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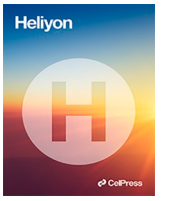

Research article

Reflections on training and teaching modes for anesthesia monitoring nurses in China

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ABSTRACT

Objective: The purpose of this scoping review was to map and identify studies describing the current state of research and teaching methods and evaluation systems for nurse anesthetists within China.
Design: A wide-ranging search of multiple databases and gray literature was performed according to JBI criteria, employing predefined selection criteria and following PRISMA guidelines.
Methods: This scoping review included studies published between 1988 and 2021 that explored the current state of clinical training and teaching methods for nurse anesthetists nationally and internationally. These articles were reviewed by four reviewers and content analysis was performed.
Results: Fifty-two articles were included in the review. The results suggest that both simulation teaching in nursing education and Kolb's experiential learning cycle theory improve nursing staff teamwork, develop critical thinking skills, and improve core nursing competencies.
Conclusions: High-fidelity simulation teaching based on Kolb's experiential learning cycle theory may be an effective teaching method to develop and improve the competence of nurse anesthesia monitors.

1. Introduction

The increased number of surgical procedures and the development of various painless diagnoses and treatment techniques have caused a growing demand for anesthesia in the Chinese health care system. In order to better provide patients with various anesthesia services, the National Health and Family Planning Commission published a policy that aimed to strengthen anesthesia medical services within three consecutive years from 2017 to 2019; this policy clearly stated the construction and development of anesthesia nursing teams and put forward clear requirements for the post-setting and management of nurses in the anesthesiology department [1]. According to statistical analysis, a study performed by Peking University Third Hospital noted that the ratio of anesthesiologists to anesthesia nurses was 1:0.06 in 2884 hospitals in China from 2002 to 2010, while that in the USA was 1:1–2. These data indicate that the number of anesthesia nurses is seriously insufficient and that there is a significant gap between China and overseas countries [2]. Therefore, there is an urgent need to strengthen the training and cultivation of anesthesia nurses in China.

Anesthesia nurses in China are mainly responsible for anesthesia recovery room management, material management and patient follow-up. With the development of anesthesiology and anesthesia nursing, anesthesia nurses need to undertake wider and deeper nursing work for anesthesia patients, such as intraoperative monitoring, acute pain management, and perioperative anesthesia

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nursing. Thus, anesthesia nurses should have solid theoretical knowledge of perioperative anesthesia nursing and be skillful in anesthesia operating techniques [3]. The training and cultivation of anesthesia nurses are important means to effectively improve the competency of nursing in anesthesia.

The corresponding education and training system has long been established and perfected in the USA for over 160 years; indeed, the USA was the first country in the world to train and develop anesthesia nurses [4]; this system mainly relies upon post-vocational education [5]. The education of anesthesia nurses in mainland China began in 1993. Although such training has been established for 29 years, the training and development of anesthesia nurses require urgent improvement [6]. At present, the training of anesthesia nurses in China mainly consists of academic education and continuing education. However, the former requires a long period of time with a small number of trainees, thereby failing to affect the rapid development of the discipline of anesthesia nursing [6]. Therefore, the latter option remains the mainstay of training for anesthesia nurses at present [7].

As yet, an effective training system has not been established for the continuing education and development of anesthesia monitoring nurses after graduation in China. The training content adopted by hospitals that have carried out training for anesthesia monitoring nurses can be classified into anesthesia nursing theory learning, anesthesia specialist skill training and clinical practice [8]. The training methods can be summarized as hierarchical training, phased training, rotational training with the help of ICU refresher training, and refresher training [7]. At present, there is a lack of development for critical thinking ability and comprehensive emergency ability in the training of anesthesia monitoring nurses; this is worrying as this is a core competency for nurses working in this discipline.

