Empirical Research on the Application of Flipped Classroom in Anesthesia Nursing Teaching in a Chinese City-based Hospital

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Abstract

In order to explore the teaching application effect of flipped classroom teaching mode in anesthesia internship nursing students, 136 nursing interns in the Department of Anesthesiology of Deyang People's Hospital from August 2022 to August 2024 were selected as the research subjects, and were divided into the control group (n=68) and the observation group (n=68) according to the order of the internship. To compare the application effect and result of the 2 nursing teaching methods, the control group implemented the traditional anesthesia nursing teaching method, and the observation group implemented the flipped classroom teaching mode respectively. As a result, the anesthesia nursing theory test scores and skill operation test scores, the CTDI-CV scores and the satisfaction degree scores of the observation group were all significantly higher than those of the control group (P＜0.05). It could be drawn that implementation of the flipped classroom teaching mode for anesthesiology interns could not only effectively improve the mastery of theoretical knowledge and practical skills of anesthesiology nursing, but also improve the critical thinking ability and the satisfaction degree of interns, which is worthy of deeper clinical application and promotion in further research.

Keywords: flipped classroom, anesthesia nursing, nursing teaching, critical thinking

1. Introduction

Anesthesia nursing originated in the United States during the Civil War, with nurse Katherine Lawrence's first administration of anesthesia care marking the budding practice of anesthesia nursing, while the founding of the National Association of Nurse Anesthetists (NANA, later

renamed AANA) in 1931 marked the emergence of anesthesia nursing as a stand-alone discipline, and was the first to establish the standards of anesthesia nursing in 1935, which in turn, also pushed anesthesia nursing education toward standardization and professional management (Ray & Desai, 2016). China's anesthesia nursing education started relatively late, and the current education model for nursing students is mainly pre-service academic education, in which only a very small number of colleges and universities have carried out a complete anesthesia nursing education program, and most of the pre-service academic education model is the anesthesia nursing theoretical learning combined with the clinical internship education in school (Hu et al., 2025). Clinical practicum education is the main gateway for nursing students to learn anesthesia nursing-related knowledge, which includes the teaching of anesthesia nursing theories and the cultivation of students' practical skills. With the gap, the teaching of clinical anesthesia nursing practicum has put forward new requirements (Yu et al., 2024).

Unlike ordinary clinical internship teaching, anesthesia nursing is not only related to various types of surgical procedures, but also requires anesthesia nursing staff to have a strict sense of asepsis, master the use of a variety of monitoring instruments and devices, and implement appropriate nursing measures for the different states of the patient to ensure the safety of the patient's life in a complex environment, which also poses a great challenge and difficulty in the teaching of anesthesia nursing (Jeon et al., 2015, 2020). The traditional nursing practice teaching mainly adopts the teacher-centered lecture mode, which is mainly dominated by the teacher, and the nursing students passively accept the relevant professional knowledge transmitted by the teacher, which could easily lead to the deepening of the knowledge taught by the teacher by relying on the rote-learning of the nursing students, and with the pass of time, the students will ultimately forget the relevant knowledge and fail to grasp the key points of the clinical practice (Rotellar & Cain, 2015, Rotellar & Cain, 2016).

Flipped classroom originated in the United States, is a kind of individual tasks or group activities oriented instead of teacher-led teaching methods, this teaching method subverts the traditional teaching methods in that students outside the classroom will learn independently through reading, watching videos to understand the new knowledge, in the classroom by discussing or debating the way to solve the new problems and therefore absorb the new knowledge content. With the help of the teaching method, it could fully mobilize the learning enthusiasm of nursing students, improve students' problem-solving ability and critical thinking ability, and is currently introduced into the education of various health care professions and has achieved good practical results (Betihavas et al., 2016; Hew & Lo, 2018). However, the application of this teaching method in Chinese anesthesia nursing internship students is relatively rare and in a small scale, so in order to further improve the quality of teaching anesthesia nursing students in our hospital, we applied this teaching method in the anesthesia nursing teaching of nursing interns to check its effect and applicability.

2. General Information and Methodology

This study is a prospective study, and all internship nursing students were from correlated medical schools that signed internship agreements with our hospital beforehand. 136 intern

nursing students who interned in the Department of Anesthesiology of our hospital from August 2022 to August 2024 were selected as the study subjects, and they were divided into a control group (n=68) and an observation group (n=68) according to the order before and after their admission to the department. Inclusion criteria: (1) those who were informed and agreed to participate in this study; (2) age $\geq$ 18 years; (3) initial education level is full-time college and above. Exclusion criteria: (1) those who have mental behavioral disorders; (2) those who discontinued or stopped their internship in the Department of Anesthesiology for various reasons. In general, in the control group there were 25 males and 43 females, aged 20-24 years old, with an average age of 20.89±2.14 years old, 42 junior college students and 26 senior college undergraduates; in the observation group, there were 21 males and 47 females, aged 21-24 years old, with an average age of 21.26±1.89 years old, 36 junior college students and 32 senior college undergraduates. There was no significant difference between the general information of the 2 groups of internship nursing students (P>0.05), and thus comparable.

