

Original Article

## Do Parenteral Medication Administration Skills of Nursing Students Increase with Educational Videos Materials?

**Arzu Bahar, RN, PhD**

Asistant Proffesor, Turgut Ozal University, School of Nursing, Yenimahalle, Ankara, Turkey

**Muzeyyen Arslan, RN, PhD**

Asistant Proffesor, Girne American University School of Nursing, Kyrenia, Cyprus

**Nurcan Gokgoz, MsN**

Research Assistant, Turgut Ozal University, School of Nursing, Yenimahalle, Ankara, Turkey

**Hacer Ak, RN**

Research Assistant, Turgut Ozal University, School of Nursing, Yenimahalle, Ankara, Turkey

**Haydar Kaya,**

Research Assistant, Turgut Ozal University, School of Nursing, Yenimahalle, Ankara, Turkey

**Correspondence: Arzu Bahar, RN, PhD, Asistant Proffesor, Turgut Ozal University, School of Nursing, Yenimahalle, Ankara, Turkey**  
E-mail: arzbahar@gmail.com

### Abstract

**Background:** In order to increase the quality of patient care and to ensure patient safety, nursing students should be given the best possible clinical skills education. Therefore, nursing educators should be strengthening their skills training through the use of education technologies.

**Objective:** This randomized controlled trial study was conducted to examine the effects of the use of supported educational videos on the nursing student's skills to administer parenteral medication.

**Methods:** The sample was 80 first year nursing students who enrolled at a University in Turkey. The 40 of students were randomly selected into the control group while the remaining 40 students were assigned to the experimental group. The parenteral treatment training was given to the control group (n= 40) only with the demonstration method while the experimental group (n= 40) was trained using educational videos in addition to the demonstration method. A questionnaire and obstructed skill clinical examination (OSCE) were used for the data collection

**Results:** The obstructed skill clinical examination posttest skill scores of the experimental group trained with supported educational videos were found to be higher than control group was trained with just demonstration method. In addition, most of the students who were experimental group were quite satisfied.

**Conclusion:** A supported of educational videos education and conventional teaching methods will contribute to the training nursing skills education.

**Keywords:** education; intravenous medication skills; nursing students; multimedia

### Introduction

Acquisition of the skills for administering parenteral medication in the training of nurses is of critical importance for the patient security (Sowan et al. 2014; Purcell 2010; Ong et al.2003). In literature, the studies on an erroneous administration of medication noted the parenteral medication treatment is a complicated process

and errors in these applications may have fatal consequences (Ong et al.2003; Hicks et al.2006). A study conducted in 2003 reported 265 application errors in 483 medication applications observed (Ong et al.2003). Hicks and Baker found that medication errors varied between 3% and 5% and the errors resulted from negligence and the inability to demonstrate the skill (Hicks

et al. 2006). Considering the results of these studies, it is noted that the successful clinical implementation of the skills for administering parenteral medication entails that this skill must be learned in the best way before graduation (Sowan 2014; Ong et al.2003; Hicks et al.2006; Sayed et al.2013). The frequently used methods for teaching basic nursing skills are a demonstration, presentations, and other traditional training methods. These methods for skills training are now falling short of meeting the needs. The reasons for this include the increased number of nursing students, the low number of the teaching staff members, the decrease in the support given by clinical nurses to the practical training due to the increase in their clinical duties, and the inability of laboratory facilities to meet the increased demand stemming from crowded classrooms (Jang et al.2005; Gerdprased et al. 2010; Kavevitchai et al.2009; Bloomfield et al.2010) This necessitates the use of innovative multimedia technologies in the skills training (Alonso et al.2005; Adams et al.2005; Kelly et al.2009). Videos are among the multimedia technologies that can be used for this purpose as they provide students with a more sensory learning environment to ensure that the information learned can be retained for longer periods. Users have the chance to pick specific videos and watch them many times to their liking (Sowan 2014; Smith et al. 2006; Corbally 2005). In addition, because of, cost-effectiveness and providing more faster learning than text-based material video materials have an increasing interest (Albanese, 2005; De Leng et.al., 2007). Therefore well-designed and well-prepared videos make a positive effect on teaching desired skills to students, increasing their motivation and making them recall theoretical information (Nichols 1994; Cardoso et. al 2012; Mcgrath et al. 2005). Regarding the effectiveness of video Chan (2010) found that videos help students remember the critical points that are in the skills steps and contribute learning process these are the points that make the students prefer this learning material.