This study aimed to improve the competency of anesthesia monitoring nurses, explore the combined application of Kolb's experiential learning circle theory and high-fidelity simulation teaching in the training and development of anesthesia monitoring nurses, and further optimize the training system used for anesthesia monitoring nurses. Our goal was to improve the core ability of anesthesia

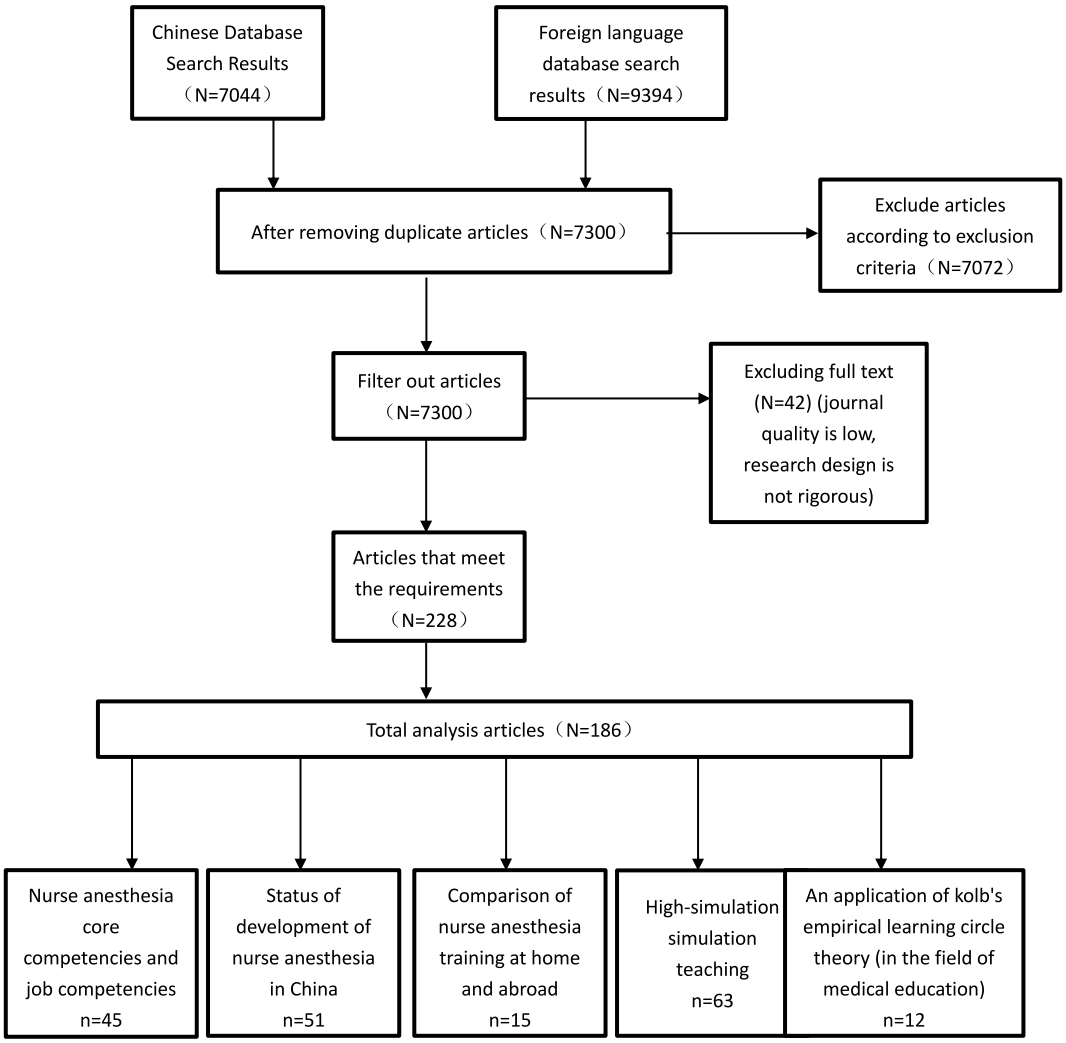

Fig. 1. Flowchart for selection of included studies.

monitoring nurses, including comprehensive evaluation ability, emergency ability and critical thinking, thereby improving their ability to cooperate with anesthesiologists during the perioperative period, thus ensuring the safety of perioperative patients.

