

Original Article

The Effects of Lab-assisted Training on the Gain of Surgical Hand Scrubbing Skill

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Abstract

Background: Skill laboratories are essential to help students achieve psychomotor skills, integrate theoretical knowledge into practice and get prepared for clinical environment.

Aim: The purpose of this study was to determine the effects of lab-assisted training on the acquisition of surgical hand scrubbing skill.

Method: This descriptive observational study was conducted with 142 second-grade students who took the surgical nursing course at a school of health in Mersin and a nursing faculty in Istanbul were selected with stratified random sampling between February and July 2015. All students were given theoretical lecture on surgical hand scrubbing. Nursing faculty students were made to perform surgical hand scrubbing practice in skills laboratory. All students filled up a "Surgical Hand Scrubbing Knowledge Form" before going into the operating room. Students' practice of surgical hand scrubbing was observed in the operating room according to "Surgical Hand Scrubbing Skill Form". Data analysis was performed using frequency, percentage, mean, standard deviation, t test, and Pearson's correlation test.

Results: It was found that the mean scores of hand scrubbing knowledge and skills of students who received training on surgical hand scrubbing in the skills laboratory were significantly higher than those of the students who were given theoretical lecture alone and that as the knowledge mean score increased so did the skill mean score in both groups ($p < 0.05$).

Conclusion: The results showed that applied training provided to nursing students in skills laboratory was more effective in students' acquisition of surgical hand scrubbing skill.

Keywords: Lab-assisted Training, Surgical Hand Scrubbing, Nursing Education.

Introduction

Nursing education is a system that covers cognitive, affective and psychomotor learning domains (Morgan, 2006). The cognitive domain involves thinking-based educational objectives; the affective domain includes behaviours associated with feelings of human beings and the psychomotor domain encompasses behaviours resulting from the cooperation of sense organs, mind and muscles (Metz & Uysal, 2009). In nursing education, occupational skill laboratories that integrate theoretical knowledge into practice enable students to get prepared for clinical practice, decrease anxiety and help improve psychomotor skills (Ewertsson, Allvin, Holmstrom, & Blomberg, 2015; Keetsemang et al., 2008; Metz & Uysal 2009; Metz & Uysal 2010; Morgan, 2006). Lab-assisted training has an important place in nursing education, provide students with an opportunity to practice under the guidance of an instructor, thus enable them to reinforce theoretical knowledge, to acquire psychomotor skills, to integrate theoretical knowledge into practice and to get prepared for clinical environment (Alper & Ozdemir, 2005; Coffman, 2012; Metz & Uysal, 2010; Widmer et al., 2010).

Skills laboratories that mimic clinical environment enable students to practice repeatedly on simple mannequins/simulators or in special areas such as intensive care unit and surgical hand scrubbing unit, thus helping them improve their psychomotor skills (Ewertsson et al., 2015; Morgan, 2006). One of the skills students are expected to acquire in these laboratories is effective surgical hand scrubbing. Effective surgical hand scrubbing is particularly important for preventing surgical site infection and it is well known that the use of sterile gloves before surgery does not rule out the necessity of surgical hand scrubbing (Windmer et al., 2010). Therefore, surgical hand scrubbing is a routine procedure in operating rooms to eliminate transient flora and reduce resident skin flora on hands (Celik, Parsak, & Aksaray, 2007; Terzi, 2006; Usluer et al., 2006; Uzunkoy, 2004).

In schools that have skills laboratories with surgical hand scrubbing units, students are provided with a detailed demonstration of surgical hand scrubbing in skills laboratories before clinical practice and students are expected to practice themselves. On the other hand, in schools with no skills laboratories, students are

shown a demonstration of surgical hand scrubbing during clinical practice in operating rooms and are allowed to practice themselves. In the literature (Alper & Ozdemir, 2005; Coffman, 2012; Eker, ACıkgoz & Karaca, 2014; Morgan, 2006; Sabuncu, Kose, Ozhan, Batmaz & Ozdilli, 2008), there are several studies addressing the effects of laboratory practice on learning and anxiety, whereas there are no studies which demonstrated the efficacy of lab-assisted training on gain of surgical hand scrubbing skill. In according to these data, this study was conducted to identify the effects of lab-assisted training on surgical hand scrubbing skill that students are expected to gain within the context of surgical nursing course.

Method

Study Design: This study was designed as a descriptive observational trial.

