Original Article

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Quick Response Code:

Website: www.jehp.net

DOI: 10.4103/jehp.jehp_850_21

Comparing the effects of demonstration, video display, and virtual social networks on nursing students' learning of hemodialysis clinical skills: An interventional and comparative study

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Received: 08-06-2021
Accepted: 27-08-2021
Published: 11-06-2022

Abstract:

BACKGROUND: Applying new methods of clinical education seems to provide nursing students with educational opportunities. The present study aimed to compare the effectiveness of training through demonstration, video display, and virtual social space on the learning of clinical skills among nursing students.

MATERIALS AND METHODS: In this semi-experimental research with posttest that was performed in 2019, thirty nursing students of the seventh semester were randomly assigned to three groups of demonstration, video display, and the social virtual space education with ten people in each group. The research was conducted in the hemodialysis ward of university hospitals. Each group was trained and evaluated during 10 days with 5-h sessions continuously. Participants' skills were evaluated using eight self-made, valid and reliable checklists, and the three groups were compared. For data analysis such as the means and standard deviations and inferential statistics, Mann–Whitney test, Kruskal–Wallis likelihood-ratio, and Chi-squared test in SPSS version 16 were used.

RESULTS: The results indicated that practical skill levels in the group of virtual social network were significantly higher than the two groups of video display ($P = 0.045$) and demonstration ($P = 0.03$). In addition, the group of virtual space had significantly higher scores than those of the other two groups only in two skills of "prime" and "disconnecting the patients from the machine" ($P < 0.05$).

CONCLUSION: Proper use of networks and social virtual space for clinical training, along with conventional methods of learning, provides good learning opportunities and is affordable in terms of time, cost, and process.

Keywords:

Demonstration, mobile device, video display, virtual space

Introduction

Clinical skills development is one of the vital elements of nursing training and one of the components of one's preparation for acquiring professional qualifications.[1]

Clinical training is a process in which students gradually learn practical and clinical skills by involving in clinical judgment, solving patients' problems, and using their experience and logical arguments. This kind of training is aimed at making measurable changes in clinical skills.[2]

How to cite this article: Ghahfarokhi MM, Arzani-Birgani A, Taheri N, Maqsoodi F. Comparing the effects of demonstration, video display, and virtual social networks on nursing students' learning of hemodialysis clinical skills: An interventional and comparative study. J Edu Health Promot 2022;11:163.

Training based on videos or CDs is among the methods used in practical nursing training. These methods provide the opportunity to replay and repeat videos at the request of the audience so that they can learn the skill.[3] Moreover, the presence of the trainer and the exchange of views between the trainer and the trainee in the form of questions and answers make double the effect of this training process.[4] The moving images expose movements as they occur, and through this technique, these movements can be showed slowly or quickly. Electronic learning (e-learning) in Iran is progressing; there is currently a need to use its educational facilities.[5] E-learning is one type of self-directed learning, which is characterized by its interactive and communicative nature.[6] Mobile phones, as an e-learning tool, increase the quality of students' learning; help in quick and easy access to large amounts of information; and supports in the reduction of some educational costs.[7]

One of the ways to provide learning based on communication and information technology is training through virtual social networks. Social media has been introduced as internet networks, leading to quick and easy interactions.[8] Virtual social networks can provide many learning opportunities anywhere just by connecting to the world wide web via a mobile phone.[9]

The most common method for teaching clinical nursing skills is based on the demonstration of the trainer. This method provides interactions and discussions between the students and the trainer.[5] Nonetheless, this method is cost and time-consuming alone.[3] Also, increasing number of students in hospital wards is associated with declining quality of education.[5] Based on Aliafsari Mamaghani *et al*. study, Iranian clinical instructors apply varying educational methods in clinical learning environments. However, some of these instructions ignore lots of disciplinary problems and evaluating protocols.[10] McCutcheon *et al*. showed that blended learning in terms of knowledge and satisfaction scored higher in comparison with online-only learning.[11] Among the types of clinical nursing training, training the clinical skills for hemodialytic patients has a special position. The treatment of hemodialysis requires clinical competency and expertise of a nurse who is responsible for providing high-quality treatment and care for patients.[12] Saleh *et al*. (2018) showed that about two-thirds of nurses working in the hemodialysis unit had no information about nursing care standards of hemodialytic patients.[13]