While the researchers indicated the positive result of video using, video using has some limitations such as such as failure to obtain feedback to their student's questions, low participation to courses and some technical problems in use (Copley et. Al 2010; Delen et. al 2014; De leng 2007). Ng and Hussain proposed (2009) if a clear method is provided to take obvious feedback from students,

It will be a significant impact on the student's stated motivation in a learning process. It is essential that educational videos should be prepared by professional educators in the suitable format and they should have updated content (Duncan et al. 2013; Clifton et. al 2011). While the studies on the nursing skills training that employ videos reported different results, many researchers indicated that the method of providing skills training using educational videos are as effective as the traditional methods (Corbally 1994; Cardoso et al. 2012; Mckenny 2011; Salina et al. 2012). In Salina et al.(2012)'s which is also the study of videos learning, they found that the training using the educational videos was effective in the skills training given using the demonstration method and educational videos. Another study reported that educational video-supported training reduced anxiety in learning and it was a successful tool in boosting cognitive and technical skills (Smith et al.2006; Sally et al. 2006). In addition these results Cardoso et al.(2012) compared the results of the training programs that employed videos and classical methods.

Training on the skills of administering parenteral medication is one of the training subjects concerning fundamental nursing skills. Any incompetence in parenteral medication can cause common malpractice, which may lead to irreversible complication. Therefore, these skills must be taught to nursing students in the best way possible (Ong et al. 2003; Hicks et al. 2006). In this context, studies concerning the training methods that can be used to teach these skills in the best way possible are important. This study was carried out to examine the effects of the use of educational videos on the nursing students' skills to administer parenteral medication and seek alternative educational method to contribute the acquisition of nursing skills.

## Methodology

### Design and Sample

This single-blind, randomized controlled, quasi-experimental pre-posttest design pilot research was conducted at a school of nursing in Turkey. The study was carried out between February 2014 and May 2014. The study was conducted at Turgut Ozal University School of Nursing where basic nursing skills were taught to the first year students in the second semester within the course Fundamentals of Nursing. The data was collected in the nursing skills laboratory between February

2014 and May 2014. Out of 86 nursing students, six attended only the theoretical courses, but not the practical ones, and therefore, they were not included in the sampling group. 40 students from the sampling groups were randomly selected from the control group and the remaining 40 students formed the experimental group. No student left the study. The statistical power analysis revealed the sampling power of the study to be 0.87

### Data Collection

The data was collected using a questionnaire form which is about the demographical characteristic of students and their views on innovative educational methods, and an objective structured clinical examination (OSCE). In order to perform OSCE, seven OSCE stations have been created considering the numbers of students, materials and skills in order to measure students participated study skills performance. Seven faculty member chosen except researchers to evaluate students' skills performance examination, they had been provided training about evaluation criteria for the management of the examination process by the researchers.

Each skill assessment period has been determined to be seven minutes. Structured checklists with literature direction were created for evaluating the skills examination by researchers. In the skills assessment test each students performed each of parenteral medication skills within specified time in OSCE stations. During the exam students passed from one to another OSCE station when they heard the full time of the ringing tone. At the end of determined time period students leave the examination room. The structured clinical skills checklists for administering parenteral medication were prepared by the researchers according to the relevant literature (Taylor et al.2008; Potter et al. 2005; Perry et al. 2009). In the evaluation of the skills checklists, every step correctly performed by a student was given "1" point and every wrong or incomplete step was given "0" point while the critical steps in each skill were calculated as "2" steps. According to these checklists, "17" was the maximum score for the skill of intravenous catheter insertion, "24" for the skill of giving an intramuscular injection, "17" for the skill of administering intravenous fluid, "18" for the skill of giving an intradermal injection, "17" for the skill of given a subcutaneous injection, and "24" for the skill of

preparing medication from the vial. The sum of the scores for these seven skills concerning the parenteral medication was used to measure the student's practical performance. The maximum score for the checklists concerning the administration of parenteral medication was "135."

