

Application of Virtual Combined Simulation Model in Experimental Teaching of Intravenous Infusion in Pediatric Nursing in Higher Vocational Education

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Abstract: Objective: To explore the effect of virtual teaching combined with simulation models in the teaching of intravenous infusion skills in pediatric nursing in vocational colleges. Method: A total of 296 nursing college students from the 2021 cohort were enrolled in the teaching of intravenous infusion skills for children using virtual and simulation models called Simbaby. A questionnaire survey and operational assessment were conducted before and after the teaching. Result: Students were highly satisfied with the teaching of virtual combined simulation models, with an average score of 92.5 in the assessment of intravenous infusion operations. In the interview with the head nurse of clinical pediatrics, the evaluation of nursing students was good. Conclusion: The combination of virtual teaching and simulation models has a good effect on the teaching of intravenous infusion skills in pediatric nursing in vocational colleges and can be promoted.

Keywords: Virtual Teaching; Simulation Models; Intravenous Infusion; Pediatric Nursing.

1. Introduction

Intravenous infusion is a commonly used and effective treatment method in pediatric diseases, but most children have small blood vessels and poor compatibility and compliance with intravenous infusion, which can easily lead to complications such as drug extravasation and phlebitis. This not only increases the pain of affected children, but also increases doctor-patient conflicts and disputes [1-2].

So, how to solve a series of problems such as difficulty in puncture, fixation, and multiple complications of neonatal intravenous infusion, improve the level of venous puncture and the ability to analyze and solve clinical problems of nursing students, while exercising clinical thinking and practical abilities, promoting a better organic combination of theory and practice, effectively solving the problem of pediatric intravenous infusion, shortening the distance between nursing students and clinical pediatric nurses, and using appropriate methods in the training teaching of intravenous infusion nursing in Pediatric Nursing is particularly important.

Virtual teaching is a teaching method that utilizes information technology to generate a digital environment that is highly similar to the real environment, allowing students to experience and feel real scenes firsthand [3-4].

The simulation model Simbaby is a standard patient that uses scientific technology to mimic the characteristics of real pediatric patients in clinical practice. It can well reflect some emergency reactions of pediatric patients when receiving clinical care and treatment, and will exhibit symptoms and signs similar to real patients during operation.

Sometimes, nursing teaching is constrained by real-life conditions, and nursing students cannot simulate and experience all the knowledge of pediatric intravenous infusion in a clinical real environment. The combination of virtual teaching and Simbaby brings clinical reality stimulation to nursing students.

2. Research Object and Methods

2.1. Research Object

Select a total of 296 students from 5 nursing classes in the 2021 nursing major of our college.

2.2. Research Methods

The teaching method adopts an integrated teaching approach of theoretical knowledge, virtual operations, and Simbaby simulation model training, namely "theory, virtuality, and reality" integrated teaching. Firstly, the teacher combines case studies to teach theoretical knowledge in an integrated multifunctional classroom. Then, the students are allowed to conduct virtual challenges on a virtual platform. After successfully completing the challenges, they are given intravenous infusion on the Simbaby model. Finally, the teacher evaluates the learning effectiveness of the students before, during, and after class.

2.2.1. Design Pediatric Teaching Intravenous Infusion

Cases

Design teaching cases based on real clinical pediatric cases, such as the following cases

Li Xiao, female, 6 years old

Physical examination: body temperature 38.9 °C, pulse 130 times/min, breathing 28 times/min, auscultation of both lungs with coarse breathing sounds, and scattered wet rales can be heard.

Auxiliary examination: Blood routine, white blood cell count of 10 109/L, neutrophil percentage of 80.4%; The chest X-ray results showed increased, thickened, and disordered lung markings in both lungs. A patchy density increase shadow is seen in the lower right lung lobe, with blurred boundaries.

Diagnosis: Bronchopneumonia

Medical advice: 200ml 5% glucose injection+0.2g azithromycin for injection intravenous drip, bid

Task: Follow the doctor's advice to perform intravenous

infusion for the patient.

Perform intravenous infusion according to nursing procedures, evaluate, diagnose, plan, implement, and evaluate

2.2.2. Students are Familiar with Virtual Operation Methods

The virtual scene of pediatric intravenous infusion is set based on the hospital's clinical real environment and real objects. The virtual challenge is set according to the clinical intravenous infusion operation process. Only after completing the previous stage can the next stage be entered. For example, before infusion, it is necessary to evaluate the environment, the patient, and prepare appropriate materials. The evaluation stage needs to be completed correctly before entering the next stage.

