Research on Training Methods for Operating Skills of Infusion Thermostat Based on Simulation Experiments

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Keywords: Simulation Experiments; Infusion Thermostat; Operating Skills; Training

Abstract: This paper aim to explore the application effect of the operation skill training method of infusion thermostat based on simulation experiments. Four-year nursing undergraduates of grade 2022 were selected as the research object. Class A, 2022, with 50 participants as the control class, aged (20.16 ± 0.81) years old; Class B of 2022 consists of 50 experimental classes, aged (20.73 ± 0.68) years old. The control class continues to use conventional traditional training methods, while the experimental class adopts simulated experimental training methods. We need to compare the performance of two groups of operational assessments and investigate the feelings of students in the experimental class towards the simulation experiment training method. The results show that the final exam score of the control class was (91.28 ± 2.64) points, while that of the experimental class was (94.57 ± 1.41) points. Compared with the two classes, t=7.36, P<0.01, the difference was statistically significant. Of the 50 students in the experimental class, 47 (94%) think that the operation skills can be mastered quickly after using the simulated experiment training method. Forty-three students (86%) thought that the confidence in laboratory practice was enhanced after training by simulated experiments. The operation skill training method of infusion thermostat based on simulation experiment is an effective training method, which can improve students' operation skills and reduce the risk of operation errors, thus improving the quality and safety of patients' treatment.

1. Introduction

Transfusion thermostat is one of the indispensable devices in the medical field, which is used to ensure that the temperature of infusion liquid is maintained at a safe and effective level in clinical treatment. Correct operation of infusion thermostat is very important for patients' health and medical effect. However, due to the high technical requirements and the failure of equipment, it may have a serious impact on patients, so it is very important to train students' operational skills.

With the continuous progress of science and technology, the traditional training methods can no longer meet the training needs for the operation skills of infusion thermostats. Traditional training methods usually involve classroom teaching and book knowledge, lacking practical experience[1-2]. Therefore, the purpose of this study is to explore a training method for operating skills of infusion thermostats based on simulation experiments, so as to improve students' skills in correctly operating infusion thermostats in clinical practice. Through simulation experiments, students can practice in a safe environment and simulate real clinical situations, thus improving their skill level and self-confidence [3]. This study will explore the effectiveness of this training method, including its impact on the improvement of skills and patient safety. Finally, we hope to improve students' operation skills, improve patients' safety and promote higher quality medical care by exploring the training method of operation skills of infusion thermostats based on simulation experiments.

2. Object and method

2.1. Research objects

Select 2022 four-year undergraduate nursing students as the research subjects. Class A, 2022, with 50 participants as the control class, aged (20.16 ± 0.81) years old; Class B of 2022 consists of 50 experimental classes, aged (20.73 ± 0.68) years old. Both groups of students were enrolled in the college entrance examination, and there were no statistically significant differences in age, gender, and admission scores (P>0.05), indicating comparability.

2.2. Research method

The control class follows the conventional traditional training method, namely the teaching-teaching-imitation teaching method[4-5]. First, the teachers teach the theory of intravenous infusion, then demonstrate and explain the operation of intravenous infusion, and finally the students practice by themselves.

The experimental class adopts simulated experimental training mode. The specific arrangements are as follows:

Step 1: Preparation before training

Collect necessary training materials, including simulated infusion thermostats, syringes, drug models and related documents. Ensure that the training room has proper temperature and lighting conditions. Prepare a list of training materials and ensure that they are intact.

Step 2: Introduce the infusion thermostat

The lecturer introduced the use and importance of infusion thermostat. Explain the main components and functions of infusion thermostat.

Emphasize the importance of correct operation to ensure the safety of patients and the effectiveness of treatment.

Step 3: Demonstrate the correct operation steps

Instructor demonstrates the correct operation steps of infusion thermostat, including connection, temperature setting, safety inspection, etc.

Explain the reasons and precautions for each step. Encourage students to ask questions and make sure they fully understand each step.

Step 4: Students participate in the simulation experiment

Divide the students into groups, and each group provides a simulated infusion thermostat and corresponding materials. Students take turns to operate the infusion thermostat and follow the steps demonstrated by the instructor. Instructors provide guidance and feedback when students operate to ensure that they master the correct skills.