2. Design and methods

2.1. Literature search and screening methods

Search keywords "anesthesia nurse OR anesthesia monitoring nurse OR anesthesia nursing OR anesthesiology nurse" in Chinese databases (Wanfang, Weipu, CNKI); search strategy based on "anesthesia nurse OR anesthesia monitoring nurse OR anesthesia nursing OR anesthesiology nurse" and "job competencies OR core competencies"; "anesthesia nurse OR anesthesia monitoring nurse OR anesthesia nursing OR anesthesiology nurse" and "education OR teaching OR training OR nurturing"; "nursing Education OR nurse Training OR nursing" and "job Competency OR critical Thinking". We searched the Chinese databases (Wanfang, Weipu, CNKI) for the subject terms "nursing education" and "theory" for literature search, and also searched foreign language databases (PubMed, Web of science) for the key words "certified registered nurse anesthetist (CRNA) or nurse anesthetist or nurse anesthesia or anesthsia monitoring nurse"; "certified registered nurse anesthetist (CRNA) or nurse anesthetist or nurse anesthesia or anesthsia monitoring nurse" and "competency or core competency or nontechnical skill"; "certified registered nurse anesthetist (CRNA) or nurse anesthetist or nurse anesthesia or anesthsia monitoring nurse" and "education or training or continuing education"; "first aid skills training"; "nursing training theory"for literature search, set up for the period January 1, 1988–December 31, 2021. Literature inclusion criteria: literature dealing with education or training related to anesthesia care. Exclusion criteria: study population unrelated to nursing stakeholders; full text could not be found; overlapping article content. A total of 7044 documents were searched in Chinese databases (Wanfang, Weipu, CNKI), and a total of 146 documents were included in the study after exclusion according to the exclusion criteria. A total of 9394 papers were searched in foreign language databases (PubMed, Web of science) and 40 papers were included in the study after exclusion according to the exclusion criteria.

2.2. Literature analysis

According to the purpose of the study, EndNote X9 was used to establish a database, and the contents of the screened 228 Chinese and English literature were screened again to exclude articles with incomplete article contents and those with poor journal influence, and were refined from the current status of the development of domestic anesthesia nursing, the comparison of domestic and foreign anesthesia nursing education and training, the core competencies of nurse anesthesiologists and their job competency, the application of high-fidelity simulation teaching, and the application of the theory of the Kolb empirical learning circle, and the literature was reviewed and analyzed by four people at the same time. The flowchart for selection of included studies was showed in Fig. 1.

2.3. The status quo of anesthesia nurses research in China and overseas countries

By comparing the developmental history of anesthesia nurses between China and overseas countries, it was found that the development of anesthesia nurse education in China started relatively late and is still in the exploratory stage. Over recent years, China has gradually formed an anesthesia nursing education and training mode with Chinese characteristics due to the efforts of experts in anesthesiology and anesthesia nursing [9]. The focus of training for anesthesia specialist nurses shifted from academic education to post-graduation continuing education at the 7th National Academic Conference on Progress in Anesthesia and Resuscitation in March 2009 [10]. In recent years, hospitals in Beijing, Shanghai, Guangzhou, Jiangsu and Shandong have explored the continuing education modes for anesthesia nurses. The training systems for anesthesia specialist nurses designed by the Shanghai Ninth People's Hospital, Shanghai JiaoTong University School of Medicine and Nanjing BenQ Medical Center successively passed the International Federation of Nurse Anesthetists (IFNA) certification in 2015 and 2017 [11,12] Anesthesia nurses first appeared in the USA in 1861. The American Association of Nurse Anesthetists (AANA) was established in 1931 [13] and a certification mechanism for anesthesia nurse education programs was set up in 1952 to standardize the teaching of anesthesia nurses across the country [14]. The IFNA, founded in 1989, not only continues to provide guidelines and suggestions for the development of the global cause of anesthesia nursing but also promotes the exchange of anesthesia nursing skills among countries and the rapid improvement of the quality of anesthesia nursing worldwide [15].

Although the training system used for anesthesia specialist nurses in China has improved continuously after many years of research and exploration, there are still significant differences when compared to the training systems used for anesthesia nurses in other countries. These differences are three-fold and are explained below.

1) Academic education: The main training programs overseas include a Master's degree and a Doctor's degree. Chinese anesthesia nurses are mainly taught by undergraduate nurses and junior college nurses.
2) Training aims: Overseas countries, especially the USA, place emphasis on the abilities of the anesthesia nurses during training and require them to be able to perform anesthesia-related operations independently. In China, the role of an anesthesia nurse is still as an assistant to the anesthesiologist. Furthermore, anesthesia nurses are mostly trained with professional knowledge and skills training, without training in clinical decision-making ability and emergency rescue ability [16].
3) Teaching methods and means: The forms of teaching used overseas are innovative, flexible, and vivid, including simulation technology, distance teaching, self-study discussion, problem-oriented teaching, heuristic teaching, case analysis and situational

Table 1
Describes AANA's job competency for nurse anesthesia and the details of the existing job competency evaluation system for nurse anesthesia in China.

