

The Effect of Simulation Teaching on Baccalaureate Nursing Students' Self-confidence Related to Peripheral Venous Catheterization in Children: A Randomized Trial

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ABSTRACT

Introduction:In recent decades, nursing instructors have tended to use simulation rather than traditional methods due to benefits such as increased self-confidence. However, little academic literature is available to verify this claim. The procedure of establishing peripheral venous catheterization in pediatric patients is of great importance. Therefore, the researchers attempted to review the effect of the simulation teaching method on nursing students' self-confidence related to peripheral venous catheterization in pediatric patients. **Methods:**In this trial, 45 students in the 5th and 6th semester of nursing school in the first half of school year 2012 from the Faculty of Nursing and Midwifery, Tabriz University of Medical Sciences, Iran, were randomly assigned to three groups (a control group, and two intervention groups). They were trained in establishing peripheral venous catheterization in pediatric patients through simulation teaching method and practical training. The students' self-confidence was assessed by C-Scale before and after the intervention. **Results:**The students' self-confidence score showed a significant increase in the simulation group after the intervention in comparison to other groups ($p = 0.03$). **Conclusion:**Results revealed a significant increase in self-confidence of nursing students related to peripheral venous catheterization in pediatric patients by simulation. This substantiates the assertion that simulation can improve self-confidence. Due to the low sample size, further studies with larger population are suggested.

Introduction

Most newly graduated nurses do not have the required skills to perform psychomotor procedures.¹ Difficulty in finding a safe clinical environment, where it is possible to provide good clinical experiences for students during the limited time of nursing education, can be one of the causes.² In fact, this is more prevalent in pediatric units; since, due to the crowdedness of hospitals

most children are being treated on an outpatient basis. Furthermore, most children who are being hospitalized suffer from acute illnesses.³ Moreover, for the child's safety, parents and staff prohibit some activities from being done by students.⁴ Therefore, nursing instructors who have the responsibility to provide rich clinical experiences for students and a safe care for children and their families, seek additional

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non-traditional methods to enhance the clinical experiences of students.^{2,5}

In order to increase learning opportunities

for students, in recent decades faculty members tend to use simulation, such as the use of mannequin and standard patients.⁵ To be precise, simulation was used for the first time in the military and aviation industries. The use of simulation in nursing education began in the UK.⁶ In fact, simulation refers to those activities that reflect the reality of a clinical environment. In other words, it includes activities such as role-playing, and using interactive videotapes and mannequins that help students in learning. Moreover, it gives them the opportunity to show their ability in decision-making, critical thinking, and other skills.⁷ creating an environment in which learners can gain cognitive, psychometric, and affective areas of knowledge without fear of harm to the patient are benefits of the simulated environment.⁸ However, this method is time-consuming, expensive, and requires personnel to launch simulators.^{9,10}

In a research, Parker *et al.* (2011) showed that using the simulation technique leads to satisfaction and self-confidence.¹¹ Students' self-confidence has a significant impact on their understanding and feeling of success in their clinical practices.¹² Feeling of efficacy, self-esteem, and self-confidence influence students' ability to accept their role as a nurse.¹³ In the research of Thomas and Mackey (2011) a significant increase was observed in the level of students' confidence, who were trained clinical skills using simulation, compared to the traditional training group in areas such as diagnosis and symptoms of disease, patient assessment, nursing interventions, and evaluation.¹⁴ Soucy (2011) indicated no significant difference in the confidence scores of students who received simulation training in pediatric care.¹⁵

Given the growing use of simulation in nursing education, and since it is costly and time consuming, further research is required

to determine the benefits of this method.¹⁶ There should be further research on students' self-confidence in order to prove that stimulation leads to increased confidence; a characteristic that plays a significant role in students' clinical success.

One of the most common and important nursing skills which is performed by nurses, and one of the most challenging skills taught in schools of nursing is peripheral venous catheterization for fluids and intravenous medication; it can have serious side effects on patient in case of any mistakes.^{17,18} Implementing this skill in a safe way with minimal damage and stress to the child and his or her family is one of the main daily tasks of a nurse. Nursing students always try to gain confidence in performing intravenous catheter insertion.¹⁹ In fact, success in this skill requires not only knowledge of the techniques and skills in performing its steps, but also requires confidence that can be achieved through practice.²⁰

Considering students' self-confidence in pediatric clinical training is of great importance, because students are often anxious in the beginning of these courses.²¹ This is due to their patients being smaller and more delicate than adults. Moreover, parents are usually present at the time of care, and this can be stressful and threatening for nursing students.²² However, in the undergraduate nursing education curriculum in Iran, nursing clinical skills related to pediatric patients is taught through using pictures and slide lectures. In other words, students do not practice these skills in a laboratory environment before entering the real clinical situation.

