Research in Health Science
ISSN 2470-6205 (Print) ISSN 2470-6213 (Online)
Vol. 11, No. 2, 2026
www.scholink.org/ojs/index.php/rhs

Original Paper

Research on the Application of the "Three-Dimensions, Four-Layers, Five-Cycles" Training Model in General Training for Operating Room Nurses

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Received: April 29, 2026 Accepted: May 18, 2026 Online Published: May 27, 2026

doi:10.22158/rhs.v11n2p145 URL: http://dx.doi.org/10.22158/rhs.v11n2p145

Abstract

This study developed and optimized a novel standardized training system for operating room nurses based on a three-dimensional, four-layer, five-cycle framework, aiming to facilitate standardized and homogeneous nursing talent training in tertiary hospitals. A self-controlled before-and-after design was adopted, with traditional training in 2024 as the control and optimized systematic closed-loop training in 2025 as the experimental intervention. Comprehensive optimizations were made to the training framework, hierarchical content, diversified teaching modes and full-process assessment mechanisms. Relevant training and assessment indicators were compared between the two phases. Results revealed substantial increases in annual training sessions (26.74%), class hours (25.17%) and participations (39.50%). Nurses' infection control assessment performance, training satisfaction, professional participation and teaching-research achievements were also significantly improved ($P < 0.05$). This optimized training system effectively expands training coverage, standardizes training procedures, improves nurses' post competency and promotes continuous nursing quality improvement, which is suitable for wide application in tertiary hospitals.

Keywords

operating room, nurse training, general training, post competency, training model optimization

1. Introduction

As a core clinical department featuring high risks, high work intensity and integrated high technologies in hospitals, the operating room delivers nursing care whose quality is directly linked to surgical safety, patient prognosis and the bottom line of medical quality and safety. With the rapid iterative development

of new technologies including minimally invasive surgery, robotic surgery and precise surgery, operating room nursing has gradually evolved toward refined subspecialty management, specialized post competency and standardized services[2], imposing higher requirements on operating room nurses' general basic capabilities, specialized surgical cooperation skills, nosocomial infection prevention and control literacy, emergency response capacity and comprehensive professional quality. Clinical practice reveals that the current operating room nursing team is confronted with problems such as wide rank gaps, uneven professional proficiency, unbalanced career growth between junior and senior nurses, limited subspecialty vision, insufficient emergency handling experience and prominent occupational burnout[1]. The traditional general training mode for operating rooms adopts a single framework of unified lectures, intensive knowledge infusion and year-end assessments, which is plagued by homogeneous training content, rigid teaching forms, poor pertinence, inadequate process supervision and the absence of closed-loop rectification mechanisms. Such mode fails to meet the demands of subspecialty development and targeted post competency training for operating room nursing in the new era.

General nursing training serves as a vital cultivation model for modern clinical nursing talents. It features full staff coverage and hierarchical training, focusing on consolidating fundamental skills, strengthening specialized capabilities and pursuing continuous improvement, which can effectively standardize basic competencies of nursing staff, narrow gaps in post performance and elevate the overall professionalism of the team[5-7]. In recent years, diversified cultivation concepts have been introduced into domestic nursing education, including the onion model of post competency theory, hierarchical patient safety training system, SPOC five-step information-based teaching method, experiential scenario-based teaching and positive psychology intervention. These theories provide solid theoretical support for the reform of systematic and targeted training in operating rooms[8-11]. Accordingly, targeting the practical training difficulties and management demands of operating rooms, this study integrates multi-dimensional teaching theories to establish the **"Three-Dimensions, Four-Layers, Five-Cycles"** general training system for operating room nursing staff. By comparing the annual training data of 2024 and 2025, this paper verifies the application effect of the optimized training model. It aims to formulate a practicable, replicable and iterable standardized training protocol for operating room nurses, and offer practical references for homogeneous and high-quality cultivation of operating room nursing talents.