2.1 Control Group

The control group implemented the traditional teaching methods of anesthesia care, and the internship period was 1 month, with the following specific interventions: (1) Admission training: during the first week of the interns' arrival at the Department of Anesthesiology, the teacher who is in charge of the general teaching in the department will conduct the admission training for the interns, and the training contents include: the layout of the operating room, the sterilizing and isolating system of the operating room, the sterile treatment of anesthesia instruments, common anesthesia drugs and their mechanisms of action, and the use of anesthesia-related instruments and equipment. (2) Theoretical training related to anesthesia care: after completing the admission training, the leading teacher of the department will carry out theoretical training for the interns, which includes the principles and indications of various kinds of anesthesia, corresponding nursing care and treatment of common complications, and the process of dealing with the adverse reactions of anesthesia drugs, etc., to lay a solid foundation for the practical skills training. (3) Anesthesia care related practical skills training: in this stage, the instructor needs to lead the interns to master the specific operation process of putting on and taking off the surgical isolation gown and surgical hand disinfection, the key points of preoperative visit and assessment, to assess the anesthesia risk of the patient and the related potential risk, and lay a foundation of the risk management of the patient's anesthesia during the operation, and secondly, to lead the interns to master the monitoring of vital signs, skin and tube care, intraoperative specimen collection, preservation and transportation process, and the key points and methods of intraoperative instrument and goods inventory and how to manage the patient's body and health. (4) Anesthesia resuscitation related care: in this stage of anesthesia nursing teaching process, we need to teach the nursing interns to correctly assess the patient's postoperative pain, to learn to observe and promptly deal with the patient's postoperative respiratory depression, hypotension, delayed awakening, vomiting, etc., and to master the first-aid skills, such as cardio-resuscitation, to strengthen the development of their emergency response ability. (5) Examination: After completing the internship, the teaching staff of the department will

evaluate the mastery of theory and skills of the interns and ensure that they have archived the goals, then put the data into their archives.

2.2 Observation Group

The observation group implemented the flipped classroom teaching mode, the internship period was 1 month, and the specific implementation was as follows: (1) Establish a flipped classroom teaching team: the head nurse of the department served as the head of the teaching team, and the nursing instructor of the department served as a member of the team, and formulated a flipped classroom teaching plan (see Table 1). (2) Anesthesia nursing teaching preparation for the flipped classroom: the teaching instructor was the leader in combing the knowledge points related to anesthesia nursing internship, including the environment of the anesthesia department, knowledge of anesthesia nursing operation skills, anesthesia resuscitation nursing key points and rescue skills. The knowledge points mentioned above will be filmed as a teaching video, which is about 15-20 minutes long. (3) Anesthesia nursing flipped classroom teaching implementation: after the interns entered the department, the teaching teacher led the interns to familiarize themselves with the environment of the anesthesia department, and set up the WeChat group to facilitate the implementation of the teaching plan. Pre-course preparation: according to the teaching plan, the teacher will release the corresponding teaching video for students to study on Monday of the week, so that students can understand and familiarize with the teaching content of the week, and the familiarization time is 1 day. Classroom activities: Before the classroom activities, the teaching teacher will design a quiz according to the content of the teaching video to evaluate and understand the students' learning effect before class. The teaching instructor will carry out the classroom teaching procedure according to the students' learning situation, guide the students to think about and discuss the questions before class in the form of group discussion or according to entry point of the problem, and finally, the teacher will carry out the Q & A to help the internship nurses consolidate the relevant knowledge. Post-course learning activities: this stage of teaching is led by the teaching instructor to carry out case-based practical exercises. Through the implementation of student-centered case-based practical teaching, to understand the students' deficiencies in theory and practical operation and provide guidance, so that students can efficiently master the anesthesia nursing related knowledge. (4) Assessment: Before the nursing interns leave the department, the instructor will organize the students to conduct and record the theoretical and practical assessment accordingly.

Table 1. Anesthesia Nursing Flipped Classroom Teaching Plan

Week 1	Familiarize yourself with the anesthesiology ward environment and master the theoretical knowledge related to anesthesia nursing
Week 2	Understand and master anesthesia nursing operation skills
Week 3	Master the key points of anesthesia resuscitation care and rescue skills
Week 4	Practical teaching of cases, theoretical and practical examination

2.3 Observation Indicators

2.3.1 Theoretical Examination Results of Anesthesia Nursing for Internship Nursing Students

The theoretical examination questions for internship nursing students are prepared by the head nurse of the department leading the teaching instructor of the department, and the questions cover comprehensive anesthesia nursing related contents, the score of the examination paper is 100 points in total, and the higher the score, the better the mastery of the theoretical knowledge of anesthesia nursing for the internship nursing students. In this study, we adopt this theoretical examination paper for the theory results of both groups of internship nursing students to carry out the theoretical performance appraisal.

