abilities of nursing interns, as well as cultivating their clinical reasoning and critical thinking skills, are urgent issues that need to be addressed in nursing internship teaching right now.

The escape room teaching method is an innovative teaching method that integrates the immersive puzzle-solving mechanism of escape rooms into educational scenarios, whose core philosophy lies in creating realistic clinical environments, transforming abstract neurology nursing knowledge into actionable clues and props, and using complex tasks as drivers to prompt students to integrate medical-related knowledge. Through teamwork and task division among members, students solve related clues, thereby enhancing their critical thinking, clinical reasoning abilities, and resilience (Berthod et al., 2020; Gómez-Urquiza et al., 2019). When implementing the escape room teaching method, key elements include a cohesive narrative backdrop, layered puzzles, time constraints, and multi-modal clues, enabling nursing students to experience a complete cognitive cycle of problem identification, resource integration, and trial-and-error validation during the game, ultimately achieving knowledge transfer and the integration of social-emotional skills (Davis et al., 2022). Currently, this teaching method is widely applied in clinical pharmacy, healthcare, and nursing internship teaching activities (Gómez-Urquiza et al., 2022; Quek et al., 2024; Wilby & Kremer, 2020). However, this teaching method has not yet been implemented or applied in neurology nursing education area in China. Therefore, this study adopts a discipline-integration approach to apply this innovative teaching method to the educational activities of undergraduate nursing

interns in neurology, exploring the impact of the escape room teaching method on their exam scores, learning engagement, and clinical reasoning abilities. This research aims to fill the gap in domestic studies on the application of the escape room teaching method in neurology nursing education and provide theoretical and practical foundations for its clinical implementation.

2. General Information

A total of 80 nursing undergraduates who completed their internship in the Department of Neurology at our hospital from January 2024 to January 2025 were selected as the study subjects. The internship period was six weeks for all participants, and they were randomly divided into a control group (n=40) and an observation group (n=40). Inclusion criteria: (1) All interns were full-time undergraduate students in a four-year program; (2) Age ≥ 18 years; (3) No prior clinical internship experience; (4) Informed consent to participate in this educational study. Exclusion criteria: (1) Concurrent mental or behavioral disorders or poor compliance; (2) Internship course completion rate <10% due to various reasons. Among the 40 interns in the control group, there were 10 males and 30 females, aged 21–23 years, with an average age of (21.22 ± 3.01) years, and a pre-internship core course score of (82.89 ± 4.28) points; in the observation group of 40 interns, there were 12 males and 28 females, aged 20–22 years, with an average age of (21.02 ± 3.71) years. Their scores in core professional courses prior to internship were (83.03 ± 4.52) points. There were no significant differences in general characteristics between the two groups of interns ($P > 0.05$), making them comparable.

3. Methodology

3.1 Control Group

The control group was taught using conventional clinical nursing teaching methods, specifically: (1) Orientation training: After entering the department, the interns received orientation education from the chief instructor, including familiarization with the department environment, department regulations, and medication storage. (2) Clinical teaching: The chief instructor conducted theoretical and nursing skill instruction using multimedia software and other equipment based on the hospital's internship teaching syllabus. The remaining clinical instruction was conducted by the clinical instructor based on the neurology internship teaching syllabus, providing one-on-one clinical guidance to students, leading them in routine neurology nursing work, and familiarizing them with various nursing procedures. (3) Assessment: During the final week of the internship, the chief instructor conducted theoretical and nursing skill assessments for the interns.

3.2 Observation Group

The observation group implements a discipline-integrated escape room teaching method based on the control group, with the following specific methods:

3.2.1 Form an Escape Room Teaching Team and Assign Tasks

The teaching team consists of two internship instructors, two experienced clinical nurses, one

neurology physician, and one electronics engineer. Clinical nurses, physicians, and nursing educators collaboratively develop teaching objectives, determine the escape room theme as ischemic stroke, organize and convert knowledge points into game tasks; the electronic engineer is responsible for debugging electronic devices in the escape room and producing and editing videos.

3.2.2 Establish a Discipline-Integrated Escape Room Teaching Model

Through case reviews and literature research, the necessary steps for the escape room teaching activity are determined. Based on clinical workflows, disciplines closely related to neurology are identified. The four disciplines—nursing, clinical medicine, medical laboratory technology, and medical imaging technology—are integrated into the escape room theme, with their content flexibly incorporated into the escape puzzles, completing the design of an interdisciplinary escape room teaching model.