2. Objects and Methods

2.1 Research Objects

This study adopted a single-center prospective self-controlled before-and-after research method. The research objects were all registered nurses who were continuously on the job in the Operation and Anesthesia Center of a tertiary Class A hospital from January 2024 to December 2025. All nurses had complete on-the-job files and no long-term absence records during the research period. The inclusion criteria were as follows: ①holding a valid national nurse practicing certificate; ②engaging in full-time clinical operating room nursing work; ③participating in all regular training and assessment tasks of the

department during the research period; ④voluntarily participating in this study with informed consent. The exclusion criteria were as follows: refresher nurses, short-term rotational intern nurses, standardized training nurses, nurses who were absent for more than one month due to illness or personal leave during the year, and nurses who resigned or transferred during the research period.

The 2024 annual training stage was set as the observation group, which implemented the traditional conventional general training mode, with a total of 273 training sessions and 9,441 training participations throughout the year. The 2025 annual training stage was set as the experimental group, which implemented the optimized "Three-Dimensions, Four-Layers, Five-Cycles" integrated training system, with a total of 346 training sessions and 13,170 training participations throughout the year. The baseline data of the two groups of nursing teams, including age composition, working years, professional title structure, educational background level and subspecialty work area distribution, were statistically analyzed, and there was no significant difference between the two groups ($P > 0.05$), indicating that the baseline conditions of the two groups were balanced and comparable, which met the research conditions of before-and-after comparative analysis.

2.2 Training Implementation Methods

2.2.1 Observation Group (2024): Traditional Conventional General Training Mode

In 2024, the Operation and Anesthesia Center continued to adopt the traditional operating room nurse general training mode, with relatively single training system and solidified teaching form. The training content was mainly divided into three modules: daily institutional system learning, subspecialty business knowledge teaching and clinical skill operation workshop training. The training implementation form was dominated by offline centralized classroom teaching, supplemented by video picture browsing and on-site teacher demonstration explanation, lacking diversified interactive teaching links and personalized training design.

In terms of training implementation scale, the observation group carried out 11 sessions of institutional system and nosocomial infection control standardized training throughout the year, focusing on the interpretation of daily management system and basic infection control specifications; 257 sessions of subspecialty professional and technical training, covering routine operation cooperation knowledge of each surgical subspecialty; and 5 sessions of instrument and equipment operation skill workshops, focusing on the basic operation and maintenance of conventional surgical instruments. The total number of annual training sessions was 273, with a total training duration of 286 class hours.

In terms of assessment management, the traditional training mode adopted the end-of-year centralized written theoretical examination and irregular on-site skill spot check as the main assessment methods. There was no phased regular assessment mechanism in the training process, no special statistical analysis of wrong questions and weak knowledge points after the assessment, and no targeted supplementary training and closed-loop correction measures for existing problems. The whole training management focused on the final assessment results, lacked effective supervision and improvement mechanism for the training process, and the overall training effect was greatly restricted.

2.2.2 Experimental Group (2025): Optimized “Three-Dimensions, Four-Layers, Five-Cycles” Training Mode

On the basis of summarizing the practical problems and deficiencies of traditional training in 2024, the department integrated multiple advanced nursing teaching theories in 2025, including onion model post competency theory, patient safety hierarchical training theory, SPOC five-step intelligent teaching method and positive psychology intervention concept, and innovatively constructed a standardized and closed-loop “Three-Dimensions, Four-Layers, Five-Cycles” general training system for operating room nurses. The system has clear training objectives, hierarchical training content, diversified teaching methods and standardized closed-loop management, realizing the full optimization of the whole training chain.

Three-dimensional training objectives: Centering on the core needs of operating room clinical nursing work and talent growth, three-dimensional comprehensive training objectives are defined, including professional knowledge standardization to ensure that all nurses master institutional norms and professional theories accurately, operational skill standardization to standardize clinical surgical cooperation and instrument operation behaviors, and comprehensive literacy improvement to optimize nurses’ safety awareness, service awareness and psychological resilience.