Setting and Sample: This study was conducted in a nursing faculty in Istanbul and nursing department of a school of health in Mersin. The population of the study consisted of a total of 570 students, 370 of whom were second graders taking the surgical nursing course at the nursing faculty in Istanbul and 200 of whom were second graders at the nursing department of the school of health in Mersin in the 2014-2015 academic year. A preliminary practice conducted with 9 students revealed that the rate of error was 44.4% in maximum. Based on this ratio, the number of students to be included in the sample was calculated as 138 with moderate effect size (0.25), and a power of 90% at a confidence level of 95%. Based on the number of students at the mentioned schools, strata weights were determined as 0.65 for the nursing faculty in Istanbul and 0.35 for the School of Health in Mersin. According to the strata weights, the study sample consisted of 90 students from the nursing faculty in Istanbul and 48 students from the school of health in Mersin. The study was completed with 142 students (nursing faculty: 92; school of health: 50). Students who participated in the preliminary practice were not included in the study.

Data Collection Tools: Data were collected using a data collection form developed by the researchers based on the literature (Akyuz, 2011; Curchoe, 2013; WHO, 2009). The data collection form consisted of 3 sections; section 1 included information regarding descriptive

characteristics of the students (age, gender and high school they graduated from); section 2 included “Surgical Hand Scrubbing Knowledge Form” consisting of 10 questions regarding students’ knowledge and status of surgical hand scrubbing; and section 3 included “Surgical Hand Scrubbing Skill Form” including the steps of surgical hand scrubbing such as surgical hand scrubbing technique, scrubbing time and drying skill. The surgical hand scrubbing skill form consisted of 20 steps designed to observe and identify whether students were able to practice surgical hand scrubbing skill properly. In order to express students’ knowledge and skills in numbers, each item was given a value to obtain 100 as the maximum score from these forms (knowledge and skill) and a student’s status of knowledge and skill was evaluated over 100.

Data Collection: Data were collected by the researchers using the data collection form between February –July 2015. Students of both universities were lectured on surgical hand scrubbing within the context of surgical diseases nursing course. Students were asked to fill up the “Surgical Hand Scrubbing Knowledge Form” before they go for operating room clinical practice.

One day after the students of the nursing faculty in Istanbul were taught the surgical hand scrubbing course, they were asked to practice surgical hand scrubbing according to surgical hand scrubbing steps in the skills laboratory. Students were asked to repeat the practice until they do it in accordance with the steps of surgical hand scrubbing. Students were able to practice the skill correctly after about two repeats. The surgical hand scrubbing unit in skills laboratory has photocell faucets, a minute counter, disposable brushes and a hands-free antiseptic solution faucet operated with the knee, which are all same as those in operating rooms.

Students of the nursing faculty in Istanbul performed surgical hand scrubbing one week after laboratory practice whereas students of the nursing department of the school of health in Mersin performed surgical hand scrubbing one

week after the course in operating room clinical practice. The entire hand scrubbing procedure was observed from the beginning to the end in accordance with the 20 steps in “Surgical Hand Scrubbing Skill Form” by two different researchers from each school.

Data Analysis: Data were analyzed using frequency, percentage, mean, standard deviation, t test, and Pearson’s correlation test. A p value of <0.05 (95% confidence interval) was considered statistically significant.

Ethical Considerations

Prior to the study, ethical approval (approval number: 83045809/604.01) was obtained from clinical research ethics committee, directorate of school of health and deanery of nursing faculty where the study was conducted. Students were informed that a study on nursing education was being conducted and that an observation would be carried out during two-week operating room practice whereas no information was provided regarding by whom, at which date and hour and for which practice the observation would be carried out. Participation was based on voluntariness and written and oral consent were obtained from the participants.

Results

The mean age of the students who participated in the study was 20.18 ± 1.02 years; 73.2% of them were females and more than half (58.5%) were graduates of regular high schools (Table 1).

An intergroup comparison revealed that the mean score of hand-scrubbing knowledge of students who received lab-assisted training surgical hand scrubbing skill (78.45 ± 9.42) was significantly higher than those who received theoretical hand scrubbing training alone (66.62 ± 10.45) ($p < 0.05$). The mean score of hand scrubbing skill of the group who were given lab-assisted training (85.90 ± 10.86) was significantly higher than that of other students (79.12 ± 10.50) ($p < 0.05$). An intragroup comparison showed a weak positive relationship between students’ knowledge and skills of surgical hand scrubbing ($p < 0.05$, Table 2).