3.2.3 Escape Room Game Design, Room Construction, and Pre-Experiment

Based on theoretical knowledge and nursing practice regarding the etiology, pathogenesis, clinical manifestations, diagnostic and treatment principles, acute-phase treatment, and rehabilitation-phase prevention of ischemic stroke, task points, room scenarios, activity formats, and game clues are designed. Utilizing the hospital's nursing training room, each escape room is partitioned off with screens. Surveillance equipment is installed inside the rooms to monitor conditions, and props including high-fidelity manikins, oxygen cylinders, emergency medication carts, walkie-talkies, laptops, paper and pen, password boxes, and clue cards are prepared to construct the escape rooms. After the escape room was completed, three nursing students and two clinical nurses were invited for a pre-experience to assess the game's difficulty level and the reasonableness of its settings, followed by further refinements to the game.

3.2.4 Implementation of Escape Room Teaching Guided by Interdisciplinary Integration

(1) Clarify the game rules: This escape room game features three rooms, multiple task points, and a clue card for each room. Only by obtaining the clue card for a room can participants proceed to the next one. The escape room game is timed for 60 minutes. Nursing students are randomly assigned to groups of four based on the letters drawn, and they must collaborate to complete the room tasks. The group with the shortest completion time wins. (2) Game Implementation: The story is presented through the video “Saving Mr. Wang,” which serves as the opening for the escape room game. Students must use the critical information from the video about Mr. Wang's sudden stroke to conduct a physical examination and make a rapid clinical decision. The condition is then entered into a laptop computer, and the answer to the laptop's screen lock password is “high blood pressure.” Upon entering the correct answer, the laptop will unlock and display the question page, which contains five multiple-choice questions related to the principles of hypertension and blood pressure management. Each question has four options (A, B, C, or D). After answering all questions correctly, the computer will display a passcode, which can be used to open the password-protected box next to the patient and obtain the clues for the second stage (patient condition record and

medical orders). The intern nurse immediately establishes an intravenous line based on the clues, administers mannitol according to the medical orders to reduce intracranial pressure, and provides respiratory support. After answering correctly, the computer displays the answer page. The questions primarily assess the indications and contraindications for thrombolytic therapy and its nursing considerations, with ten multiple-choice questions, each with five options (ABCDE). After answering all questions correctly, the computer will display the passcode, allowing access to the password box and obtaining the third-stage access clues. (Multiple-choice question: Nursing care during the rehabilitation phase of cerebral infarction). Nursing students complete the multiple-choice questions on the clue card. The numerical order of the selected options constitutes the password for this level's safe. After opening the safe, students must complete the key points of the four major topics related to secondary prevention of cerebral infarction, including medication guidance, daily living precautions, diet and hydration, and physical exercise. Finally, the teaching assistant evaluates and determines whether the student has passed the level.

4. Observation Indicators

4.1 Theoretical and Practical Examination Scores

During the final week of the internship, the chief instructor will organize theoretical and practical assessments for the two groups of interns. The theoretical assessment is scored out of 100 points, with a passing score of 60 points. The question types include multiple-choice questions, fill-in-the-blank questions, and case analysis questions. The content covers various neurological diseases and related nursing knowledge, with scores directly proportional to the interns' mastery of theoretical knowledge; The practical assessment focuses on negative pressure suctioning, with a maximum score of 100 points and a passing score of 80 points. The score is directly proportional to the interns' practical skills.

4.2 Nursing Clinical Reasoning Ability

The Nursing Clinical Reasoning Scale (NCRS) (Ren et al., 2025) evaluates the clinical reasoning ability of the two groups of interns in this study. The scale has a Cronbach's α value of 0.89, comprising four dimensions: information processing, establishing connections, determining patient needs, and taking action, with a total of 15 items. All items are forward-scoring questions, and the scale uses a 5-point Likert Scale, where "completely disagree" scores 1 point, "Somewhat disagree" = 2 points, 'Undecided' = 3 points, "Somewhat agree" = 4 points, and "Completely agree" = 5 points. The total score ranges from 15 to 75 points, with higher scores indicating stronger clinical reasoning ability.