Four-layer training content system: According to the difficulty of knowledge and the importance of clinical work, the training content is divided into four progressive levels. The first level is the basic institutional norm layer, covering hospital management system, department rules and regulations and basic nursing specifications; the second level is the nosocomial infection and safety control layer, focusing on operating room safety management goals, sterile operation specifications and infection prevention and control key points; the third level is the subspecialty professional skill layer, covering personalized surgical cooperation skills and professional equipment operation of each surgical subspecialty; the fourth level is the comprehensive ability improvement layer, including nursing scientific research, quality improvement, emergency response and teaching innovation ability training.

Five-cycle closed-loop management process: The whole training work follows five standardized closed-loop links, including pre-training demand assessment, targeted training scheme design, diversified accurate training implementation, multi-dimensional training effect evaluation, and post-training problem review and iterative optimization, realizing the sustainable improvement of training quality.

On the basis of the above theoretical framework, the department has carried out comprehensive optimization and innovation in training structure, content setting, teaching form and quality management: First, the training structure has been upgraded in an all-round way. On the basis of retaining traditional basic training, subspecialty training and skill workshops, three special training modules of emergency response disposal, QC nursing quality improvement and tertiary hospital grade review special training have been added, forming a four-wheel driven training pattern of foundation consolidation, specialty refinement, special reinforcement and emergency empowerment, which makes up for the deficiency of traditional training in quality management and emergency capability cultivation. Second, the training

content is refined and personalized, focusing on high-risk clinical links such as surgical article counting, specimen standardized management, foreign body and instrument disposal, and sudden surgical emergency rescue, setting targeted special courses, and carrying out precise teaching combined with the disease characteristics and operation difficulties of each subspecialty. Third, diversified mixed teaching modes are adopted, breaking the single offline teaching mode, and realizing the integrated teaching of online pre-preview, offline practical operation, situational simulation drill and on-site learning check-in. A time-limited learning assessment mechanism is implemented, requiring training materials to be uploaded within 2 hours after class and all nurses to complete learning and assessment within 48 hours to ensure timely learning and effective absorption. Fourth, a whole-process closed-loop assessment mechanism is established. Through phased assessment, data statistical analysis, wrong question sorting and targeted supplementary training, the problem of repeated errors and unconsolidated knowledge in traditional training is solved. Fifth, a standardized teaching quality control system is built. The head nurses of each professional area are responsible for auditing the training courseware to ensure the professionalism and practicality of the courses, and the training participation and assessment results are linked with personal performance evaluation and professional title assessment to stimulate nurses' independent learning initiative. At the same time, the scale of practical workshops is expanded, with 8 training sessions and 632 participations throughout the year, which significantly improves nurses' practical operation ability.

2.3 Observation Indicators

In this study, multi-dimensional and all-round observation indicators were set from the aspects of training scale, training quality, learning experience, process management and discipline development to comprehensively evaluate the training effect, avoiding the one-sidedness of single index evaluation. The specific indicators are as follows: (1) Training scale indicators: annual total training sessions, total training class hours, total training participations and annual growth rate of each indicator; (2) Professional assessment indicators: average score of institutional and nosocomial infection control assessment, annual assessment participation times, annual assessment sessions and assessment qualified rate; (3) Training experience and participation indicators: overall general training satisfaction, subspecialty training satisfaction and average participation rate of each operating professional area; (4) Process quality control indicators: whole-process training closed-loop implementation rate and courseware qualified audit rate; (5) Teaching and research innovation indicators: number of municipal and hospital-level scientific research projects, number of published academic papers, number of authorized utility model patents, number of software copyrights and number of teaching competition awards.

2.4 Statistical Analysis Methods

All the research data in this study were sorted and verified by special personnel, and the effective data were imported into SPSS 26.0 statistical software for professional statistical analysis. The measurement data such as assessment scores, training class hours and participation rates that conform to the normal distribution are expressed as mean ± standard deviation (x±s), and the paired t-test is used for the before-

and-after comparison of the same group. The counting data such as training sessions, qualified rate and satisfaction rate are expressed as frequency and percentage (%), and the χ^2 test is used for group comparison. The inspection level of all statistical tests is set as $\alpha=0.05$, and $P < 0.05$ is defined as the difference is statistically significant.