The application of new clinical training methods, along with conventional methods, seems to be useful in providing more opportunities to learn specialized hemodialysis skills. Therefore, the present study aimed to compare the effectiveness of training through three methods (demonstration, video display, and using electronic virtual networks) for the acquisition of practical skills by nursing students in the hemodialysis unit.

Materials and Methods

Study design and setting

This study was a semi-experimental research work that was performed in the Abadan University of Medical Sciences in fall 2019.

Study participants and sampling

The population consisted of all nursing students (thirty students) of the seventh semester. These students had passed the intensive care in hemodialysis course in the previous semester. The sampling method was based on the census and according to the following inclusion criteria: students of the seventh semester, students passing the intensive care in hemodialysis course, those with absence of any formal training for working with a hemodialysis machine, and those with a lack of work experience in this area. Exclusion criteria included previous clinical training or work experience in a hemodialysis unit and not passing the theoretical unit of the related course. Participants were randomly assigned to three groups of demonstration, video display, and the social virtual space education with ten people in each group.

Data collection tools and technique

All groups first attended a briefing session, in which all stages of education were explained. Informed consents were then obtained from eligible students. The students were divided into three groups of 10 days with 5-h sessions continuously, in which they received training through demonstration, video display, and the social virtual space. The students were trained by the same trainer during the academic semester. The contents of the sessions were as follows: the first session involved getting familiar with the unit and hemodialysis equipment. The second session included an examination of the patient for chronic renal failure. The third session included training students on how to set and prime the hemodialysis machine. The fourth session included connecting patients to the hemodialysis machine and caring for them during hemodialysis. The fifth session included training patients with chronic renal failure about nutrition and fluid intake. The sixth session included learning how to disconnect the patient from the hemodialysis machine. The seventh session included accessing vessels and providing nursing care. The eighth session included introducing important medications used for hemodialysis (dosage, injection, function, side effects, and drug dialysis). The ninth session included initiating and managing complications during

hemodialysis. Finally, during the tenth session, the students completed a practical examination according to predesigned checklists.

The first group received a demonstration method. This was carried out through the conventional method of demonstration by an appropriate trainer with experience in the unit. During training, the researcher's assistant filmed the trainer using a professional camcorder while training the practical skills in each session.

The second group watched the videos that were filmed during the first group's training at the beginning of each internship session in the training class of the unit. Videos were displayed using a video projector in the presence of the trainer with questions and answers over the second period of 10 days. Then, the learned skills were practiced in the unit in the presence of the trainer.

The third group joined a two-way social channel through WhatsApp. The WhatsApp chat group was created by the trainer; a 1-h briefing session was attended before the start of the internship. The videos were edited to be a limited time and size for 1 day. This group attended their internship after having prepared by watching the videos via WhatsApp and practicing the skills with the help of the trainer. There was no time limitation for watching the videos. Students could ask questions via WhatsApp. If a student lacked access to the Internet or a smartphone, they could use their groupmates' internet connection or smartphones. The final evaluation was administered in the hemodialysis unit where the students were taught clinical nursing skills for hemodialysis based on predesigned checklists. The evaluators were three experienced hemodialysis nurses as researcher assistants under the supervision of the trainer. Finally, the practical test was performed by the main trainer to avoid any bias in observations after data collection and observations. The final evaluation of each group was performed with the help of self-made checklists. The checklists of the demographic characteristics were related to the students' demographic information including age, total mean, sex, and current residence (living in the dormitory or home). The checklists of hemodialysis skills containing level criteria were related to the clinical skills in the hemodialysis intensive care unit. In total, there were six separate checklists with yes/no answers. To calculate the scores of each checklist, each correct answer was scored 1, and each incorrect answer was scored 0. The test stage checklist included 5 items, the setting of machine included eight items, prime included 10 items, connecting the patient to the machine included 7 items, weaning the patient included 28 items, nursing care before connecting the patients with fistula included 14 items, patients with catheterization included 10 items, care during hemodialysis included 10 items, and care after hemodialysis included 8 items.

