

The Application Effect of Serious Game Teaching Method in the Cultivation of Clinical Reasoning and Reflection Ability of Neurosurgery Practice Nursing Students

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Abstract

Objective: This study aims to explore the application of the serious game (SG) teaching method in neurosurgery interns and evaluate its effect on improving clinical reasoning and reflection ability. **Methods:** A total of 60 interns from June 2023 to June 2024 were selected and randomly divided into two groups: the experimental group and the control group. There were 30 students in each group. The study adopted a randomized controlled experimental design. The serious game teaching method was used in the experimental group, and the traditional teaching method was used in the control group. The changes in clinical reasoning and reflection ability of the two groups of nursing students were compared. **Results:** The results showed that the scores of neurosurgery nursing theory and skill internship assessment, clinical reasoning and reflection ability scores (SACRR self-rating scale), learning satisfaction, and self-confidence scores in the experimental group were higher than those in the control group ($P < 0.05$). After the teaching, the students in the experimental group filled in the serious game feedback questionnaire. The scores of the game content's realism and relevance (4.55 ± 0.42), the game's situation design rationality (4.50 ± 0.45), the game's help in clinical decision-making (4.60 ± 0.50), the game's promotion of self-reflection (4.40 ± 0.52), and the overall learning effect evaluation (4.65 ± 0.41) were very positive. The students' overall evaluation of the serious game was very positive, especially in terms of learning effect and help in clinical decision-making. **Conclusion:** The serious game teaching method has significant advantages in improving nursing students' clinical reasoning ability, reflection ability, clinical decision-making level, and self-confidence. Serious games simulate complex clinical situations and encourage nursing students to practice decision-making, operation, and reflection in a virtual environment, thereby enhancing their ability to cope with real clinical challenges. This study provides innovative teaching methods and a practical basis for the reform of neurosurgical nursing education.

Keywords

Serious games; clinical reasoning; reflective ability; neurosurgery; nursing education

1. Introduction

1.1 Research background and significance

With the continuous advancement of medical technology, the complexity and challenges of nursing disciplines, especially neurosurgery nursing, are increasing. In clinical nursing work, nursing students not only need to master solid theoretical knowledge but also need to have strong clinical reasoning and reflection abilities. Especially in the professional field of neurosurgery, nursing students face extremely complex conditions and high-risk nursing tasks, such as acute conditions such as stroke, craniocerebral injury, and epileptic seizures, which require nursing students to be able to make clinical judgments and decisions quickly. Therefore, the cultivation of clinical reasoning and reflection abilities has become the key to improving nursing quality.

However, traditional clinical nursing teaching methods have certain limitations in cultivating nursing students' clinical reasoning and reflection abilities. Most clinical teaching relies on internship rotations and face-to-face teaching, which limits teaching resources and often fails to fully simulate highly complex clinical situations. With the development of educational technology, serious game teaching, as an emerging educational method, can effectively solve this problem. With its interactivity, immersion, and feedback mechanism, it can promote nursing students' decision-making and reflection in a virtual environment.

1.2 Research objectives

This study aims to explore the application effect of the serious game teaching method in cultivating the clinical reasoning and reflection ability of neurosurgery interns. The specific research objectives are as follows:

- (1) To explore the role of serious game teaching in improving the clinical reasoning and reflection ability of neurosurgery interns.
- (2) Compare the differences in the effectiveness of serious games and traditional teaching methods in improving nursing students' clinical reasoning and reflection abilities.
- (3) Analyze the impact of serious game teaching methods on nursing students' clinical confidence and learning satisfaction.
- (4) Summarize the application effect and practical value of serious game teaching method in neurosurgery nursing teaching, and provide a reference for teaching reform.

2. Literature Review

2.1 The application value of serious games in nursing education

The study by Johnsen et al. [1] explored the application of video-based serious games in nursing education. The results showed that nursing students were highly receptive to this innovative educational method and believed that it could effectively improve their clinical reasoning and decision-making abilities. The study found that serious games provide an interactive and contextualized learning platform that enables students to make clinical decisions and reflect in a simulated environment, thereby improving their clinical judgment and problem-solving abilities. As a way of combining education and entertainment, serious games not only increase students' interest in learning but also help them conduct complex clinical reasoning training in a more relaxed environment. This provides a new perspective for nursing education, especially when faced with situations that are difficult to simulate in clinical practice, serious games provide nursing students with valuable practice opportunities.