3. Results

3.1 Comparison of Overall Training Scale and Coverage Between the Two Groups

After the implementation of the optimized training model in 2025, the overall training supply capacity and full coverage effect of the department have been significantly improved. The total number of training sessions, total class hours and total training participations of the experimental group were all higher than those of the observation group, and the growth range was obvious. The overall training volume increased steadily, the training resource supply was more sufficient, and the full coverage of all nurses' training was basically realized. The detailed data comparison is shown in Table 1.

Table 1. Comparison of overall training scale indicators between the two groups

Evaluation Indicators	Observation Group (2024)	Experimental Group (2025)	Annual Change Rate
Total training sessions	273	346	+26.74%
Total training class hours	286	358	+25.17%
Total training participations	9441	13170	+39.50%
Overall general training satisfaction	86.10%	99.40%	+13.30%

3.2 Comparison of Training Structure and Module Distribution Between the Two Groups

The optimized training model has realized the diversification and systematization of training modules. While retaining the traditional advantageous training modules such as institutional infection control training and subspecialty professional training, it has added three practical special training modules closely combined with clinical management and quality improvement, including emergency response training, QC quality improvement training and tertiary hospital review special training. At the same time, the scale of practical skill workshops has been expanded, which makes up for the deficiency of insufficient practical operation training in traditional training, and the training structure is more scientific and comprehensive, fully covering the multi-dimensional needs of nurses' basic ability consolidation, professional skill improvement, quality management awareness and emergency response ability cultivation. The detailed comparison of training module data is shown in Table 2.

Table 2. Comparison of Training Module Structure and Participation Volume between the Two Groups

Training Module Type	Observation Group (2024)	Experimental Group (2025)
Institutional and nosocomial infection control training	11 sessions / 2520 participations	20 sessions / 2330 participations
Subspecialty professional training	257 sessions / 6930 participations	274 sessions / 5803 participations
Practical skill workshop training	5 sessions / 491 participations	8 sessions / 632 participations
Emergency response disposal training	—	11 sessions / 396 participations
QC quality improvement special training	—	20 sessions / 980 participations
Tertiary hospital review special training	—	13 sessions / 3029 participations
Total training volume	273 sessions / 9441 participations	346 sessions / 13170 participations

3.3 Comparison of Institutional and Infection Control Assessment Effects between the Two Groups

After the implementation of the closed-loop standardized training system, the nurses' mastery of hospital institutional norms and nosocomial infection control knowledge has been significantly improved. The average assessment score, annual assessment participation times, assessment sessions and assessment qualified rate of the experimental group are all better than those of the observation group. The results show that the targeted training and phased assessment mechanism can effectively consolidate nurses' professional basic knowledge, standardize clinical nursing behaviors, and lay a solid foundation for clinical nursing safety and standardized management. The detailed assessment data comparison is shown in Table 3.

Table 3. Comparison of Institutional and Nosocomial Infection Control Assessment Results between the Two Groups

Assessment Indicators	Observation Group (2024)	Experimental Group (2025)	Improvement Range
Average assessment score	89.45	92.33	+3.22%
Total assessment participations	1261	1831	+45.20%
Annual assessment sessions	7	9	+28.57%
Assessment qualified rate	92.1%	97.8%	+5.7 percentage points

3.4 Comparison of Training Satisfaction and Professional Area Participation Balance

The diversified teaching forms and humanized training arrangement of the optimized training model have greatly improved nurses' training experience and learning initiative. The overall general training

satisfaction and subspecialty training satisfaction of the experimental group have reached a high level, and the participation gap among different operating professional areas has been significantly narrowed. The whole-process closed-loop management and standardized courseware audit system ensure the standardization and high quality of training work, realizing the balanced improvement of training level of the whole nursing team. The detailed data are shown in Table 4.