### Research Ethics

The Ethics Committee of the Turgut Ozal University approved the study. The study was conducted after obtaining written consent from the Ethics Committee of the Nursing School, Turgut Ozal University. Students were informed and their written consent was taken after the first meeting with the researcher. In order to get reliable answers, general information was given to the students in both groups before proceeding with the research. All of the footage of videos was checked, and scenes were re-shot and edited in if necessary, and nursing intervention procedures were applied on the models. After the data was collected, the educational videos were sent to the control group to watch these videos.

### Educational Videos

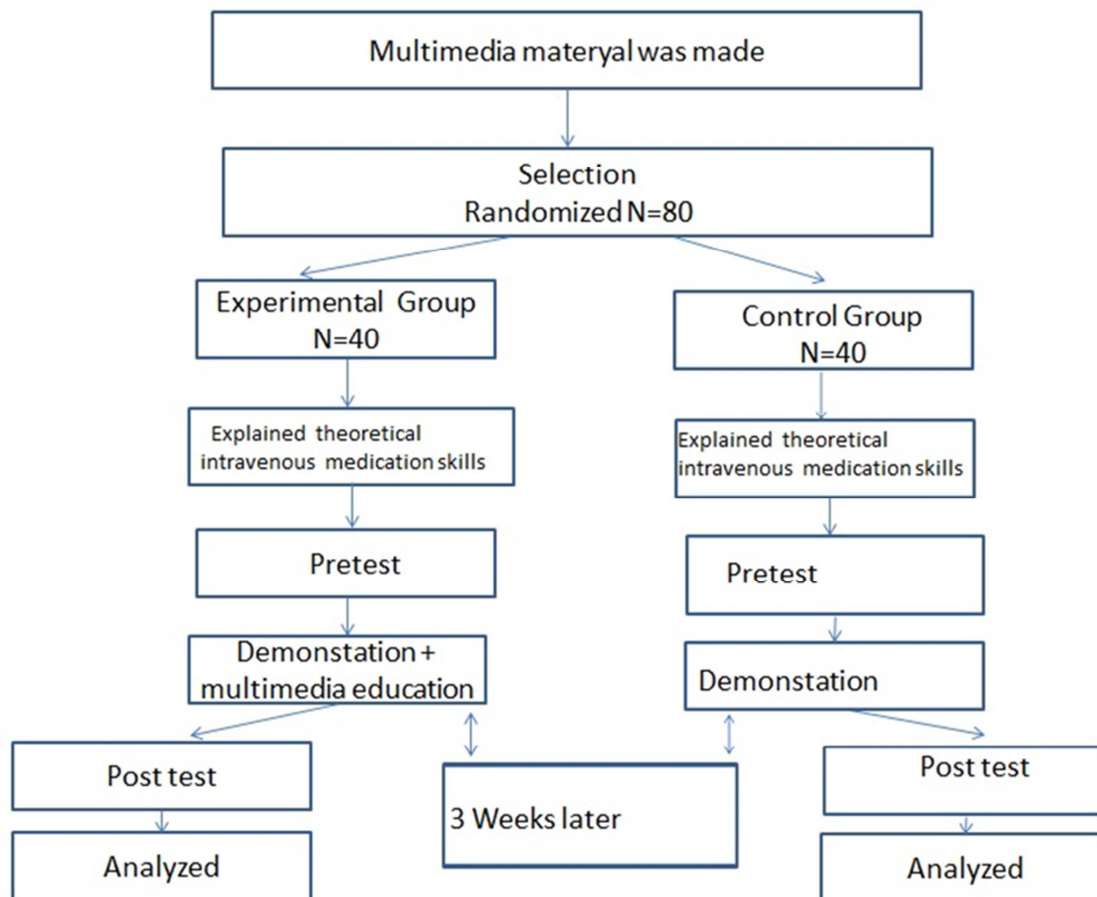
When the compare videos distributed DVD and online videos, DVD videos are preferred as educational material in the study because they don't require the internet connection and are easily accessible materials on but online videos have problem with quality of image during watching in case of low internet speed and somewhere you have to paid for internet to access these videos.