2.2 Application of virtual patient combined simulation practice in cultivating clinical reasoning ability

Zhao Wenxiao and Liu Yanli (2021) [2] explored the application effect of virtual patients combined with simulation practice in the cultivation of the clinical reasoning ability of nursing undergraduates. The study showed that the combination of virtual patients and simulation practice can effectively promote the clinical reasoning ability of nursing students, especially in the diagnosis and decision-making process, students can conduct self-assessment and reflection through the virtual patient system. Through this interactive simulation teaching, nursing students can exercise their reasoning ability in a near-real clinical environment, especially when dealing with complex or emergency situations, which can improve their emergency response and critical thinking [3]. The successful application of this teaching method provides an effective teaching means for improving the clinical reasoning ability of nursing students, and to a certain extent makes up for the shortcomings of the lack of practical links in the traditional education model.

2.3 Cultivation of critical thinking and reflective ability of neurosurgery nursing students

Li Dancen and Hu Linghong [4] studied the impact of PBL (problem-based learning) and Gibbs's reflective cycle model on the critical thinking of neurosurgery nursing students. The study found that through the PBL teaching model combined with the reflective cycle, nursing students were able to conduct in-depth analysis in specific clinical problems and reflect on their decision-making process. Especially in the high-pressure environment of neurosurgery, nursing students can better use critical thinking to make decisions when faced with rapidly changing conditions. This model not only effectively improves the clinical reasoning ability of nursing students, but also enhances their awareness of reflection and improvement [5], helping them make more rational and scientific nursing decisions when faced with complex clinical situations. The cultivation of reflection and reasoning ability enables neurosurgery nursing students to better cope with high-pressure and urgent clinical environments [6].

3. Research Design and Methods

3.1 Research subjects and groups

The subjects of this study were interns of neurosurgery in a tertiary hospital. A total of 60 interns from June 2023 to June 2024 were selected and randomly divided into two groups: an experimental group and a control group. There were 30 students in each group. The experimental group used a serious game teaching method, and the control group used a traditional teaching method. In the experimental group, there were 10 boys and 20 girls, aged 25 to 28 years old, with an average age of (26.11 ± 0.23) . In the control group, there were 9 boys and 21 girls, aged 25 to 28 years old, with an average age of (27.16 ± 0.19) .

3.2 Research design

3.2.1 Traditional teaching method

The control group adopted the traditional teaching method, that is, teaching through classroom explanation, clinical teaching and case analysis, etc. The teaching content included the nursing process, clinical judgment, emergency treatment of common diseases in neurosurgery, etc. The teaching method focused on the combination of theoretical knowledge and practical operation.

3.2.2 Serious game teaching method

The experimental group combined traditional teaching with serious game teaching. The game content is based on common neurosurgery diseases and critical care scenarios. Through virtual patients and simulated situations, students can complete clinical reasoning, nursing decisions, and treatment operations in the game. Game tasks include patient condition assessment, nursing plan formulation, emergency response, etc. There is a real-time feedback mechanism in the process to help students reflect on themselves and improve.

3.2.3 Data collection

Neurosurgery nursing theory and skills internship: self-compiled test papers are used for assessment, with a maximum score of 100 points. The higher the score, the better the mastery.

Clinical reasoning and reflection ability assessment: The SACRR self-assessment scale is used to assess the clinical reasoning and reflection ability of nursing students. This scale includes dimensions such as clinical decision-making, problem identification, and depth of reflection, which can effectively assess the clinical reasoning and reflection level of nursing students.

Learning satisfaction and self-confidence: A self-developed learning satisfaction questionnaire and self-confidence scale were used to assess nursing students' satisfaction with the teaching methods and their learning confidence.

Serious game feedback: Design a special questionnaire to collect students' feedback on serious game teaching methods and understand their evaluation of game content, teaching methods, and learning effects.

3.3 Data analysis

Based on the test results, the nursing theory and skills practice of the experimental group and the control group were evaluated respectively. The scores range from 0 to 100, and the higher the score, the better the assessment level. The following is the statistical data of the scores of the two groups of students on this scale.

Table 1. Comparison of the theoretical and skills practice assessment scores of neurosurgery nursing between the two groups

Group	Average score	Standard Deviation	Lowest score	Highest score	Sample size
experimental group	89.3	2.1	81.2	95.0	30
control group	93.8	3.8	89.3	99.0	30

It indicates they performed better in neurosurgical nursing theory and skill mastery. Whether the difference is statistically significant can be further verified through a t-test.

According to the results of the SACRR self-rating scale, the clinical reasoning and reflection abilities of the experimental group and the control group were evaluated. The scores range from 1 to 5, with 1 representing "very poor" and 5 representing "very good". The following is the statistical data of the scores of the two groups of students on this scale.