Table 4. Comparison of Training Satisfaction and Professional Area Participation Indicators between the Two Groups

Evaluation Indicators	Observation Group (2024)	Experimental Group (2025)
Overall general training satisfaction	86.10%	99.40%
Subspecialty professional training satisfaction	87.81%	99.17%
Whole-process training closed-loop implementation rate	—	100%
Training courseware qualified audit rate	—	100%
Average participation rate of each professional area	34.62%	48.52%

3.5 Comparison of Teaching and Scientific Research Innovation Achievements

The systematic training system not only improves nurses' clinical professional ability, but also cultivates their scientific research thinking and teaching innovation awareness. In 2025, relying on the optimized training platform, the department has achieved fruitful results in nursing scientific research, academic innovation and teaching competition, with a significant increase in the number and quality of achievements compared with 2024, forming a good development pattern of promoting teaching by research and feeding research by teaching. The detailed comparison of teaching and research achievements is shown in Table 5.

Table 5. Comparison of Annual Teaching and Scientific Research Innovation Achievements between the Two Groups

Achievement Type	Observation Group (2024)	Experimental Group (2025)
Hospital-level and above scientific research projects	0	1 item
Published academic papers	1 piece	3 pieces
Authorized utility model patents	1 item	3 items
Registered software copyrights	0	2 items
Teaching competition awards at all levels	1 item	3 items

4. Discussion

4.1 Scientificity and Rigor of the Research Design and Data

This study adopts a single-center self-controlled before-and-after study design, which takes the same operating room nursing team as the continuous research object. Compared with the traditional cross-sectional control study, this design effectively avoids the confounding interference caused by the differences in personnel structure, team atmosphere and management mode of different nursing teams, and ensures the consistency and comparability of the research baseline. The research objects are strictly included and excluded, and the baseline data of age, working years, professional title and educational background of the two stages are balanced, which meets the basic requirements of clinical intervention research.

All the research data in this study are derived from the department's official training management ledger, online assessment system background data, hospital quality control department's daily assessment records and teaching and research achievement registration files. The data sources are true, reliable and traceable. The total training participation of the two years exceeds 20,000 person-times, with a large sample volume and good data representativeness. In terms of index setting, this study breaks through the limitation of most similar studies that only focus on assessment scores, and builds a multi-dimensional evaluation system covering training process, training scale, learning experience, clinical ability improvement and disciplinary development, which comprehensively reflects the practical value of the training model. In terms of statistical methods, paired t-test and χ^2 test are used for standardized analysis, which effectively verifies the authenticity and effectiveness of the training effect. Although the research has some limitations such as single-center research and lack of individual hierarchical difference analysis, the overall research design is scientific and the data argumentation is rigorous, which can provide reliable practical evidence for the optimization of operating room nursing training mode.

4.2 Optimized Training Model Expands Training Coverage and Realizes Homogeneous Team Cultivation

The research results show that after the implementation of the "Three-Dimensions, Four-Layers, Five-Cycles" training model, the annual training sessions, class hours and participations of the department have achieved substantial growth, with the participation volume increasing by 39.50% year-on-year, which fully proves that the demand-oriented systematic training optimization can effectively break the bottlenecks of insufficient training supply, uneven personnel coverage and low resource utilization rate in traditional training. Traditional operating room training has long had the problem of unbalanced training focus, focusing too much on the professional skill training of subspecialty backbone nurses, while ignoring the basic ability consolidation and comprehensive quality improvement of new nurses and general nurses, resulting in obvious ability stratification of the nursing team[5].

The optimized training system adheres to the general training concept of full coverage and hierarchical improvement, and builds a multi-level training framework of basic popularization, specialty refinement and special reinforcement. By adding high-value practical training modules such as hospital grade review and quality improvement, the training content is closely linked with hospital daily management and

clinical quality safety work, which improves the practical value of the training. The mixed online and offline teaching mode adapts to the special shift work mode of the operating room, solves the conflict between clinical work and training learning, reduces the threshold of nurses' participation in learning, and effectively improves the overall participation rate and coverage of training. The significant increase in the average participation rate of each professional area indicates that the optimized training arrangement fully considers the work characteristics of different surgical subspecialties, realizes the balanced development of training work in all professional areas, and effectively promotes the homogeneous improvement of the comprehensive ability of the whole operating room nursing team.