Object	Primary indicators	Secondary indicators
Anesthesia room nurses (Guo et al., 2014)	1. Professional theoretical knowledge 2. Professional practice ability 3. Critical thinking skills 4. Communication and coordination skills 5. Professional development skills	1-1 Familiar with the theoretical knowledge of anesthesiology 1-2 Pharmacological knowledge 1-3 Master common postoperative complications and their care 1-4 Familiar with various anesthesia monitoring instruments and equipment 1-5 Proficient in the standards of entering and exiting the anesthesia recovery room 1-6 Master the method of relieving wound pain in postoperative patients 1-7 Proficient in the knowledge of various drainage tubes after surgery 1-8 Proficient in the knowledge of disinfection and hospital sense in the awakening room 2-1 Manipulation of endotracheal intubation and extubation 2-2 Observe the recovery of muscle strength after general anesthesia 2-3 Observe the patient's ability to drain the wound after surgery 2-4 Observe analgesia and sedation rating 2-5 Proficient in the operation of monitoring instruments and equipment in the awakening room 3-1 Evaluation and foresight ability 3-2 Resilience 3-3 Analytical and comprehensive ability 3-4 Judgment and decision-making ability 4-1 Communication skills 4-2 Coordination and cooperation ability 4-3 Self-psychological adjustment ability 5-1 Ability to learn 5-2 Research ability 5-3 Teaching ability
Anesthesia nurse (Yayun 2017)	1. Basics 2. Perioperative knowledge 3. Operational skills 4. Risk control 5. Career development 6. Individual traits	II-1 Fundamentals of Nursing II-2 Fundamentals of anesthesia care II-3 Pharmacological knowledge of commonly used drugs II-4 Knowledge of anesthesiology drug and consumables management II-5 Knowledge of quality management of anesthesiology care II-6 Knowledge of safety management of anesthesiology nursing II-7 Knowledge of anesthesiology information management (e.g., clerical writing, etc.) II-8 Knowledge of nosocomial infection management II-9 Pre-anesthesia care preparation II-10 Perioperative fluid management II-11 Clinical anesthesia monitoring (e.g., respiratory function monitoring, etc.) II-12 Nursing care for various anesthesia modalities (e.g., nursing care for intravenous anesthesia, etc.) II-13 Anesthesia care for various types of surgical procedures II-14 Care of perioperative complications and accidents II-15 Nursing for organ insufficiency (e.g., respiratory insufficiency, etc.) II-16 Use and maintenance of instruments and equipment II-17 PCA pump configuration and pain management II-18 Common nursing techniques (e.g., catheter care, etc.) II-19 Skills to assist in various types of anesthesia II-20 Rescue skills (e.g., cardiopulmonary resuscitation, etc.) II-21 Assessment Capability II-22 Preparedness II-23 Critical Thinking Skills II-24 Judgment decision-making ability II-25 Evidence-based intervention capacity II-26 Self-learning ability II-27 Research Capability II-28 Pioneering and innovative capabilities II-29 Clinical Teaching Ability II-30 Theoretical teaching ability II-31 Self-confidence II-32 Responsibility II-33 Rigorous and conscientious

(*continued on next page*)

Table 1 (*continued*)