There is little empirical literature on the effect of simulation on the self-confidence of students in performing psychomotor skills. Moreover, establishing peripheral venous catheterization in pediatric patients is of great importance. Therefore, the researcher decided to assess the effect of simulation method on self-confidence of nursing students related to peripheral venous

catheterization in pediatric patients through an experimental study. These researchers aim was also to help the growing body of knowledge in this area and to suggest additional clinical skill training in pediatric nursing for bachelor students.

Materials and methods

The present research is a controlled, three-group trial. All participants were nursing students from the Faculty of Nursing and Midwifery, Tabriz University of Medical Sciences, Iran. Students were in the 5th and 6th semester of the first half of 2012 (45 subjects).

Instruments used in this research included an infant mannequin named Crisis which had the possibility of establishing a peripheral venous catheterization in basilica vein, cephalic vein, dorsal hand vein of the upper limb bows, saphenous vein, and lower extremity venous arch on the foot. In addition, the confidence scale to measure self-confidence during performing psychomotor skills was (C-Scale) a self-report tool which the authors have obtained permission to use. This scale was developed by Ms. Susan Erin Grundy in 1993. Moreover, its reliability was specified through Cronbach's alpha scores which were between 0.84 to 0.93.²³

The C-Scale contains five statements on a five-point scale (1: procedure without confidence, 5: procedure with full confidence) in which students must determine the case that better represents their ability in peripheral venous catheterization in pediatric patients. The minimum score is 5 and maximum is 25. In the present research, the validity of this instrument was assessed by ten experts (nursing faculty members, especially pediatrics and psychologists). Its reliability was examined through test-retest in collaboration with the bachelor nursing students in the 8th semester ($R = 0.8$).

Before obtaining informed consent, the aim of the study and its benefits and advantages were explained orally and in written form to all subjects. Then, students

who wished to participate were asked to complete the consent and demographic form.

The inclusion criteria included willingness to participate in the study, and to be in the 5th and 6th semester of undergraduate nursing. The exclusion criteria included having an experience of peripheral venous catheterization in pediatric patients and having clinical experience, being a guest or transfer (temporary) student from a second or third class university, and refusing to participate in training sessions or pre-test and post-test. Finally, 22 students in their 6th semester and 25 students in their 5th semester participated in our study.

Instruments and steps related to peripheral venous catheterization for pediatric patients were explained by the researcher through lecture and use of pictures and slides (common method in the curriculum related to theory-based courses of pediatric patients) in about 15 minutes for all subjects. After pre-test, students were asked to perform the procedure on an infant mannequin in the clinical laboratory in a run time of up to 15 minutes under supervision of an examiner. Then, they determined their self-confidence during the procedure on the target scale of assessing self-confidence about psychomotor skills.

In the next step, participants from each semester were randomly assigned to three groups (one control and two intervention groups). 22 students in the 6th semester were randomly divided into three groups (a group of 8 people, and 2 groups of 7 people). After that, they were randomly assigned to the control group ($n=7$), simulations group ($n = 8$), and demonstration group ($n = 7$). One student of the demonstration group was excluded because of her father's death and not participating in the post-test, and one of the students in their 5th semester was excluded due to clinical experience and experiences related to peripheral venous catheterization in pediatric patients. The remaining 24 were randomly divided into three groups ($n = 8$). Therefore, the total

number of participants in the simulation group was 16, demonstration group 14, and control group was 15. In the simulation group, at least 4 students (power = 0.9) were required to determine the effect of teaching method on students' self-confidence related to peripheral venous catheterization in children.

In the simulation method of teaching students practiced the peripheral venous catheterization procedure in a clinical laboratory (practice room) on infant mannequins under supervision of the researcher. In this method, they entered the laboratory two by two. Before starting; the objectives, equipment, and environment were introduced. Then, they were given a written scenario about taking care of a child who has severe dehydration and needs compensation of fluids and electrolytes by establishing a peripheral venous line and a detailed description of the environment, requirements, expectations of students, and their role. One of the students played the role of a nurse who had to establish peripheral venous catheterization on an infant mannequin within 25 minutes. In addition, he or she had to build an appropriate relationship with the parents. Another student had the role of an observer. The researcher played the role of facilitator and also the role of parents while handling the whole scenario. The researcher and student, who played the role of the observer, recorded the necessary points related to implementation and communication with parents during the procedure. Then students switched roles with each other. At the end, there was a 20-minute question and answer course with researcher as a facilitator. During this part, students provided feedbacks about their personal feelings of simulation and their skill while establishing peripheral venous catheterization. Furthermore, in case of need the researcher provided the necessary feedback to student and responded to their questions and concerns. Teaching and learning by this method takes 45 minutes in total.