4.3 Closed-Loop Training Mechanism Improves Nurses' Safety Competency and Clinical Quality Control Level

Patient safety and nosocomial infection prevention and control are the core bottom line of operating room nursing work, and standardized and systematic professional training is the key measure to improve nurses' risk prevention and control ability[9]. The data of this study show that the nurses' institutional and infection control assessment scores and pass rate are significantly improved after the implementation of the optimized model, which fully verifies that the precise curriculum setting and whole-process closed-loop assessment mechanism can effectively consolidate nurses' professional basic knowledge and standardize clinical nursing behaviors. Traditional training adopts the post-event assessment mode, lacking phased supervision and real-time feedback. Nurses are prone to the problems of forgetting knowledge quickly and repeated errors in high-risk links, which brings hidden dangers to clinical surgical safety[10].

The "Three-Dimensions, Four-Layers, Five-Cycles" training model integrates the patient safety hierarchical training concept and SPOC intelligent teaching method, focuses on the high-risk and error-prone links in clinical work such as surgical counting, specimen management and emergency rescue to set up special courses, and realizes the precise docking between training content and clinical risk prevention and control. The 48-hour time-limited learning and assessment mechanism conforms to the fragmented learning characteristics of clinical nurses, realizes timely learning and timely absorption of knowledge, and improves learning efficiency[4]. The error sorting and targeted supplementary training mechanism after assessment forms a closed-loop management of "learning-assessment-correction-consolidation", effectively solves the problem of unconsolidated weak knowledge points, and continuously optimizes nurses' clinical risk awareness and standardized operation ability. At the same time, the training system integrates positive psychology intervention ideas, which can effectively relieve the occupational pressure and burnout of operating room nurses[1], improve their professional identity and psychological resilience, and provide dual guarantee of professional ability and psychological quality for clinical nursing safety.

4.4 Diversified Teaching and Standardized Quality Control Improve Training Satisfaction and Team Cohesion

Training satisfaction and team participation balance are important soft indicators to evaluate the

scientificity and practicability of the training model. In this study, the training satisfaction of general and subspecialty has increased to more than 99%, and the participation gap between professional areas has been significantly narrowed, which fully reflects the high recognition of nurses for the optimized training model. Traditional training is limited by the single indoctrination teaching form, with rigid classroom atmosphere and poor interaction, and the unified training content cannot adapt to the personalized learning needs of nurses at different levels, resulting in low learning initiative and poor training experience of individual nurses[11].

The optimized training model innovatively adopts diversified experiential teaching methods such as situational simulation and role-playing, transforming passive classroom listening into active practical operation and immersive learning, which greatly enhances the interest and practicality of training and deepens nurses' memory and understanding of professional knowledge and operational skills. The established whole-process courseware audit quality control system strictly controls the quality of training courses from the source, avoids the formalization and homogenization of training content, and ensures that each training course can solve practical clinical problems[12]. The incentive mechanism linking training performance with personal career development fully mobilizes the internal learning motivation of nurses, changes the passive learning state of nurses in traditional training, and realizes the transformation from "requiring me to learn" to "I want to learn". The balanced improvement of participation in various professional areas also shows that the optimized training scheme has strong adaptability, can adapt to the work rhythm of different surgical teams, and effectively promotes the balanced and high-quality development of the whole department's training work[13].

4.5 Teaching-Research Integration Promotes Long-Term Talent Echelon Construction and Disciplinary Development

High-quality clinical nursing training is not only an important means to improve individual professional ability, but also the core carrier of nursing discipline construction and talent echelon cultivation[3]. The traditional training mode only focuses on the teaching of professional operation skills and institutional knowledge, ignores the cultivation of nurses' scientific research thinking and quality innovation ability, resulting in the common problems of weak scientific research ability and insufficient innovation awareness of operating room nurses, which restricts the long-term development of nursing discipline[8]. Based on the onion model post competency theory, the optimized training system builds a hierarchical progressive talent cultivation system, which not only focuses on the improvement of nurses' superficial operational skills and middle-level professional knowledge, but also pays attention to the deep-level cultivation of scientific research thinking, quality improvement ability and teaching innovation ability. By setting up special courses such as nursing scientific research, literature retrieval and QC quality tool application, the training guides nurses to excavate clinical problems from daily training and nursing work, transform practical experience into scientific research topics and innovative achievements, and realize the effective transformation of clinical practice results[14]. The substantial growth of academic papers, patents, software copyrights and research projects in the experimental group fully proves that the