Object	Primary indicators	Secondary indicators
		II-34 Adaptive capacity II-35 Organizational Commitment
Anesthesia specialist nurses (Xing et al., 2021)	1. Professional knowledge 2. Professional skills 3. Professional competence 4. Management capabilities 5. Personal traits	1.1 Master the pharmacological knowledge of anesthesia related sedation, analgesia and muscle relaxant drugs 1.2 Master the pharmacology knowledge of perioperative emergency drugs 1.3 Master the management system of commonly used drugs (especially narcotic drugs and psychotropic substances) and consumables in anesthesiology 1.4 Master the knowledge of human internal environment and fluid treatment, be able to assess the blood volume of perioperative patients, and master the nursing points of intraoperative fluid infusion and blood transfusion 1.5 Familiar with human respiratory anatomy, physiology and pathological knowledge 1.6 Master the knowledge of open airways and establishing artificial control airways 1.7 Master the use of ventilators and the setting of parameters in different modes 1.8 Familiar with circulatory system anatomy, physiology and pathological knowledge 1.9 Familiar with the significance of relevant parameters of the circulatory system 1.10 Master postoperative resuscitation care for general anesthesia 1.11 Master postoperative resuscitation care for non-general anesthesia 1.12 Master the assessment and treatment of anesthesia and postoperative related complications 1.13 Master the assessment and care of patient resuscitation 1.14 Master the assessment and care of pain 2.1 Proficient in hand-grasping cardiopulmonary brain restoration, electrical defibrillation, sputum suction, oxygen and other rescue skills 2.2 Grip airway opening and assisted ventilation skills 2.3 Master blood gas analysis and thromboelastogram detection skills 2.4 Practice the use of numbness, monitors, breathers, defibrillators and other common instruments 2.5 Possession of postoperative patient safe transport techniques 3.1 Can perform expiratory function, central venous pressure, electrocardiogram and other monitoring 3.2 Systematic collection of patient data to assess perioperative patient condition and potential complications 3.3 During the work, the patient's clinical observation index changes, timeliness and feasibility of operation can be analyzed and judged 3.4 Have awareness of infection control, familiar with nosocomial infection related knowledge and ability to apply it 3.5 Be able to prepare for preoperative anesthesia drugs, anesthesia instruments, anesthesia instruments, different anesthesia methods and technical operations 3.6 Use evidence-based methods to generate evidence to address anesthesia care 3.7 Have critical thinking skills 3.8 Academic and scientific research ability 3.9 Ability to use different means of teaching 4.1 Palm control of anesthesia drugs and consumables 4.2 Familiar with the principles of use and safety management of equipment related to the department of anesthesia, 4.3 Master the management of patient safety and adverse events 4.4 Familiarize yourself with the quality evaluation standards and continuous improvement of nursing care 4.5 Rational distribution of work tasks 4.6 Ability to respond to sudden situations 5.1 Have a spirit of prudence 5.2 Actively communicate effectively with colleagues and work as a team 5.3 Respect life and respect personality 5.4 Accept challenges and be willing to give

(*continued on next page*)

Table 1 (*continued*)

Object	Primary indicators	Secondary indicators
Certified registered nurse anesthetist (Professional Competence of the Certified Registered Nurse Anesthetist: Novice to Expert Focus Session Report)	1. Autonomy 2. Emotional intelligence 3. Knowledge and learning 4. Communication, collaboration and teamwork 5. Involvement	1.1 CRNAs should be accountable for their own actions and be able to make decisions and solve complex problems on their own. 1.2 By practicing autonomously, the CRNA is able to act and make decisions on their own but is still able to interact and work with others to provide the best care. 1.3 Maturity was another key competency identified that is necessary for practice. 2.1 Moral framework, empathy, and compassion for others were described as inherent traits crucial for practicing and interacting with patients. 2.2 Situational awareness and the ability to accurately and efficiently evaluate the case also were identified as important competencies. 2.3 Prioritizing and planning skills are important, especially within each clinical situation, in order to deliver care that is patient-centric. 2.4 Self-awareness is important. 3.1 it is important that they have a strong nursing foundation (i.e., adequate knowledge and skillset). 3.2 nurse anesthesia practice is evolving and new opportunities will arise that CRNAs must be ready for, so the desire to know more and learning over the course of a career are important in order to stay relevant in practice. 3.3 Intellectual curiosity and inquisitiveness were identified as key attributes that drive CRNAs to continuously learn new techniques and adapt to new practices. 4.1 Effective communication (with patients and healthcare providers) skills were identified as important for professional practice. 4.2 The focus sessions specifically identified interpersonal skills and teamwork as necessary traits for practice. 4.3 Crew-resource management concepts (e.g., critical thinking, leadership, decision-making), were noted as necessary in order to practice anesthesia and lead the team. 5.1 Being politically active as a CRNA is important because legislation can drastically impact how CRNAs practice.

simulation. However, anesthesia nursing teaching in China is mainly based on classroom lectures. Although studies on different teaching methods have gradually emerged over recent years, these are still in the exploratory stage [17].