2.3.2 The Results of Anesthesia Nursing Skills Operation Examination for Internship Nursing Students

The departmental instructor organizes 2 groups of internship nursing students to carry out surgical hand disinfection, putting on and taking off sterile surgical gowns, contactless gloves and placing the position of the body, with a total score of 100 points in these 4 skill operational examinations, and the higher the score, the higher the degree of mastery of anesthesia nursing skills representing the internship nursing students.

2.3.3 Critical Thinking Disposition Inventory

The Chinese Version of Critical Thinking Disposition Inventory (CTDI-CV) (Yeh, 2002) was used to evaluate the critical thinking of the 2 groups of nurse interns. Content Validity Index (CVI) = 0.89 and Cronbach's alpha = 0.90. The scale consists of 7 items: search for truth, open-mindedness, analytical ability, systematization ability, self-efficacy in critical thinking, intellectual curiosity, and cognitive maturity. There are 10 sub-items in total for each item, and each sub-item is rated from 1-6 out of a total of 420 points, with a total score between 211 and 279 points indicates that the intern nursing students have an average critical thinking ability; more than 280 points indicates that the intern nursing students have a positive critical

thinking ability, and more than 350 points indicates that the intern nursing students have a strong critical thinking ability.

2.3.4 Satisfaction Evaluation of Teaching Methods

The department's self-designed teaching methods satisfaction questionnaire was used to evaluate the satisfaction degree of teaching methods of the 2 groups of internship nursing students, the total satisfaction degree score was 100 points, and the score value was directly proportional to the satisfaction degree of teaching methods of the 2 groups of nursing students

2.4 Statistical Methods

All data were statistically analyzed by applying SPSS 26.0, and statistical significance was indicated when P<0.05. For general information, frequency, percentage, $\bar{x} \pm s$ were used for statistical description. Count data were statistically analyzed by Chi-square test, the data of intern nursing students' theoretical examination results, practical skills examination results, critical thinking ability assessment scale and intern nursing students' satisfaction degree with teaching methods were statistically described by $\bar{x} \pm s$, and analyzed by Independent Samples t-test and Repeated Measures ANOVA.

3. Results

3.1 Comparing the Anesthesia Nursing Theory Test Scores and Skill Operation Test Scores of the 2 Groups of Internship Nursing Students

The anesthesia nursing theory test scores and skill operation test scores of the observation group are significantly higher than those of the control group internship nursing students (P < 0.05). See Table 2.

Table 2. Comparison of Anesthesia Nursing Theory Test Scores and Skill Operation Test Scores Between the 2 Groups of Internship Nursing Students ($\bar{x} \pm s$, points)

Group	Number of Cases	Anesthesia Nursing Theory Examination Results	Anesthesia Nursing Skill Operation Examination Results
Control Group	68	81.26±3.76	84.21±4.28
Observation Group	68	90.52±3.21	93.90±2.77
t		15.445	15.673
P		0.000	0.000

3.2 Comparing the Scores of the Critical Thinking Disability Inventory Scale

As for the (CTDI-CV) of the 2 groups of internship nursing students, the CTDI-CV scores of the internship nursing students in the observation group were significantly higher than those of the internship nursing students in the control group (P < 0.05). See Table 3.

Table 3. Comparison of CTDI-CV Scores Between the 2 Groups of Internship Nursing Students ($\bar{x} \pm s$, points)

Group	Number of Cases	Critical Thinking Disability Inventory (CTDI-CV) Scores
Control Group	68	257.89±23.76
Observation Group	68	290.87±28.65
t		7.307
P		0.000

3.3 Comparing the Ratings of the 2 Groups of Internship Nursing Students' Satisfaction Degree with Different Teaching Methods

The satisfaction degree ratings of the observation group's internship nursing students with flipped classroom teaching method were significantly higher than those of the control group's internship nursing students with traditional teaching method (P < 0.05). See Table 3.