Step 5: Emergency drill

The lecturer introduced the common failures and emergencies of infusion thermostat, such as leakage and high temperature alarm. Students simulate these emergency situations to ensure that they can cope with emergencies.

Step 6: Evaluate and Feedback

After each group of students completed the simulation experiment, the lecturer made a comprehensive evaluation to check their operation skills. Provide positive feedback and suggestions to help students improve their operational skills.

Step 7: Summarize and review

The lecturer summarized the training content and emphasized the importance and safety of operation skills. Encourage students to ask any questions or questions that need further help.

Step 8: Examination and Certification

If necessary, take an operation skill test to assess students' mastery. Issue corresponding certificates or qualifications in recognition of students who have passed the training.

Step 9: End of training

End the training, thank the students for their participation and encourage them to apply the skills they have learned in the actual clinical environment.

Step 10: Records and documents

Record the details of the training, including the list of participating students, the training date and the evaluation results. Archive relevant training materials and student certification documents.

This operation process can be adjusted and customized according to the specific training needs to ensure that the training can meet the requirements and standards of different medical institutions.

2.3. Training effect evaluation

Applying the operation process and scoring standard of intravenous infusion, every time a sampling point is completed, the corresponding score is added, and the accumulated total score is the assessment score[6].

In addition, a self-designed questionnaire was used to investigate 100 students who used the simulated experiment training method. The questionnaire includes the functions of the system in mastering operation skills, mastering relevant theories, confidence in laboratory practice, holistic nursing concept, strengthening nursing procedures and autonomous learning ability. Use "good, average and bad" to evaluate each project. A total of 100 questionnaires were distributed, 100 were recovered and 100 were valid, with an effective recovery rate of 100%.

2.4. Statistical method

The data were statistically analyzed by SPSS26.0, and the difference was statistically significant ($P < 0.05$).

3. Result

3.1. Analysis of two groups' operation examination results

The final exam score of the control class was (91.28 ± 2.64) points, while the experimental class was (94.57 ± 1.41) points. Compared with the two classes, t=7.36, P<0.01, the difference was statistically significant. See Table 1.

Table 1 Comparison of performance of two groups (%)

group	n	96 ~ 100	91 ~ 95	85 ~ 90
Control class	50	4(8)	31(62)	15(30)
experimental class	50	12(24)	35(70)	3(6)

3.2. Students' feelings of using simulated experimental training mode of intravenous infusion

Of the 50 students in the experimental class, 47 (94%) think that the operation skills can be mastered quickly after using the simulated experiment training method. 39 students (78%) think that the training mode of simulation experiment can promote the mastery of relevant theories; 41 students (82%) thought that the simulated experimental training mode reflected the concept of holistic nursing; 38 (76%) thought that simulated experimental training could strengthen the application of nursing procedures; Forty-three students (86%) thought that the confidence in laboratory practice was enhanced after training by simulated experiments. 37 students (74%) think that the use of this system can improve their autonomous learning ability.

4. Discussion

Transfusion thermostat is one of the commonly used devices in the medical field, which is used to control the temperature of infusion liquid and ensure the safety and effectiveness of infusion drugs. In order to improve the training quality of students' operation skills of infusion thermostat, the application of simulation experiment method in training is of great significance[7-8].

The wrong operation of infusion thermostat may lead to abnormal temperature of drugs, which poses a risk to the health of patients. Through simulation experiments, trainers can simulate operations in real situations, understand and correct potential errors, thus improving the safety of operations[9]. Traditional theoretical courses can't provide enough practical experience for students. The simulation experiment method allows students to operate in the simulation environment,

accumulate practical experience, improve their ability to deal with actual scenes and reduce potential mistakes. Simulation experiment method can provide standardized operation process and evaluation standard for training, and ensure that every trainee receives similar training quality. This helps to ensure that the operation skills of infusion thermostats are consistent among different medical institutions and reduce the risk of medical accidents.