The clinical skills were scored as follows: very good = 3 (80%–100% of the items were correct in the procedure), good = 2 (60%–79% of the items were correct), relatively good = 1 (40%–59% of the items were correct), and very bad = 0 (<40% of the items were correct). The checklist was provided using papers, books, and the professors' opinions, and its content validity was confirmed by ten faculty members of the faculty of nursing and midwifery. The calculated content validity ratio was 0/64 and content validity index was 0/82 regarding these checklists. To investigate the reliability of the checklists using Cronbach's alpha, a coefficient of 0.78 was used.

Ethical consideration

This study was conducted after receiving approval from the Ethics Committee of Abadan University of Medical Sciences (IR.AADANUMS.REC.1398.04B). Written permission was obtained from the university.

Data analysis

In this study, descriptive indicators such as the means and standard deviations were used for the quantitative variables, and numbers and percentages were used as qualitative variables. Regarding results of Kolmogorov–Smirnov test, the data did not follow the normal distribution. Hence, nonparametric tests were applied. In addition, the Mann–Whitney test was used to investigate the relationship between the levels of each skill for each of the three training methods. The Kruskal–Wallis test was used to compare the levels of practical skills among the three groups (training through a virtual social network, video display, and demonstration). A likelihood-ratio Chi-squared test was used to investigate the relationships between the qualitative variables among the three groups, and the Kruskal–Wallis test was used to assess qualitative variables. The data were analyzed in SPSS software version 16 (SPSS Inc., Chicago, IL, USA).

Results

Each group included ten students. One-way analysis of variance showed that the mean age (P = 0.65) and the total mean (P = 0.52) among the three groups had no significant difference [Table 1].

Table 1: The mean age and total mean of the three groups

Variable	Mean±SD			*P**
	Virtual space	Video display	Demonstration	
Age (years old)	21.70±0.65	21.50±0.53	21.80±0.92	0.65
Total mean	17.45±1.03	17.68±1.26	17.16±1.20	0.52

*ANOVA. SD=Standard deviation, ANOVA=Analysis of variance

The likelihood-ratio Chi-squared test showed that the frequency distribution of sex (P = 0.86) and the residence (P = 0.17) had no significant difference among the three groups. Moreover, Kruskal–Wallis test indicated that the students' interest in nursing had no significant difference among the three groups (P = 0.52) [Table 2].

The Kruskal–Wallis test showed that the group of virtual space had significantly higher scores than that of the other two groups only in two skills of "prime" and "disconnecting the patients from the machine." Further, the skills during dialysis in the group of demonstration were significantly higher than those of the other two groups. There was no significant difference in other variables among the three groups [Table 3].

The Kruskal–Wallis test showed that the practical skill levels were significantly different among the three groups (P = 0.02). The Mann–Whitney test indicated that the practical skill levels in the group of virtual social network were significantly higher than those of the two groups of video display (P = 0.045) and demonstration (P = 0.03). However, there was no significant difference between the two groups of video display and demonstration (P = 0.31) [Table 4].

Discussion

Clinical training is an important part of professional nursing training. Using innovations and new teaching methods in the clinical training has an effective role in its dynamism.[14] The results of the present study showed that the students' practical skill level in the virtual social network group was significantly different from that of the other two groups. Virtual social network produced significantly higher levels of knowledge in the skills of priming and weaning the machine. However, the improved skill of setting the machine in this group was not significant in the present study due to the small sample size. Contrary to virtual social network group, in video display group, the students' skills of providing care during dialysis were significantly higher than those of the other two groups. In demonstration, most students' skills were at the "good" level. This was lower than the skill levels of the other two methods.