2.4. The status quo of research in clinical training for anesthesia nurses

With the continuous development of the medicine in China, improving the comprehensive ability of anesthesia nurses is the future training trend and represents the key to strengthening the competency of anesthesia nurses. Due to the lack of anesthesiologists in China, the role of anesthesia nurses is no longer limited to the management of anesthetic drugs and consumables, anesthesia preparation, and anesthesia resuscitation. Instead, the role now encompasses preoperative anesthesia evaluation, perioperative anesthesia management, and postoperative pain management involving comprehensive assessment ability and emergency rescue ability [1]. In a previous study, Huang [18] reported that with the development of medical treatment as well as the specialty of anesthesia and anesthesia nursing, it is an inevitable trend to improve the comprehensive ability of anesthesia nursing staff to meet the international levels of anesthesia nursing and carry out high-level anesthesia nursing education. However, Fu et al. [7] pointed out that the core ability of anesthesia specialist nurses is not highlighted in the current clinical training of anesthesia nurses in China. Moreover, most anesthesia nurses only receive training in relevant anesthesia operations and nursing cooperations, without the cultivation of their ability to think and deal with emergencies independently.

As anesthesia monitoring nurse posts have been set up, Liu et al. [19] and Luo et al. [20] both reported that anesthesia monitoring nurses are at greater risk with regard to their responsibilities than ever before and need stronger specialist abilities. Therefore, different systems need to be developed to evaluate competency to meet the differing roles of anesthesia nurses so as to reflect the uniqueness and importance of these specialist nurses.

2.5. The construction of competency evaluation systems for anesthesia nurses

The China National Nursing Development Plan (2016–2020) proposed that a demand-oriented and competency-centered nurse training system should be established. Therefore, the competency of anesthesia nurses should also be the core focus of training for anesthesia nurses. Competency refers to the potential and deep personal characteristics that can distinguish well-performing nurses from fairly performing nurses in a certain work situation and can significantly distinguish excellent performance from fair performance [21]. Research relating to the construction of a competency model for nurses in the anesthesiology department has already been

undertaken. In 1988, Callahan [22] recommended the construction of a competency model for anesthesia nurses and that this should be applied in normal practice. Discussion at the 2015 AANA (The American Association of Nurse Anesthetists) Congress led to the understanding that the competency of anesthesia nurses includes autonomy, emotional intelligence, knowledge and learning, communication, collaboration, teamwork, and involvement [23]. Over recent years, the construction of the competency evaluation system for anesthesia nurses in China has been gradually implemented with continuous exploration and research. In 2014, Guo et al. [24] preliminarily constructed a series of evaluation indicators to test the core ability of nurses in the anesthesia recovery room by performing a literature search and expert interviews. In 2017, Zhang et al. [25] constructed a competency evaluation system for anesthesia nurses and applied this for the first time in practice. In 2021, Lan et al. [26] determined a series of evaluation indicators and weightings for all levels of competency for anesthesia specialist nurses by performing a literature review, group discussion, Delphi expert correspondence and an analytical hierarchy process. Table 1 describes AANA's job competency for nurse anesthesia and the details of the existing job competency evaluation system for nurse anesthesia in China The evaluation system used to evaluate the competency of anesthesia nurses can scientifically, objectively and comprehensively evaluate the comprehensive ability of anesthesia nurses, thus providing a reference for the analysis of training effects in anesthesia nurses and allowing the selection and assessment of anesthesia nurses.

With the rapid development of surgeries and various operation techniques in China, anesthesia nurses also have to change work categories and responsibilities. Therefore, there is an urgent need to further improve the competency of anesthesia nurses. However, relationships between patients and clinical care providers are strained in China at present; thus, there are fewer practical opportunities for nurse to practice skills on real patients. It has been clinically observed that many new nurses generally have poor clinical operation and emergency abilities [27] and that many feel anxious [28,29].