systematic training mode can effectively stimulate the innovative potential of nursing teams. At the same time, the rich teaching and research achievements can also feed back the iterative optimization of the training system, forming a virtuous cycle of "teaching promotes research, research optimizes teaching", which continuously improves the comprehensive core competitiveness of the nursing team, improves the department's talent echelon construction, and provides a solid talent foundation for the long-term high-quality development of operating room nursing discipline.

4.6 Research Innovation Advantages and Clinical Application Value

Compared with the existing domestic and foreign research on operating room nursing training, this study has obvious innovative advantages and high clinical popularization value. First, the theoretical system is innovative. This study integrates a variety of advanced nursing teaching and management theories, breaks the empirical training mode relying on single clinical experience, and builds a multi-dimensional theoretical support system for the training model, making the training framework more scientific and systematic. Second, the training system is standardized and complete. The constructed "Three-Dimensions, Four-Layers, Five-Cycles" model has clear training objectives, hierarchical content, standardized process and perfect quality control, realizing the full-chain closed-loop management of training from demand assessment to effect optimization, which makes up for the defects of scattered content and missing process in traditional training. Third, the empirical evidence is sufficient. This study relies on two consecutive years of large-sample real clinical data, multi-dimensional indicators verify the training effect, and the research conclusion is objective and reliable, avoiding the one-sidedness of subjective evaluation in most training studies. Fourth, the clinical adaptability is strong. The training model is closely combined with hospital grade review, nursing quality improvement, patient safety management and other key work, which can effectively help the daily standardized management of the department, and has high practical value and replicability for tertiary hospital operating room nursing training reform.

4.7 Research Limitations and Future Research Prospects

This study also has some limitations in the research process. First, this is a single-center clinical intervention study, all research data come from a single tertiary hospital, lacking multi-center sample verification of different levels of hospitals, and the universality of the research conclusion needs to be further improved. Second, part of the process quality control indicators such as training closed-loop implementation rate and courseware audit rate only have complete statistical data in the experimental stage, lacking baseline control data of the observation group, which cannot carry out more rigorous horizontal comparative analysis. Third, this study only carried out short-term annual effect evaluation, did not track the long-term impact of the training model on clinical nursing quality indicators such as nursing adverse event rate and surgical cooperation quality, and lacked long-term outcome verification. In addition, this study did not carry out stratified analysis according to different age, working years and professional title levels of nurses, and could not put forward targeted optimization schemes for differentiated training of different groups of nurses.

In view of the above deficiencies, future research can further expand the research scope, carry out multi-center prospective controlled studies, select operating room nursing teams from different levels of hospitals for comparative analysis, and further verify the universality and stability of the training model. On the basis of the existing research, increase the stratified grouping research of nurses at different levels, explore the differentiated training needs and ability improvement rules of new nurses, backbone nurses and teaching nurses, and build a more refined hierarchical and classified training system. At the same time, extend the research observation cycle, add long-term clinical outcome indicators such as nursing adverse event incidence, surgical cooperation qualification rate and patient perioperative satisfaction, and comprehensively evaluate the long-term clinical application value of the training model. In addition, combined with the intelligent development trend of modern nursing, introduce VR simulation teaching, AI intelligent assessment and online intelligent question bank and other information technology means, further optimize the teaching form and assessment system, and build an intelligent, precise and long-term operating room nursing training system.