2.2.3. Students are Familiar with Simboby Simulation Models

Students are familiar with the characteristics of Simboby's puncture blood vessels, scalp veins, and limb veins, and master how to deal with the relevant characteristics of pediatric patients during puncture, such as how to soothe crying and how to handle hand and foot movements.

2.2.4. Teaching Evaluation

Evaluate students from three aspects: knowledge, skills,

and emotional attitudes. The evaluation methods are formative evaluation and summative evaluation. The evaluation subjects include students, teachers, and head nurses, and a combination of quantitative evaluation and qualitative evaluation is adopted. The specific operation is to release questionnaires before class, during class and after class to evaluate students' knowledge, skills and emotional attitudes. After class, students will be assessed on children's intravenous transfusion puncture skills and satisfaction survey. After entering clinical practice, students will interview their pediatric head nurses.

3. Survey Results and Analysis

3.1. Q&A Results on Knowledge Related to Intravenous Infusion in Children

A survey on children's intravenous infusion related knowledge was conducted on the research subjects before, during, and after class. The average score of the 12 items significantly improved after class, especially in "How to appease crying" and "Clinical manifestations of drug extravasation in children". The results are shown in Table 1.

Table 1. Scores of children's intravenous infusion related knowledge Q&A

entries	before class	During class	After class
1,Assessment content before operation	70	80	99
2,Criteria for vascular selection	72	83	95
3,The correct method for finding blood vessels	68	85	98
4, How to appease crying	60	80	97
5,Skin disinfection range	80	89	96
6,Principles for selecting puncture tools	67	83	97
7,The operation process of pediatric infusion	70	83	94
8,The reasons for poor infusion in children	75	88	96
9, Symptoms of drug extravasation in children	60	86	92
10,Children's infusion rate	66	87	94
11, The main risks of intravenous infusion in children	68	88	96
12,How to improve the success rate of pediatric venous puncture	65	88	95

3.2. Survey Results on the Preference of Nursing Students for Virtual Teaching Combined with Simulation Models in Practical Training Teaching Mode

95% of nursing students like it, 4 nursing students don't like it, only 1.4% of the total. They think that learning virtual software is time-consuming, and virtual operations, such as playing games, are worried about addiction and harmful to vision.

3.3. Children's Intravenous Infusion Skill Test Results

After the course, 296 nursing students were tested for pediatric intravenous infusion skills, with an average score of 92.5 points. Among them, 256 scored above 90 points.

3.4. Interview Results of Pediatric Head Nurses During Student Internships

Clinical pediatric head nurses generally believe that virtual teaching combined with simulation model infusion training for nursing students before entering clinical internships can not only train their clinical thinking ability, but also improve their venous puncture skills. Especially, the application of

simulation models makes it easy for nursing students to immerse themselves in real clinical scenarios. For example, when hearing the crying of a child during the operation, they will involuntarily provide humanistic care. "In clinical practice, it has also been found that these nursing students know how to comfort child patients," "nursing students will chat with child patients," "nursing students can communicate with the parents of the child," and the head nurses respond.

4. Conclusion

4.1. Innovative Models, Increased Interest, and Enhanced Professional Competence

The nursing students of the new era have grown up in the rapid development of information and computer technology. They enjoy and are good at using network technology, are more receptive to new technologies and methods, and are prone to fatigue and boredom towards traditional teaching methods [5].

In this study, nursing students highly recognized the combination of virtual operations and simulation doll simulation training. They generally believed that it was "exciting", "interesting", and "fun", and also had more opportunities for self-directed learning. They could master and flexibly apply knowledge through repeated "trial and

error". The use of simulation dolls in training made nursing students "unable to put it down" and added a professional quality of "loving children like mothers".

Related research [6-7] has also proven that virtual simulation systems can help students understand theoretical knowledge of the course, improve skills, satisfaction, and self-confidence.

Innovative teaching models can utilize virtual reality combined with simulation models to enhance the clinical reality perception of nursing students. The application of artificial intelligence technology also breaks the limitations of traditional teaching in terms of time, space, and number of people.

4.2. Optimize Design, Explore Improvements

The scope of use of this teaching mode is relatively small, and it is currently only used in one college and one course, making it impossible to compare the learning effects of students from different schools and courses. Therefore, we should strengthen the improvement, application, and optimization of course design for this teaching model, in order to look forward to further promotion and application.

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