Initially, educational aims of education videos are defined then seven educational videos were prepared to be used in the training of the experimental group about giving an intramuscular, intradermal, subcutaneous, and intravenous injection, and inserting an intravenous catheter, giving intravenous fluids and preparing medication from the vial. The determined parenteral medication administration skills were demonstrated according to skills steps of the process in the educational models by researchers in the educational videos. The audio montage on the video was made after finishing the camera shooting. The total duration of these videos was about 30 minutes. The videos described the necessary materials, the application steps using mannequins and a slide showing the critical steps for the application. The slide section was placed at the end of videos to ensure that

students can recall the critical steps in the end. In the first phase of the preparation of videos, video scenarios were created based on the book, "Fundamentals of Nursing" (Taylor et al.2008; Potter et al. 2005; Perry et al. 2009). One day before the videos was shot, rehearsals were made on the training mannequins and the scripts were revised. Video shooting was performed by a professional team in the vocational skills laboratories. The sound was also recorded into

the videos which were later edited. The completed videos were watched by the researchers to check the content. Measures were taken to prevent the video reproduction or copying by the students. The videos were replicated in the DVD format to be handed to the students in the experimental group. An image of the educational video concerning peripheral venous catheter insertion is given Figure 1.

**Figure1:** Study process



### Data analysis

Data analysis was performed using the Statistical Package for Social Science (SPSS) version 15.0. The confidence interval was 95%. A statistical significance level of  $p < .05$  was set. The Shapiro-Wilk test was used for accordance of dependent variables and for their normal distribution. The chi-square test was used for the similarity of age and gender distributions in the two groups. The student test, Mann-Whitney U test and Kruskal-Wallis tests were used to examine and compare the differences in the pre-test, post-test and pre-post-test differences scores relating to the nursing skills in the control and experimental groups. The Wilcoxon signed-rank test was used for each skill separately to compare pre-intervention and post-intervention skill scores between two groups relating to all nursing skills. Mann-Whitney U and Kruskal-Wallis tests were used to examine the effects of independent variables.

### Data Processing

The effectiveness of the demonstration method and the educational video-supported demonstration method in teaching parenteral medication skills were studied in the study. The students who took the theoretical course of the skills concerned were randomly assigned to the control and experimental groups. Verbal and written consent of the students was obtained and pre-tests were performed on both groups using the skills checklists. One day after the pre-tests were conducted, the students in the experimental group received video-supported instruction in addition to the instruction made using the demonstration method. For this purpose, before the demonstration, the students were made to watch the educational videos, and then, teachers used the demonstration method to teach the skills. The students in the experimental group were also made to watch the educational videos at the end of the demonstration-centric instruction. The students in the control group were given the skills training only with the demonstration method. Post-tests were given to the students in both groups three weeks after the pre-tests to measure the effectiveness of both methods. Equal time was allocated to each student for the assessment. To avoid bias in the data collection phase of the study, data were collected by two competent teachers. Following the data collection phase, the students in the control group were made to watch the

educational videos as well. The working method is given in Figure 2.

### Results

The study was conducted using 80 first graders who were taking the course on the fundamentals of nursing at a school of nursing. socio-demographic characteristics of the students sampled revealed that 50 percent of the students were in the age group 20. The statistical analysis found no statistical difference in terms of the school graduated, age group, the place where they stayed and both groups were found to have a homogeneous distribution ( $p = .327$ ,  $p = .796$ , and  $p = .247$  respectively). When the students were interviewed about their views on the use of technological materials in education, 85% of the students in the experimental group stated that materials like CDs or DVDs can be used in the courses and 95% noted that they want other materials to be used in the courses in addition to the traditional methods. 87.5% of the students in the experimental group indicated that the opportunity to watch the videos for several times is an important facilitator in the acquisition of the skills and 95% of the students in the same group stated that they were satisfied with the video-supported medication skills training. Table 1 presents the demographics of the students in both groups.