2.6. Simulation teaching in nursing education

High-fidelity simulators can lead to changes in the condition of a disease according to the treatment of nursing staff and reflect treatment effects through pre-set computer programs. These simulators represent the closest model to the actual clinical situation [30–32] and can improve the competency of nurses; thus, simulators are worth promoting and applying on a wider basis. The emergence of high-fidelity simulators, which are widely used in clinical medical teaching, has greatly promoted the development of medical education [33]. Researched and developed in the 1990s, high-fidelity simulators are the most intelligent simulation trainers developed thus far. According to specific teaching needs, these simulators can be used to design a variety of "cases" that represent various pathological and physiological changes, such as myocardial infarction, shock, ventricular fibrillation and asthma. These simulators can then be used to train the clinical thinking of nursing staff and their abilities to observe and evaluate disease conditions and independent rescue [30]. Although high-fidelity simulation teaching began only recently, it developed rapidly in China and has been widely used in nursing education in China [34]. Deng et al. [35] demonstrated that the high-fidelity simulation teaching method could improve the competency of nurses with a higher vocational college degree. Yu et al. [36] reported that the situational simulation teaching method could improve the clinical operation level and emergency ability of nurses and elevate the positive psychological level, thereby promoting the improvement of competency and laying a foundation for the reserve of nursing talent in the future. Sun et al. [37] further reported that the application of video cases combined with situational simulation teaching for the standardized training of newly enrolled nurses could improve their competency and standardized training satisfaction; consequently, this technique is worthy of clinical promotion and application. The development of anesthesia specialist nurses remains in its infancy in China. Although the use of traditional teaching methods can improve theoretical knowledge and single skills, it is not effective for critical clinical thinking and the comprehensive improvement of abilities related to first aid and emergencies. In overseas countries, the use of simulation teaching has been widely recognized in the management of perioperative emergencies by junior anesthesiologists and nurses [38,39]; however, in China, there have been few studies relating to the application of simulation teaching in specialist training in anesthesia nurses. Dai et al. [40]conducted a study on *in situ* simulation training to improve the treatment ability of anesthesia specialist nurses for emergency respiratory depression during the recovery period and highlighted that *in situ* simulation training significantly reduced the time of emergency initiation and treatment provided by trainees; it also improved their professional technical abilities, emergency treatment abilities, and teamworking, thus resulting in good acceptance of and satisfaction with the training method.

Thus, the application of simulation teaching in continuing education can effectively improve the competency of nurses. However, there are still some problems in the continuing education of anesthesia nurses, such as a lack of theoretical support and insufficient systematization of the teaching system. In order to improve the competency of anesthesia nurses, there is an urgent need to carry out in-depth studies and exploration in this area.

2.7. Application and research status of Kolb's experiential learning cycle theory in medicine and nursing education

Kolb's experiential learning cycle theory has become an important theoretical method of teaching in the field of nursing education, including higher nursing, in-service nursing and patient health [41], and has become of the most applied theories and tools in simulation teaching for the development of core nursing ability. This theory can improve the teamwork ability of nursing staff, develop critical thinking skills and improve core nursing ability [42]. Kolb's experiential learning circle theory, proposed by David Cooper, a famous American educator, is a learner-centered learning method that emphasizes practice and reflection [43]. The application of Kolb's experiential learning circle theory when constructing simulated teaching activities can improve the effects and efficiency of this form of teaching [44], as well as the ability of trainee nurses to acquire new skills [42]. At present, there is no literature relating to the

field of simulation teaching for anesthesia nurses. Evidence indicates that a simulated education system for anesthesia monitoring nurses could be effectively constructed under the guidance of Kolb's experiential learning circle theory.

3. Conclusion

The development of anesthesia nurses lacks focus on core abilities such as comprehensive evaluation and emergency abilities and critical thinking in China and cannot currently meet the clinical requirements required for nurses working in the field of anesthesia. High-fidelity simulation teaching methods based on Kolb's experiential learning cycle theory is a practical and feasible method with which to improve clinical assessment, analysis and decision-making abilities of anesthesia monitoring nurses, thereby strengthening their competency.

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Data availability statement

This is a systematic review, so the data were detailed in the manuscript.

CRediT authorship contribution statement

Han Yu: Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Cao Zhang:** Conceptualization, Data curation, Methodology, Project administration, Validation. **Jiangqin He:** Conceptualization, Data curation, Formal analysis, Project administration, Validation, Visualization. **Jianhong Xu:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Abbreviations

IFNA	International Federation of Nurse Anesthetists
AANA	American Association of Nurse Anesthetists

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