Training requires a lot of time and resources. By using the simulation experiment method, the actual cost of training can be reduced, because there is no need to consume a lot of drugs and equipment, and at the same time, the efficiency can be improved in repeated exercises[10]. The learning speed and needs of different students may be different. The simulation experiment method allows trainers to carry out personalized training according to each student's level and needs, so as to ensure that they master the required skills in an appropriate time. Through continuous simulation experiments, students can gradually enhance their self-confidence, reduce the possibility of anxiety and insecurity in practical work, and improve their ability to deal with complex medical situations. The application of simulation experiment method in the operation skill training of infusion thermostat is of great significance. It not only improves the quality and efficiency of training, but also reduces the medical risks of patients and provides students with better skills and experience, thus improving the overall quality of medical services.

This study showed that the final exam score of the control class was (91.28 ± 2.64) points, while the experimental class was (94.57 ± 1.41) points. Compared with the two classes, $t=7.36$, $P<0.01$, the difference was statistically significant. Among the 50 students in the experimental class, 47 (94%) believe that the speed of mastering operational skills through the use of simulated experimental training methods is fast; 39 (78%) believe that simulation experiment training can promote the mastery of relevant theories; 41 students (82%) thought that the simulated experimental training mode reflected the concept of holistic nursing; 38 (76%) thought that simulated experimental training could strengthen the application of nursing procedures; Forty-three students (86%) thought that the confidence in laboratory practice was enhanced after training by simulated experiments. 37 students (74%) think that the use of this system can improve their autonomous learning ability. The research shows that the operation skill training method of infusion thermostat based on simulation experiment has obvious advantages in improving operation skills and reducing operation errors. Through the actual simulation operation, participants can better understand the working principle of the equipment, better deal with unexpected situations, and improve their self-confidence in operation. This is very important to improve students' patient safety and treatment quality.

Although this study has achieved positive results, there are still some limitations. First, the sample size is relatively small, so larger-scale research is needed to verify these findings. Secondly, this study only pays attention to the short-term effect of skill training, and the long-term effect and the ability to continuously maintain skills need further study. Finally, the participants in this study are limited to students, and may not fully represent the operators in other professional fields.

5. Conclusions

The operation skill training method of infusion thermostat based on simulation experiment is an effective training method, which can improve students' operation skills and reduce the risk of operation errors, thus improving the quality and safety of patients' treatment. The application of this method can be popularized in the medical field to improve students' operational skills and knowledge. Future research can further explore the long-term effect and the expansion of application scope of this training method.

References

[1] Li Weihua, Shi Ying, He Yanxian, & Chen Jinying. (2015). Application of PBL combined with pltl in the training of intravenous infusion therapy teachers. PLA Nursing Journal, 32(12), 3.

[2] Wei Shaojun, & Li Qiuju. (2020). Application of PBL combined with scenario simulation teaching method in first aid skills training of psychiatric nurses. chinese medicine guides, 17(17), 5.

[3] Qiu Yun, & Huang Huaping. (2015). Application of scenario simulation exercise teaching method in standardized training of nurses' nursing operation skills teaching. Global Chinese Medicine (2), 2.

[4] Meng, C. D. (2019). Application of direct observation of operation skills in the operation training of nurses in continuous renal replacement therapy. Chinese Journal of Modern Nursing, 025(005), 643-646.

[5] Sun Yuling, & Lu Yong. (2012). Application of Microsim medical simulation system in emergency nursing skills training. Journal of nursing science, 09(017), 37-38.

[6] Cao Ying. (2014). Application of infusion thermostat in perioperative fluid therapy of accelerated rehabilitation surgery. Shanghai Nursing, 14(7).

[7] Liu Bing, & Qi Dianjun. (2019). Application of direct observation and evaluation of operational skills in standardized training of surgical residents. Chinese Journal of Medical Education (007), 039.

[8] Lu Xiuer, Shao Yueping, & Zhang Liqin. (2014). Application of modern medical simulation teaching method in skills training of community nurses. Chinese Journal of Modern Nursing (2), 3.

[9] Tan Hui, Hu Liyuan, Li Zhihua, Wu Jingyan, & Zhou Wenhao. (2022). Application of BOPPS combined with virtual simulation technology in neonatal asphyxia resuscitation simulation training. Chinese Journal of Medical Education, 42(2), 4.

[10] Niu Ziran, Wang Zixi, & Zhang Bo. (2023). Pay attention to the correct application of adrenaline in severe allergic reactions. Adverse drug reactions journal, 25(9), 517-520.