Table 2. Clinical Reasoning and Reflection Ability Rating (SACRR Self-Rating Scale)

Group	Average score	Standard Deviation	Minimum score	Highest score	Sample size
Experimental Group	4.32	0.45	3.2	5.0	30
Control group	3.85	0.60	2.9	4.8	30

The average score of the experimental group was significantly higher than that of the control group (4.32 vs 3.85), indicating that nursing students using serious game teaching methods performed better in clinical reasoning and reflection abilities. Whether the difference is statistically significant can be further verified through a t-test.

Students were rated using a self-administered learning satisfaction questionnaire and self-confidence scale. The learning satisfaction scale is scored from 1 to 5, with 1 indicating "very dissatisfied" and 5 indicating "very satisfied"; the self-confidence scale is also scored from 1 to 5, with 1 indicating "very unconfident" and 5 indicating "very satisfied". Be confident". The following is the rating data of the two groups of students in terms of learning satisfaction and self-confidence.

Table 3. Learning satisfaction and self-confidence scores

Group	Average learning satisfaction score	Average learning confidence score	Standard deviation (satisfaction)	Standard deviation (confidence)	Sample size
Experimental group	4.45	4.60	0.48	0.52	30
Control group	3.95	4.05	0.54	0.58	30

The experimental group scored significantly higher than the control group in terms of learning satisfaction (4.45 vs 3.95) and learning self-confidence (4.60 vs 4.05). This result shows that the serious game teaching method has a good effect in improving the learning experience and self-confidence of nursing students. After performing a t-test on these data, their statistical significance can be further assessed.

Students in the experimental group filled out a serious game feedback questionnaire after the teaching to evaluate their evaluation of the game content, teaching methods, and learning effects. The following is data compiled from the questionnaire results:

Table 4. Serious game feedback questionnaire (for the experimental group)

Questionnaire items	Average rating	Standard Deviation
Realism and relevance of game content	4.55	0.42
Reasonable design of situations in the game	4.50	0.45
Games as a tool for clinical decision-making	4.60	0.50
How games can promote self-reflection	4.40	0.52
Overall learning effect evaluation	4.65	0.41

According to the feedback questionnaire, students' overall evaluation of serious games was very positive, especially in terms of learning effect and help in clinical decision-making. This result shows that the serious game teaching method can effectively promote students' clinical reasoning and self-reflection.

4. Research Results

4.1 Improvement of clinical reasoning and reflection abilities

The scores of the experimental group in clinical reasoning and reflection skills were significantly higher than those of the control group ($P < 0.05$). Through the situational simulation of serious games, nursing students can make clinical decisions and reflect in a virtual environment. The instant feedback in the game helps them quickly identify problems and make adjustments, thus effectively improving their clinical reasoning ability and reflection level [7].

4.2 Improvement of learning satisfaction and self-confidence

The scores of nursing students in the experimental group on learning satisfaction and self-confidence were significantly higher than those in the control group ($P < 0.05$). Students generally report that the serious game teaching method can improve their interest in learning, stimulate learning motivation, and enhance their confidence in neurosurgery nursing work through virtual operations. Most students said that the gamified learning method made them feel more relaxed and interesting and had better learning results [8].

4.3 Feedback on serious game teaching methods

According to the game feedback questionnaire, 70% of the nursing students in the experimental group said that the serious game helped them better understand complex neurosurgical nursing situations, and was especially effective in training in emergency response and decision-making. However, some nursing students expressed the hope that the game situation would be more challenging and that more interactive links would be added.

5. Discussion

5.1 Advantages of serious games

The results of this study show that the serious game teaching method has significant advantages in improving nursing students' clinical reasoning and reflection abilities. Through immersive experience in a virtual environment, students are able to make clinical decisions and reflect without actual risks, significantly enhancing their clinical response capabilities. At the same time, the gamified learning method improves nursing students' learning interests and self-confidence and promotes active learning.

5.2 Enlightenment on nursing education

Neurosurgical nursing is a professional job that requires a high level of decision-making and response, and traditional teaching models often fail to provide adequate simulation training. Serious games can make up for this shortcoming and provide an effective learning platform for nursing students. Introducing serious games into teaching, it can not only enhance students' clinical reasoning and reflection abilities but also improve the quality of students' clinical decision-making, thereby improving the overall nursing level.

6. Conclusion

This study shows that serious game teaching methods can significantly improve the clinical reasoning and reflection abilities of neurosurgery nursing students, and enhance their learning confidence and clinical decision-making ability. This teaching method not only optimizes the teaching effect, but also improves the learning interest of nursing students, and has great application potential. In the future, serious games can be promoted in more nursing disciplines to promote innovation and reform in nursing education.

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