4.3 Intern Nursing Students' Learning Engagement Level

The Utrecht Work Engagement Scale for Students (UWES-S) (Huang et al., 2023) is used to evaluate the learning engagement levels of the two groups of undergraduate nursing interns included in the study. The Cronbach's α values for each dimension of the scale range from 0.7 to 0.9, including three dimensions: vigor, dedication, and focus, with a total of 17 items. The scale uses a 7-point Likert Scale, where 0 indicates "never," 1 indicates "almost never," 2 indicates "rarely," 3 means "sometimes", 4 means "often", 5 means "very frequently", and 6

means “always”. The total score ranges from 0 to 112 points, with higher scores indicating higher levels of learning engagement among students.

5. Statistical Methods

All data were analyzed using SPSS 26.0. and $p < 0.05$ was considered statistically significant. General data were described using frequency, percentage, and ($\bar{x} \pm s$). Count data were analyzed using the Chi-square test. Data from the theoretical and practical examination scores of intern nurses, the nurse clinical reasoning ability assessment scale, and the student version of the Utrecht Work Engagement Scale were described using ($\bar{x} \pm s$), and analyzed using Independent-samples t-tests and Repeated measures analysis of variance (ANOVA).

6. Results

6.1 Comparing the theoretical and practical exam scores of the two groups of interns after completing their internship in this department, the theoretical and practical scores of the observation group interns were significantly higher than those of the control group interns ($P < 0.05$), as shown in Table 1.

Table 1. Comparison of Theoretical and Practical Exam Scores Between the Two Groups of Interns ($\bar{x} \pm s$, points)

Group	Number of cases	Theoretical exam score	Practical exam score
Control group	40	79.77±2.87	82.78±3.21
Observation group	40	87.56±2.11	88.68±2.25
t		13.831	9.519
P		0.000	0.000

6.2 Comparison of clinical reasoning abilities between the two groups of interns after completing their internships in the department, the scores of the Nurse Clinical Reasoning Scale (NCRS) for the observation group were significantly higher than those of the control group ($P < 0.05$), as shown in Table 2.

Table 2. Comparison of NCRS Scores Between the Two Groups of Interns ($\bar{x} \pm s$, points)

Group	Number of cases	Nurses' Clinical Reasoning Scale (NCRS) score
Control group	40	52.26±2.75
Observation group	40	63.78±1.77
t		22.278
P		0.000

6.3 Comparison of the learning engagement levels of the two groups of interns after completing their internships in the department, it showed that the scores of the observation group interns on the Utrecht Work Engagement Scale for Students (UWES-S) were significantly higher than those of the control group interns ($P < 0.05$), as shown in Table 3.

Table 3. Comparison of UWES-S Scores Between the Two Groups of Interns ($\bar{x} \pm s$, points)

Group	Number of cases	Nurses' Clinical Reasoning Scale (NCRS) score
Control group	40	86.56±3.22
Observation group	40	93.78±3.32
t		9.873
P		0.000

7. Discussion

7.1 A Discipline-Integrated Escape Room Teaching Method Could Effectively Improve the Theoretical and Practical Skills of Undergraduate Nursing Students

Clinical internship education is an essential component of undergraduate nursing education which can effectively make up for the drawback that the theoretical knowledge of intern nursing students cannot be effectively combined with clinical application during their school years. It also helps nursing students develop professional identity early on, enhancing their professional confidence and sense of belonging to the profession. Therefore, clinical internship education plays a crucial role in the learning journey of nursing students (L. Wang et al., 2025; Zhang et al., 2024). However, due to changes in the medical environment and patients' increasing sensitivity to medical procedures, the professional standards required of

clinical nursing staff are becoming increasingly stringent. To adapt to clinical work, nursing students must possess extensive clinical knowledge and professional practical skills, which also presents new requirements and challenges for clinical internship education (Almadani et al., 2024). Escape room games, as a type of real-life team game, effectively integrate games with learning content while retaining discipline-specific knowledge. They provide participants with a rich experiential learning environment under specific time and pressure constraints, enabling them to apply the theoretical knowledge and practical skills they have learned to solve problems, thereby enhancing medical students' academic performance (Fedorcsak, 2024). In this study, the implementation of an escape room teaching method oriented toward interdisciplinary integration effectively improved the theoretical and practical skills of undergraduate nursing interns, confirming this viewpoint. During the design phase of the escape room teaching method, teachers integrated knowledge from four disciplines (nursing, clinical medicine, medical laboratory technology, and medical imaging technology) into the game, transforming knowledge into clues to motivate interns to complete the game. This enabled interns to flexibly apply and further deepening their mastery of professional knowledge and skills. As a result, the theoretical and practical skill performances of the observation group interns were thus significantly higher than those of the control group interns.