Table 2: The frequency distribution of sex, student's residence, and interest in nursing among the three

Variable	Virtual space (n=10), n (%)	Video display (n=10), n (%)	Demonstration (n=10), n (%)	P*
Sex	4 (40)	3 (30)	4 (40)	0.86*
	6 (60)	7 (70)	6 (60)	
Residence	8 (80)	8 (80)	10 (10)	0.17*
	0	2 (20)	2 (20)	
Interest in nursing	2 (20)	5 (50)	4 (40)	0.52**
	6 (60)	3 (30)	5 (50)	
	2 (20)	2 (20)	1 (10)	

*Chi-squared test, **Kruskal–Wallis

Regarding the use of the most appropriate training method for improving nursing students' skills, Najafi Ghezeljeh *et al*. investigated the effect of training through a virtual social network on the attitudes and knowledge of nurses in the emergency department regarding disaster preparation. Their results showed a significant increase in the knowledge scores of the intervention group in comparison to the control group, indicating the effectiveness of learning through a virtual social network.[8]

According to the work of Habibzadeh *et al*., learning to interpret cardiac dysrhythmias virtually had a better effect on the knowledge of nursing students than that of conventional learning methods. Thus, virtual learning can be used as a complementary and alternative method for training medical sciences students.[9]

Lee *et al*. showed that a group of students who learned urinary catheterization for a week by watching videos on their mobile phones exhibited significantly higher levels of learning and class satisfaction than students in a control group. Moreover, the performance level and competence of the intervention group in performing urinary catheterization were better.[2]

The stage of priming is considered a critical stage in preparing a hemodialysis machine. The aim of this stage is to wash the sets and the dialyzer to drain the air and ethylene oxide gas, which is used to sterilize the filters. This must be done with sufficient precision and following the correct principles. Following the negligence of the nurse, the weaning stage can be associated with complications such as air embolism, loss of the patient's blood, or other fatal complications.[15] The importance of the sequencing steps of weaning the patient from the hemodialysis machine correctly and scientifically requires considering many technical and key points to maintain maximum patient safety. Therefore, it can be inferred that students should have the opportunity to attend the real clinical environment with more mental and visual preparation before performing the relevant skills through receiving the videos filmed via virtual space at any time and place. Padilha *et al*.'s study on clinical virtual simulation showed that this method improves clinical reasoning and knowledge durability over time and increases students' satisfaction with the learning experience.[16]

Ab Latif *et al*. sought to recognize the learning methods used for sophomore nursing students and the factors that affect their learning methods. Motor and auditory learning were the most satisfying.[17] The provision of care

Table 3: The frequency distribution of skills levels in the three training groups

Skill	Skill level	Virtual space (*n*=10), *n* (%)	Video display (*n*=10), *n* (%)	Demonstration (*n*=10), *n* (%)	*P**
Priming the machine	Very bad	0	0	0	0.009
	Bad	0	2 (20)	3 (30)	
	Good	3 (30)	6 (60)	6 (60)	
	Very good	7 (70)	2 (20)	1 (10)	
Setting the machine	Very bad	0	0	0	0.32
	Bad	0	0	0	
	Good	1 (10)	3 (30)	4 (40)	
	Very good	9 (10)	7 (70)	6 (60)	
Disconnecting the patient	Very bad	0	0	0	0.04
	Bad	2 (20)	3 (30)	5 (50)	
	Good	3 (30)	6 (60)	4 (40)	
	Very good	5 (50)	1 (10)	1 (10)	
The cares before connecting the machine	Very bad	0	0	1 (10)	0.20
	Bad	1 (10)	1 (10)	2 (20)	
	Good	7 (70)	5 (50)	6 (60)	
	Very good	2 (20)	4 (40)	1 (10)	
Connecting the patient	Very bad	0	0	0	0.34
	Bad	0	1 (10)	3 (30)	
	Good	9 (90)	7 (70)	6 (60)	
	Very good	1 (10)	2 (0)	1 (10)	
Cares while dialysis	Very bad	0	0	0	0.03
	Bad	0	0	4 (40)	
	Good	8 (80)	5 (50)	4 (40)	
	Very good	2 (20)	5 (50)	2 (20)	
Disconnecting the machine	Very bad	0	0	0	0.04
	Bad	2 (20)	3 (3)	5 (50)	
	Good	3 (30)	6 (60)	4 (40)	
	Very good	5 (50)	1 (10)	1 (10)	
Cares after dialysis	Very bad	0	0	0	0.69
	Bad	0	1 (10)	1 (10)	
	Good	8 (8)	5 (50)	7 (70)	
	Very good	2 (20)	4 (40)	2 (20)	