Table 3. Comparison of the Ratings of the 2 Groups of Internship Nursing Students' Satisfaction Degree with Different Teaching Methods ($\bar{x} \pm s$, points)

Group	Number of Cases	Satisfaction Degree Ratings of Different Teaching Methods
Control Group	68	86.64±4.29
Observation Group	68	94.25±2.76
t		14.328
P		0.000

4. Discussion

4.1 Flipped Classroom Teaching Mode Could Effectively Improve the Level of Anesthesia Nursing Theory and Practical Skills of Nursing Interns

Nursing teaching is a discipline that integrates theoretical teaching with practical application, which needs to focus on strengthening the training of nursing staff's competence and adaptability. While traditional observation-based nursing teaching mode prevents nursing students from flexibly applying nursing theories to nursing practice, and disconnects theoretical nursing knowledge from real-life nursing practice, which has led to nursing experts and scholars urgently calling for the requirement to transform nursing education methods (Guo et al., 2022; Joseph et al., 2021). The instruction of anesthesia nursing is a complex and highly specialized nursing sub-discipline, which includes a continuum of care from preoperative assessment to discharge from the post-anesthesia care unit. However, traditional nursing teaching methods cannot enable nursing trainees to master the key points of anesthesia nursing expertise in a short period of time, which has also posed a greater challenge to the teaching of anesthesia nursing (Tamura et al., 2021). The flipped classroom, as a student-centered active learning teaching strategy, can fully mobilize the learning initiative of nursing interns, clarify the purpose and motivation of learning and carry out learning activities in a targeted manner (Morini et al., 2024). Knowledge of relevant theories and operations is instilled followed by a class discussion with relevant questions, meanwhile

the instructor answers questions based on the specific issues. In the end, through practical cases, the interns were able to combine theoretical knowledge with practical operation and solidly master anesthesia nursing knowledge, so it could be found that the level of anesthesia nursing theory and practical skills of the interns in the observation group was higher than that of the interns in the control group.

4.2 Flipped Classroom Teaching Mode Could Effectively Improve the Critical Thinking Ability of Nursing Interns

Nursing critical thinking ability refers to the ability of nursing staff to select, evaluate and optimize clinical problems or solutions based on their own professional knowledge and clinical experience through repeated analysis, reasoning and reflection in a complex and dynamic clinical environment (Falcó-Pegueroles et al., 2021). The development of critical thinking skills can help practicing nursing students improve their problem-solving abilities and emergency response, as well as ensure patient safety and reduce healthcare risks; therefore, the development of critical thinking skills in practicing nursing students has been increasingly emphasized by nursing educators (Scott et al., 2021). The application of the flipped classroom teaching method can effectively improve the critical thinking of practicing nursing students, so that they can sufficiently apply theoretical knowledge to practice (Farina et al., 2021). In this study, through the implementation of student-centered flipped classroom teaching, the interns can actively think and learn about anesthesia nursing care during the internship, raise questions about relevant knowledge points and actively seek answers accordingly. Besides, with the help of the practical case training after the class, it makes the interns adequately apply the relevant knowledge to solve practical problems in real life situations, as is found that interns in the observation group have a significantly higher score of critical thinking ability than those in the control group.

4.3 Flipped Classroom Teaching Mode Could Effectively Improve the Satisfaction Degree of Practicing Nursing Students with Teaching Methods

In the traditional teacher-centered nursing teaching mode, intern nursing students are often in a passive position, passively receiving the knowledge delivered from the nursing teacher without critical or creative thinking, so the students' knowledge acceptance and retention rates are low, thus failing to stimulate students' motivation to learn autonomously (Martinelli et al., 2017). When applying the mode of flipped classroom in nursing teaching process, the intern nursing students are more likely to be interested in the mode of teaching, keep the novelty and mobilize their active learning attitude, stimulate learn autonomy and thus rely more on their own, hence the flipped classroom teaching mode would be greatly welcomed among the students, and therefore it could sufficiently improve the intern nursing students' satisfaction degree with the teaching method as a consequence (Njie-Carr et al., 2017).

5. Limitations and Summary

The implementation of the flipped classroom teaching mode for nurse anesthesiologists could sufficiently improve the mastery of theoretical knowledge and practical skills of anesthesia nursing, effectively improve the critical thinking ability and the satisfaction degree of nurse

anesthesiologists with the teaching method. However, there are still many limitations in the use of flipped classroom teaching mode. Firstly, the internship students are required to review the relevant knowledge in advance, and then carry out discussions in the classroom, which undoubtedly increases the burden of internship nurses who are used to the traditional teaching methods, and the effect of learning will be greatly reduced when the students do not have sufficient preparation before class, and meanwhile, this mode of teaching is very demanding on the teachers, who need to guide the students to carry out discussions frequently and mobilize the atmosphere of the classroom strenuously, control the pace of the class in order to put the students in a better learning position. Therefore, in the future teaching activities, so as to amplify flipped classroom teaching mode's benefits and shrink its drawbacks to the extreme, it is necessary to continuously strengthen the quality and effectiveness of the content of pre-course learning and improve the teaching level of nursing teachers.

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).

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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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