7.2 A Discipline-Integrated Escape Room Teaching Method Could Effectively Enhance the Clinical Reasoning Abilities of Undergraduate Nursing Interns

Clinical reasoning ability is the core of medical practice. It is a dynamic cognitive process through which nursing staff collect nursing-related issues from patients, analyze them to form nursing diagnoses, develop nursing plans, and continuously reflect, adjust, and refine their approaches. This process not only requires a vast knowledge base but also advanced critical thinking and problem-solving skills. As the future backbone of nursing, they often lack rational thinking and decision-making abilities when faced with various clinical emergencies upon entering the clinical setting. Therefore, cultivating their clinical reasoning abilities is urgently needed for nursing students (Koelewijn et al., 2024; Z. Wang et al., 2024). Research has shown that implementing an escape room game teaching method can effectively enhance interns' leadership abilities, decision-making skills, and clinical reasoning abilities, fully leveraging their creative thinking abilities to seek the optimal clinical solutions (Rached et al., 2024). In this study, by implementing an escape room teaching method oriented toward interdisciplinary integration, knowledge related to ischemic stroke was embedded into the game in the form of clues. The answers provided by the clues were interconnected, and the difficulty of the knowledge points gradually increases, thereby prompting interns to fully utilize their clinical reasoning abilities to solve problems and complete the game, thereby achieving the goal of cultivating interns' clinical reasoning abilities. As a result, the clinical reasoning ability scores of the observation group interns were significantly higher than those of the control group interns, which is consistent with the findings of Anguas-Gracia's study (Anguas-Gracia et al., 2021).

7.3 A Discipline-Integrated Escape Room Teaching Method Could Effectively Enhance the Learning Engagement of Undergraduate Nursing Students

The clinical teaching environment refers to any setting where nursing students apply theoretical knowledge to clinical practice, including real patient care settings and simulated patient clinical practice environments. In such environments, clinical nursing instructors typically play a central role in helping students apply theoretical knowledge flexibly to clinical practice. However, this teaching approach often fails to stimulate students' learning motivation, resulting in low levels of learning engagement (Negm et al., 2024). Escape room teaching methods, as a teaching method primarily based on real-life games, establish a simulated practical environment and use instructions to prompt participants to use relevant knowledge to address related nursing issues and challenges. This greatly stimulates participants' interest and improves their learning engagement (Çakmak & Kaymaz, 2024). In this study, the implementation of an escape room teaching method oriented toward interdisciplinary integration effectively improved the learning engagement levels of nursing interns, confirming this standpoint. This is primarily because, compared to traditional teaching methods, the escape room teaching method is game-based and aligns well with the interests of contemporary young people, stimulating their motivation to learn. Participating nursing interns demonstrated high levels of engagement, experiencing a sense of enjoyment and accomplishment during the learning process. Therefore, the scores on the student version of the Utrecht Work Engagement Scale for the observation group of nursing interns were significantly higher than those of the control group, which is consistent with the findings of Chen et al. (2023).

8. Summary and Limitations

The implementation of a discipline-integrated escape room teaching method can effectively improve the theoretical and practical skills of undergraduate nursing students, cultivate their clinical reasoning abilities, and enhance their level of engagement in self-initiated active learning. This teaching method is worthy of promotion and application in clinical education. However, it still has some drawbacks in practice. For example, it requires stringent teamwork, and during implementation, interns may disagree or even argue with each other. Additionally, clinical teaching staff are required to spend a significant amount of time preparing, designing, supervising, monitoring, adjusting and re-constructing teaching plans, scenarios, procedures and the whole teaching processes, which could lead to fatigue, negligence and failure in instruction as a consequence. Finally, this teaching method appears in the form of scenarios, and the number of cases for this teaching mode is limited, making it impossible to implement this teaching mode for multiple-diseases teaching practice. These are urgent issues that require further consideration, research and discussion in future implementations.

Acknowledgments

Not applicable.

Authors contributions

Not applicable.

Funding

2023 Chengdu Medical College Undergraduate Education and Teaching Reform Research Project (JG2023060).

Competing interests

Not applicable.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Macrothink Institute.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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