*Kruskal-Wallis test

Table 4: Frequency distribution of practical skills levels in the three groups

Skill level	Virtual space (*n*=10), *n* (%)	Video display (*n*=10), *n* (%)	Demonstration (*n*=10), *n* (%)	*P**
Very bad	0	0	0	0.02
Bad	0	0	0	
Medium	0	0	1 (10)	
good	5 (50)	8 (80)	9 (90)	
Very good	5 (50)	2 (20)	0	

*Kruskal–Wallis

during dialysis includes the skills of setting the dialysis machine in terms of ultrafiltration, dialysis duration, blood flow rate, dialysate flow rate, transmembrane pressure, controlling arterial and venous pressures, access monitoring, controlling the patient's vital signs, and controlling the patient in terms of complications during dialysis.[15]

As the training processes of these stages via demonstration may interfere with the privacy and relaxation time of patients, it can hinder the training process and accurate learning. Video-based education provides opportunities for students to learn specialized nursing skills in hemodialysis and receive a clear explanation from the trainer while video films are being displayed. Moreover, students can freely ask and answer questions. Therefore, students are better prepared to implement these skills.

Training through video display provides a unique opportunity to develop willpower and training that will draw the students' attention to details.[18] According to a review by Forbes *et al*., effectiveness, adequacy, application, and quality are the four main attributes of making and applying training video clips to support training clinical nursing skills, which makes using such videos a useful training method.[19] The clinical trainer's initiative and interest were indicated as the most effective factors of clinical training improvement. Therefore, the selection of a creative and innovative trainer would improve the quality of clinical education.[20] The integrated education method has been introduced as the most complete teaching and learning strategy for

continuous self-learning, as it affects the learners' interest and activates the students in education by considering their motivation and experience. It also increases the student's sense of responsibility, independence, self-esteem, and creativity when performing clinical work.[11]

Regarding students' individual characteristics (age, sex, average, residence, and interest in nursing) and the three training methods, no significant relationships could be found due to the small size and relative homogeneity of the samples.

Limitation and recommendation

The limited sample size (the students of the seventh semester) was one of the research limitations. Moreover, the experimental method was performed in one training setting, limited to one area of clinical nursing skills. Another limitation was the failure to use a pretest within the cognitive domain to evaluate the students' cognitive knowledge; the only way to assess the students was using the practical posttest of motor and cognitive mental skills. Therefore, it is recommended that future studies use larger sample sizes and in a wider context, assessing other nursing skills in different nursing areas such as emergency care and other intensive care units. Furthermore, using a pretest can provide more accurate comparisons with the results of educational intervention.

Conclusion

The proper use of networks and virtual social space in training has provided valuable learning opportunities for medicine and paramedicine students. In addition, this method is affordable in terms of time, cost, and process. Therefore, the application of new educational and supplementary methods in addition to conventional demonstration methods can improve students' mental preparation before entering the unit, especially in the motor-psychological domain at the patient's bedside.

Acknowledgment

This research is the result of an approved project in Abadan of Medical Sciences University. The authors, hereby, express their gratitude and appreciation for the valuable cooperation and guidance of hardworking and experienced personnel of the hemodialysis unit and the patients who had the utmost patience and cooperation with this project.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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