In the demonstration group, the researcher first discussed the aim and requirements of the procedure with the students and then displayed the procedure on a mannequin for 20 minutes. Then, each student practiced the procedure for 25 minutes on the mannequin. The total time of this method was 45 minutes.

In the control group, subjects were trained through the lecture method by using slides and images, which is a common method in theory-based courses on peripheral venous catheterization in pediatric patients. Therefore, they did not receive any additional training.

Two weeks after training, all participants in the research, took post-test individually. All students were asked to implement the target procedure on infant mannequins in the clinical laboratory within 15 minutes (at maximum) under the supervision of the examiner. Then, they had to determine their self-confidence during performing the procedure using the mentioned scale. Instructors checked all factors to achieve equal performance.

In addition, to prevent information pollution, which may be caused by competition between students, it was explained to all of them that the research did not aim to evaluate them; but to evaluate teaching methods. Therefore, they were asked not to talk about it to each other. Moreover, they did not have access to a training mannequin during the research, except during teaching sessions, pre-test, and post-test.

Data were analyzed using SPSS for Windows (version 13; SPSS Inc., Chicago, IL., USA) with 95% confidence level and significance level of 0.05.

Results

The results showed that the three groups were congruent in demographic, social, and learning characteristics based on the Kruskal-Wallis test (Table 1). None of the participants had experience related to peripheral venous catheterization on a mannequin or a real patient.

Table 1. Socio-demographic and learning profile of nursing students in the control, Demonstration, and simulation groups

Variable	Control group N (%)	Demonstration group N (%)	Simulation group N (%)	Results of the Kruskal-Wallis test
Age [†]	21.41 (0.66)	22.33 (1.32)	21.75 (0.75)	X ² = 3.56 df = 2 p = 0.16
Gender	10 (66.7)	9 (64.3)	10 (62.5)	X ² = 0.05 df = 2 p = 0.97
Female	5 (33.7)	5 (35.7)	6 (37.5)	
Male				
Observe establishing peripheral venous catheterization on adult patients				X ² = 0.00 df = 2 p = 1.00
Yes	15 (100)	14 (100)	16 (100)	
No	0	0	0	
Perform and establish the peripheral venous catheterization on an adult training mannequin				X ² = 1.77 df = 2 p = 0.41
Yes	9 (60)	11 (78.6)	9 (56.3)	
No	6 (40)	3 (21.4)	7 (43.8)	
Establish peripheral venous catheterization on an adult patient under supervision of an instructor				X ² = 4.09 df = 2 p = 0.12
Yes	13 (86.7)	14 (100)	16 (100)	
No	2 (13.3)	0	0	
Establishing peripheral venous catheterization on an adult patient independently				X ² = 1.12 df = 2 p = 0.57
Yes	7 (46.7)	9 (64.3)	10 (62.5)	
No	8 (53.3)	5 (35.7)	6 (37.5)	
Peripheral venous catheterization skills on an adult patient				X ² = 1.79 df = 2 p = 0.40
Poor	3 (20)	3 (21.4)	3 (18.7)	
Fair to good	6 (40)	3 (21.4)	10 (62.5)	
Good	5 (33.3)	7 (50)	2 (12.5)	
Excellent	1 (6.7)	1 (7.1)	1 (6.3)	
Grade Point Average [†]	16.52 (1.05)	15.77 (1.21)	16.50 (0.90)	X ² = 2.97 df = 2 p = 0.22

[†]The data are given as mean (SD)

In order to determine the effect of teaching methods on self-confidence of nursing students related to peripheral venous catheterization in each group, the mean score of pre-test and post-test were compared. In the simulation group with $p = 0.009$ the increase in self-confidence in the post-test was statistically significant based on the Wilcoxon test (Table 2). Simulation teaching method increased self-confidence. In addition, comparison of the dependent variables (self-confidence) between the three groups by Kruskal-Wallis test (with $p = 0.03$) showed significant statistical differences

(Table 3). Simulation teaching method had the highest average rank among others.

Discussion

The results demonstrated that the simulation method in peripheral venous catheterization in pediatric patients leads to a significant increase in self-confidence of students compared to the method of demonstration and lecture using slides and images (current method of teaching this skill on pediatric patients in nursing undergraduate curriculum in Iran).