The pre-test scores of the students were assessed after the theoretical training on parenteral medication application. The Mann-Whitney U test was conducted and no statistically significant difference between the two groups in terms of pre-test total scores for parenteral medication skills were found ( $p = 0.704$ ,  $z = -0.38$ ). The post-test scores after the demonstration and video-supported training of the groups of students in the sampling indicated that there is a statistically significant increase in all parenteral skills scores of the students in both the experimental group and the control group ( $p < 0.05$ ) (Table 2). The comparison of post-test total scores between the groups revealed that the post-test total scores are higher in the experimental group than the control group ( $\bar{x} = 121 \pm 4.69$ ,  $\bar{X} = 99 \pm 7.86$  respectively). The difference was found to be statistically significant ( $p < 0.05$ ,  $z = -6.826$ ) (Table 2). To assess the effectiveness of the skills training, the difference between pre-test and post-test scores was examined. The score median for the pre-test and post-test difference total scores of parenteral medication skills was found to be  $26 \pm 10.93$  for

the experimental group and  $16 \pm 10.18$  for the control group. Statistically significant difference was found between the groups in terms of pre-test and post-test difference total scores of parenteral medication skills ( $p < 0.05$ ,  $z = -4.811$ ) (Table 2).

### Discussion

This study was conducted to assess the effectiveness of the use of educational videos being used more popularly as a multimedia technology in education, on the skills training in nursing. In the statistical analysis, the group of students who were given the skills training with

demonstration supported the educational videos had higher scores in OSCE ( $p < 0.05$ ).

This result indicates that training method with videos that employs innovative educational methods compared to traditional methods in the skills training in nursing is more effective to traditional methods. When the students in the experimental group were inquired about if they were satisfied with the educational video-supported training, 95% percent said that they were very satisfied. On account of this, It can be concluded that the opinions of the students are educational videos has helped contribute to their learning and acquiring skills.

**Table 1 Characteristics of participants**

Characteristics	Experimental		Control	
	N	%	N	%
<b>Age group</b>				
19	23	57.5	8	20.0
20	14	35	26	32.5
$\geq 21$	3	7.5	6	7.5
<b>Is it possible to teach the lessons with educational videos?</b>				
Yes	34	85	24	60.0
No	6	15	16	40.0
<b>Would you like to have lessons given by materials the other than the traditional methods such as presentation or demonstration?</b>				
Yes	38	95	33	82.5
No	2	5.0	7	17.5
<b>Was watching videos repeatedly effective to acquire the skills?(for experimental group)</b>				
Yes	35	87.5		
No	5	12.5		
<b>Did you enjoy the "parenteral medication administration" lessons given with educational videos? (for experimental group)</b>				
Yes	38	95.0		
No	2	5.0		

In literature, high rates of satisfaction were reported among the students who received video-backed skills training. In a study conducted in the United Kingdom using the video training method, 86.4% of the students reported positive feedback about training with this method. The researchers concluded that educational video-supported training makes the positive contribution to the skills training and recommended that this method should be integrated with the skill training programs (Mcgrath et al. 2005). Gerdprased et al.(2010) indicated that 91% of the students were quite satisfied with the video-supported training. In another study that reported positive results for the video-supported training method, physiotherapy students were given video-supported training for their practical exams and the effect of this training on the student's performance in these exams was assessed. The study found that the video-based training significantly reduced the exam-related anxiety of students and increased students' satisfaction (Smith et al. 2006). In addition, Kelly et al.(2009) conducted a study on nursing skills using online educational videos and the demonstration method, and 72% of the group receiving training with online videos stated that educational videos are attractive and useful in practice. Our research results show similarities with the literature in this regard. Students, who have given educational video based courses are satisfied with the training, said that educational videos are increasing their learning motivation.