Table 1. Students' descriptive characteristics (n=142)

Descriptive characteristics	Lab-assisted training group (n=92)		Theoretical lecture group (n=50)		Total (n=142)	
	n	%	n	%	n	%
Age group (Years)						
18-20	68	73.9	31	62.0	99	69.7
21-23	24	26.1	19	38.0	43	30.3
<i>X±SS</i>	20.08±0.95		20.38±1.11		20.18±1.02	
Gender						
Male	19	20.7	19	38.0	38	26.8
Female	76	79.3	31	62.0	104	73.2
High school the student graduated from						
Regular high school	29	31.5	30	60.0	59	41.5
Anatolian High School	63	68.5	20	40.0	83	58.5

Table 2. The comparison of students' mean scores of surgical hand scrubbing knowledge and skill (n=142)

Mean Score	Lab-assisted training group (n=92)		Theoretical lecture group (n=50)		<i>t</i> test	<i>p</i>
	Mean	SS	Mean	SS		
Mean score of knowledge	78.45	9.42	66.62	10.45	6.873	0.000
Mean score of skill	85.90	10.86	79.12	10.50	3.597	0.000
Mean score of knowledge & Mean score of skill	<i>r</i> : 0.299* <i>p</i> : 0.004		<i>r</i> : 0.359 <i>p</i> : 0.010			

*Pearson correlation analysis

It was found that, of students' descriptive characteristics, "age group" and "high school they graduated from" did not affect the mean score of surgical hand scrubbing knowledge and skill ($p>0.05$). It was also found that gender had no effect on the mean score of surgical hand scrubbing skill ($p>0.05$), however, it had a significant effect on the mean knowledge score and that the mean knowledge score of female students was higher than that of males ($p<0.05$, Table 3).

Discussion

An effective surgical hand scrubbing which aims to eliminate transient flora and reduce resident skin flora on hands can be achieved through correct practice of all steps of surgical hand scrubbing (Celik et al., 2007; Terzi, 2006; Usluer et al., 2006; Uzunkoy, 2004). There are several studies which demonstrated that lab-assisted training are quite beneficial in gaining skills such

as blood pressure measurement, nasogastric tube care, intramuscular and subcutaneous injections and urinary catheterization (Alper & Ozdemir, 2005; Coffman, 2012; Eker et al., 2014; Sagkal-Midilli, Cevik, & Baysal, 2017). Similar to the aforementioned study results, this study which aimed to compare theoretical lecture and skills lab-assisted training for the acquisition of surgical hand scrubbing skill within the context of surgical diseases nursing course showed that lab-assisted training had a significant effect on the acquisition of surgical hand scrubbing knowledge and skill. This can also be interpreted as a concrete indicator that learning-by-doing promotes retention in the cognitive domain.

The results of this study also showed that as students' knowledge of surgical hand scrubbing increased so did their skills. In the literature, studies investigating the effects of training provided at different levels of simulation (occupational skills laboratory, standardized

patient, high fidelity simulation laboratory) on the acquisition of certain skills (assessment of health, intramuscular and subcutaneous injections, urinary catheterization, cardiopulmonary resuscitation, blood pressure measurement) showed that knowledge and skill levels increased in parallel (Bornais, Raiger, Krahn, & El-Masri, 2012; Hee & Seong, 2011; Sagkal-Midilli, et al., 2017; Seybert & Barton, 2007). Unlike the results of the aforementioned studies, there are other studies which failed to identify the effects of knowledge and skill on each other (Gordon et al., 2013; Takmak, 2015). The transformation of the knowledge acquired into skill, as well as the increase of the level of theoretical knowledge, are important for the increase of the number of qualified members of the nursing profession, as in all professions. Within this context, the conclusion obtained from the study is of importance in demonstrating that knowledge turns into skill.

In this study, the mean score of surgical hand scrubbing knowledge and skill of female students was higher than that of males. Similar studies investigating professional knowledge and skills of nursing students reported that knowledge scores of female students were higher than those of males, which is similar to the study results (Sagkal, 2014; Karacay, 2017).

One of the important results of this study is that even though female students' knowledge score of surgical hand scrubbing was higher, gender did not affect the skill score. Even though there is a study in the literature reporting that knowledge and skill scores of female students were higher than those of male students (Sagkal-Midilli et al., 2017), there are other studies which demonstrated that gender had no effect on the skill score, similar to this study (Gunay-Islamoglu & Zaybak 2018; Ozdemir, 2015). Based on 2015 data of the Program for International Student Assessment which assessed differences in gender-specific success in Turkey indicated that female students were 25 points ahead of male students in reading, given familial and school properties of high number of students. In addition, the mentioned report indicates that female students are in general more motivated and have a stronger sense of belonging at school, they study more at home but are more anxious than male students (Batyra, 2017). Studies investigating anxiety levels of university students reported no difference in state anxiety between female and male students but a

higher level of trait anxiety in female students than in male students (Karaman, 2009; Yilmaz, Dursun, Gungor-Guzeler & Pektas, 2014). Based on all similar study data and literature data, and given the importance of primary educational years in the acquisition of reading comprehension skills, it is not unexpected that theoretical knowledge scores of female students are higher than those of males. There was no significant difference in mean skill scores between female and male students, which is likely to be due to the fact that female students are more anxious in transforming theory into practice (Batyra, 2017; Karaman 2009; Yilmaz et al., 2014).