The descriptive study by Kaddoura on ten newly graduated nursing students showed that students who were trained through simulation method, had more confidence in the care of patients.²⁴ The semi-experimental research using pre-test and post-test designed by Thomas and Mackey (2012) on 24 nursing students, also showed significant increase in confidence scores in aspects of diagnosis and symptoms, patient assessment, nursing, and evaluating in comparison with the traditional

method group.¹⁴ Based on the intervention study by Tiffen et al. on 32 nursing students of advanced performance level, self-confidence of students who were trained cardiovascular assessment through simulation increased significantly compared to the group who were trained by lecture and using models.²⁵ Moreover, in a research conducted by Brown and Chronister, a significant increase was observed in the

Table 2. Comparison of nursing students' self-confidence related to peripheral venous catheterization in pediatric patients before and after intervention in each group

Group	Number	Mean (SD)	Before CI 95%	Mean Rank	Mean (SD)	After CI 95%	Mean Rank	Results of the Wilcoxon test
Control	15	3.01 (1.07)	2.41, 3.60	26.17	3.18 (0.84)	2.71, 3.65	22.17	Z = -0.56 p = 0.57
Demonstration	14	2.60 (0.77)	2.15, 3.04	22.57	3.18 (0.62)	2.82, 3.54	20.43	Z = 1.926 p = 0.054
Simulation	16	0.51 (0.81)	2.07, 2.93	20.47	3.43 (0.64)	3.09, 3.78	26.03	Z = -2.621 p = 0.009

Table 3. Comparison of nursing students' self-confidence between the three groups of control, Demonstration, and simulation related to peripheral venous catheterization in pediatric patients

Variable	Group	Number	Mean (SD)	CI 95%	Mean rank	Results of the Kruskal-Wallis test
Baseline self-confidence	Control	15	3.01 (1.07)	2.41, 3.60	26.17	X ² =1.522 df = 2 p = 0.46
	Demonstration	14	2.60 (0.77)	2.15, 3.04	22.57	
	Simulation	16	2.51 (0.81)	2.07, 2.97	20.47	
Self-confidence after intervention	Control	15	3.18 (0.84)	2.71, 3.65	22.17	X ² =1.470 df = 2 p = 0.47
	Demonstration	14	3.18 (0.62)	2.82, 3.54	20.43	
	Simulation	16	3.43 (0.64)	3.09, 3.787	26.03	
Changes in self-confidence before and after intervention	Control	15	0.17 (0.67)	-0.20, 0.54	16.57	X ² =7.029 df = 2 p = 0.03
	Demonstration	14	0.58 (0.94)	-0.03, 1.13	23.00	
	Simulation	16	0.92 (0.90)	0.44, 1.40	29.03	

self-confidence of nursing students who were trained electrocardiogram course through simulation in addition to lecture compared to those who only received training through lectures.²⁶

The results of the above mentioned studies confirm the findings of the present research, and indicate the effect of simulation method on increased self-confidence of nursing students in carrying out procedures. However, these studies did have some limitations. For example, Tiffen et al. did not assess demographic characteristics before the

intervention, the congruity of nursing students about their experiences of cardiopulmonary assessment was not determined, they did not include a pre-test, and their instruments were made by the researcher. In the research by Brown and Chronister, the applied data collection instruments were also self made. Another point is that the validity of the instruments had not been determined which reduced validation and generalizability of the results.

However, in the research by Brannan et al., no significant difference was seen

between self-confidence of the students who were trained acute myocardial infection through simulation compared to those who were trained by lecture.²⁷

In addition, the results of the study by Soucy on 49 nursing students did not show a significant difference in the self-confidence of students who were trained caring for pediatric patients through simulation, compare to those trained through the traditional method.¹⁵

The cause of the inconsistency of these results with the present study could be the type of study, applied instruments, and training method.

As mentioned earlier, nursing students are usually anxious at the beginning of pediatric internship, because children are smaller and more fragile than adults.²¹ In addition, parents are usually present at the bedside. Simulation in pediatric clinical nursing education allows students to actively learn and develop confidence in pediatric nursing care without the fear of putting the patient at risk and being scrutinized by the parents. Better judgment can be made about the demonstration method with a greater sample size.²²

Conclusion

The results of the present study showed that simulation results in increased self-confidence of nursing students related to peripheral venous catheterization. To determine the effect of the demonstration method on increasing self-confidence of nursing students 50 subjects (power = 0.9) were needed. Due to the limited sample size of our study, further research is suggested in this regard, and on the effect of simulation on nursing students' skills related to peripheral venous catheterization in pediatric patients and on the effect of increased self-confidence on students' skill.

The results of our study could be used in planning pediatric training courses for students of medical sciences, especially

nursing students who are in close contact with patients, and for health care professionals who have an important responsibility in providing high quality services.

Ethical issues

None to be declared.

Conflict of interest

The authors declare no conflict of interest in this study.

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