The results of this research reported that using educational models supported educational videos training rose student performance on parenteral administration skills. Students group received videos training were more successful in OSCE than other groups. The studies on the nursing skills training that employ videos reported different results. In these studies, many researchers indicated that the method of using educational videos to teach skills is as effective as the traditional methods (Cardoso et al. 2012; Sally et al. 2006; Perry et al. 2009; Weeks et al. 2013; Salyers 2007). In a pilot study which reported similar results with this study as well as the positive effect of educational videos on the skills training, nursing school first graders were taught the arterial blood pressures measurement skill using the demonstration method, the educational video method and a combined method in which the demonstration method was used in conjunction with educational videos.

When the performance checklists were used to assess the performance of the students, the group which received the instruction with the combined method was more successful than the other groups (Bauer et al. 1998). In a study by Lee et al. on the teaching of the insertion of pediatric intraosseous (IO) needle, the students in the experimental group were shown a 10-minute educational video before they were given the opportunity to practice the skill on a training mannequin for 10 minutes. The students in the control group were given theoretical information before each student practiced skill on the mannequin under the supervision of an educator for a total period of 20 minutes. The students in the experimental group were found to have higher scores than the students in the control group ( $p < 0.05$ ) (Lee et al.2007). In another study which reported similar results with our study, the skill of giving the patient the proper lying position was taught using the demonstration method for the students in the control group and the educational videos for the students in the experimental group. The assessment of the checklists from the experimental and control groups revealed that the group of students who received the skills training with videos had higher scores and the video training method is more effective in the skills training (Kala et al. 2009). A study was conducted in Brazil on the central venous access skill in which students were asked to watch a 13-minute educational video on this skill for three times before they are allowed to practice the skill on the mannequin for 15 minutes. In this training in which educational videos are integrated with the demonstration method, knowledge and anxiety levels of students were measured using pre-tests and post-tests. The educational video-integrated training method reported to make no difference in decreasing anxiety levels, but boost the knowledge levels (Cardoso et al. 2012).

In a study by Holland et al., which support the results of this study, the skill of administering oral medication was taught to the nursing students in the control group with the demonstration method while the demonstration method was supported with educational videos for the students in the experimental group. The study found the both levels of satisfaction from the training and levels of skill performances of the students who received the training with the combined method were higher (Holland et al. 2013).

In literature, there are studies showing that online or offline video training can be effectively used in teaching clinical skills or theoretical knowledge to nursing, medicine and paramedic students, but there are also studies which report no difference for this method compared to other methods (Kelly et al. 2009; Bauer et al. 1998; Karen et al. 2014). Sayed et al. studied the teaching of the human anatomy and physiology course using the traditional demonstration method and using the educational video-supported demonstration method. The researcher reported that the video-supported training group was very satisfied with the method, but this method didn't make any difference in terms of acquisition of theoretical knowledge (Sayed et al. 2013). In another study on the effect of educational videos on the skills training, several nursing skills including the use of a pulse oximeter, encouraging the patient to use a spirometer, etc., were taught to one group using the demonstration method and to the other group using online videos. The group that received training with online videos was quite satisfied with the method, but no difference was found between the practical performances of the students in the two groups (Kelly et al. 2009). This discrepancy in the results of these studies may result from the assessment of different nursing skills and the assessment differences in the skills assessment checklists used.

### Conclusions

To ensure patient safety and the prevention of medication errors it's critical to give parenteral medication administration skills learning to the students who are the future nurses in the best way. In this study, the supported training method in which the demonstration method was used in conjunction with the video training was found to be effective in the parenteral medication skills training. The educational video-supported training model can be a good alternative in overcoming the recent problems in the skills training in nursing and reducing medication errors in clinical training. In addition, educational videos, which are considered as innovative educational materials, have positive contributions to the skills training for large student groups.

The educational videos must have prepared by the field expert in order to provide effective and standardized skills learning. Educational videos may be used in conjunction with the traditional methods without replacing them in the skills

training for nursing students. Although the effectiveness of the multimedia-supported training model is well-established, its use remains limited. Therefore, it is recommended that the use of mixed training models which combines traditional training methods with innovative ones should be encouraged. In addition, it is suggested that educational material such as interactive videos allowing the student to participate the learning process must be prepared a quantities studies are required to learn student's problems with video learning and get their suggestions. We recommended that other studies can be made as a collaboration work with other educational institutions in larger samples in order to generalize the result of the study.