5. Conclusion

The optimized “Three-Dimensions, Four-Layers, Five-Cycles” general training system for operating room nurses constructed in this study effectively solves the prominent problems of homogenized content, single form, insufficient pertinence, weak process supervision and unobvious practical effect in traditional operating room nursing training. Through the comprehensive optimization of training framework, hierarchical content system, diversified teaching methods and whole-process closed-loop assessment mechanism, the training scale and coverage of operating room nursing have been significantly expanded, and the full coverage and balanced development of team training have been realized. The standardized training and closed-loop error correction mechanism effectively consolidate nurses’ institutional norms and safety control professional knowledge, significantly improve their clinical operational competency and emergency response ability, and continuously consolidate the bottom line of clinical nursing safety. The diversified teaching forms and humanized management mechanism greatly improve nurses’ training participation enthusiasm and comprehensive training satisfaction, and enhance team cohesion and professional happiness.

At the same time, the systematic training model realizes the integrated development of clinical teaching and scientific research innovation, effectively stimulates the innovative potential of nursing teams, promotes the continuous growth of discipline teaching and research achievements, and accelerates the construction of high-level nursing talent echelons. The whole training system is scientific in design, standardized in process, strong in clinical practicability and replicable in promotion, which can effectively help the continuous improvement of operating room nursing quality and the standardized and high-quality cultivation of nursing talents. It has high clinical application value and is suitable for long-term promotion and application in large tertiary hospital operating rooms.

References

[1] Jin, Z., Zhang, Z. M., Bai, Y. S., et al. (2025). Effect of stress reduction training based on positive psychology in operating room nurses. *Henan Medical Research*, *34*(20), 3669-3674.

[2] Wang, W., Qian, Q. J., Ma, Y., et al. (2026). Investigation and analysis of subspecialty nursing construction in medical institutions nationwide. *Shanghai Nursing*, *26*(2), 69-74.

[3] Feng, Q., Liu, P. P., Li, H., et al. (2023). Path analysis of surgical decision-making participation and doctor-patient trust on preoperative anxiety in orthopedic patients. *Journal of Nursing Administration*, *23*(5), 370-375.

[4] Yu, X. N., & Zhang, J. X. (2007). Comparison of the application of the ego-resiliency scale and the Connor-Davidson resilience scale. *Journal of Psychological Science*, *30*(5), 1169-1171. https://doi.org/10.1037/t60027-000

[5] Tao, Y. L., Huang, X. H., Guan, Y. M., et al. (2011). Implementation and effect of general training for clinical nurses. *Journal of Nursing Administration*, *11*(6), 430-432.

[6] Wang, L., Zeng XX, Gao L, et al. (2009). Training model for emergency general nurses. Chinese Medicine Guide, 2009, 7(24), 154-155.

[7] Fang, F., & Liu, H. Z. (2003). Concept and implementation of general nurse training program. *Journal of Nursing Science*, *18*(4), 290-292.

[8] Liu, J. H., Yu, J., Zhu, H. B., et al. (2025). Construction of post competency index system for operating room nurses based on onion model. *Hebei Medicine*, *29*(8), 1664-1669.

[9] Ye, H. L., Tang, W. R., Wu, X. R., et al. (2025). Construction and application of a hierarchical training program for patient safety competency among operating room nurses. *Chinese Journal of Nursing Education*, *22*(10), 1210-1219.

[10] Feng, L. M., Zhou, Y., Yu, Y. Z., et al. (2025). Application of two-dimensional code recognition technology based on SPOC five-step teaching method in training and management of emergency equipment in operating room. *Lingnan Emergency Medicine Journal*, *30*(6), 789-792.

[11] Zheng, Y. Y. (2026). Application of experiential teaching model in lateral position training for new operating room nurses. *China Typical Cases*, *20*(1), 1393-1397.

[12] Qian, X. H., & An, L. N. (2016). Comparison and enlightenment of standardized training systems for pharmacists between China and the United States. *Central South Pharmacy*, *14*(10), 1134-1139.

[13] Ruan, C. F. (2020). Application of micro-class combined with flipped classroom in general knowledge and skill training for new nurses. *Chinese Journal of Clinicians* (Electronic Edition), *14*(5), 356-359.

[14] Wu, J., He, H. H., & Zhang, M. L. (2021). Interpretation of post competency model based on "onion model" in teaching for new nurses. *Health Must-Read*, *2021*(13), 246-247.