### Limitations of the study

The study has some potential limitations. First, it was not possible to compose a particular video for all nursing skills, only parenteral medication skills videos were incorporated into the contents of the intervention. Second limitation was small size of sample and the setting was just one institution. Third one was the use of supported educational video in experimental group might have positively skill performance scores than other group cause of taking another educational material. Lastly, three months later measurements can be repeated so that it can be seen whether the educational method with the learning videos makes contribution to the students permanent learning skills or not

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**Table 2 The effects of educational videos on parenteral medication administration scores of skills**

Variables: Skill Scores	Pretest	Posttest	Pretest-Posttest difference
	$\bar{X} \pm SD$	$\bar{X} \pm SD$	$\bar{X} \pm SD$
Intravenous injection			
Experimental Group (n = 40)	9.65 ± 2.63	14.85 ± 1.69	5.2 ± 3.11
Control Group (n = 40)	10.60 ± 3.33	12.28 ± 2.14	1.68 ± 3.64
<i>t</i>	1.251	4.93	-3.449
<i>P<sup>a</sup></i>	0.211	.001*	.001*
Administering intravenous fluid			
Experimental Group (n = 40)	10.00 ± 2.86	15.33 ± 1.62	5.33 ± 3.02
Control Group (n = 40)	10.43 ± 2.91	13.58 ± 2.85	3.15 ± 2.90
<i>Z</i>	0.646	-3.52	-2.737
<i>p<sup>b</sup></i>	0.159	.001	.004*
Intravenous catheter insertion			
Experimental Group (n = 40)	9.28 ± 2.64	16.70 ± 1.18	7.42 ± 2.94
Control Group (n = 40)	9.70 ± 3.72	15.95 ± 1.88	6.25 ± 2.22
<i>Z</i>	0.358	-3.31	-2.224
<i>p<sup>b</sup></i>	0.72	.0001	.003*
Subcutaneous injection			
Experimental Group (n = 40)	13.98 ± 1.85	16.30 ± 1.29	2.32 ± 2.12
Control Group (n = 40)	13.25 ± 2.75	14.85 ± 2.68	1.6 ± 3.39
<i>Z</i>	-0.91	-3.31	-3.254
<i>p<sup>b</sup></i>	0.363	.001	.04*
Preparing medication from the vial			
Experimental Group (n = 40)	15.48 ± 2.29	17.30 ± 1.02	1.82 ± 2.53

<i>Control Group (n = 40)</i>	15.13±1.84	14.35 ±1.72	0.78±2.34
<i>Z</i>	-1.467	-7.065	-2.23
<i>P<sup>b</sup></i>	0.142	0.001	0.04*
<i>Intradermal injection</i>			
<i>Experimental Group (n = 40)</i>	14.05±2.66	16.78±1.19	2.73±2.99
<i>Control Group (n = 40)</i>	12.98±2.15	15.20 ± 1.67	2.22±2.50
<i>Z</i>	-2.482	-4.526	-1.310
<i>p<sup>b</sup></i>	0.063	0.03	0.003*
<i>Intramuscular injection</i>			
<i>Experimental Group (n = 40)</i>	16.33±2.27	19.18± 1.93	2.85±2.47
<i>Control Group (n = 40)</i>	15.20±2.88	16.98 ±2.33	1.78 ±3.32
<i>Z</i>	-1.786	-4.642	-1.310
<i>p<sup>b</sup></i>	0.074	0.001	0.005*
<i>Total skill scores</i>			
<i>Experimental Group</i>	88.75 ± 11.07	116.43±4.69	27.68 ±10.93
<i>Control Group</i>	87.28±12.92	103.18±7.86	15.90±10.18
<i>Z</i>	-0.38	6.826	-4.811
<i>P<sup>b</sup></i>	0.704	0.001-	0.001*

\*p<0.05 a: Independent sample t test b: Mann-Whitney U test

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