Limitations of the Study

It was a double center study; therefore, the generalizability of the results to other nursing faculty and school of health is unclear.

Conclusions

The results of this study demonstrated that applied lab-assisted training improved students' knowledge and skill scores of surgical hand scrubbing compared to theoretical lecture. Within this context, the development and popularization of laboratory environment in which nursing students can reinforce theoretical knowledge provided to facilitate the transformation of knowledge into skill before clinical practice and to improve the quality of education is important for producing more well-equipped graduates in terms of knowledge and skill.

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References

- Akyuz, N. (2011). Post-operative care practices. In: Akyolcu, N., Aksoy, G., & Kanan, N (Eds.), *Surgical Nursing Practice Guide* (1st ed., pp. 21-28). Istanbul: Istanbul Medical Press.
- Alper, Z., & Ozdemir, H. (2005). Opinions of first year medical school students on the clinical skills laboratory. *Turkish Journal of Family Practice*, 9(2), 65-70.
- Batyra A. (2017). Program for International Student Assessment (PISA) Findings 2015. Success Difference Based on Gender in Turkey. Aydin Dogan Foundation. [Cited 22 Mar 2018.] Available from URL: http://aydindoganvakfi.org.tr/static/media/images/files/PISA_TR.pdf.

- Bornais, J. A., Raiger, J. E., Krahn, R. E., & El-Masri, M. M. (2012). Evaluating undergraduate nursing students' learning using standardized patients. *Journal of Professional Nursing*, 28(5), 291-296.
- Coffman, S. (2012). From static lab to simulation lab: Students reflect on their learning. *Clinical Simulation in Nursing*, 6(3), 335-340.
- Curchoe, R. M. (2013). Infection prevention and control. In: Potter, P. A., Perry, A. G., Stockert, P. A., & Hall, A. M (Eds.), *Fundamentals of nursing* (8th ed., pp. 432-434). St. Louis: Mosby.
- Celik U., Parsak, C., & Aksaray, N. (2007). Prevention of surgical site infections. *J Pediatr Inf*, 1(3), 102-108.
- Eker, F., Acikgoz, F., & Karaca, A. (2014). Occupational skill training through the eyes of nursing students. *DEUHYO ED*, 7(4), 291-294.
- Ewertsson, M., Allvin, R., Holmstrom, I. K., & Blomberg, K. (2015). Walking the bridge: Nursing students' learning in clinical skill laboratories. *Nurse Education in Practice*, 15(4), 277-283.
- Gordon, C. J., Frotjold, A., Fethney, J., Green, J., Hardy, J., Maw, M., et al. (2013). The effectiveness of simulation-based blood pressure training in preregistration nursing students. *Simulation in Healthcare*, 8(5), 335-340.
- Gunay-İsmailoglu, E., & Zaybak, A. (2018). Comparison of the effectiveness of a virtual simulator with a plastic arm model in teaching intravenous catheter insertion skills. *CIN: Computers, Informatics, Nursing*, 36(2), 98-105.
- Hee, K. Y., & Seong, J. K. (2011). Effect of a simulation-based education on cardio-pulmonary emergency care knowledge, clinical performance ability and problem solving process in new nurses. *Journal of Korean Academy of Nursing*, 41(2), 245-255.
- Karacay, P. (2017). Evaluating the faculty and student variables in nursing simulation education (Doctoral dissertation). [Cited 10 April 2018.] Available from URL: <https://tez.yok.gov.tr/UlusalTezMerkezi/tezSorguSunucYeni.jsp>.
- Karaman, S. (2009). The state and trait anxiety levels of unuverty students studying health-related education program. (Master Theses). [Cited 8 April 2018.] Available from: <https://tez.yok.gov.tr/UlusalTezMerkezi/tezSorguSunucYeni.jsp>.
- Keetsemang, S., Mugarurwa, J., Shahidi, T., Maputhege, M., Chipps, J., & Brysiewicz, P. (2008). Studentevaluation of a clinical self-study laboratory. *Nurse Education in Practice*, 8(5), 359-367.
- Mete, S., & Uysal, N. (2009). Implementation of an education model for nursing skills development. *DEUHYO ED*, 2(3), 115-123.
- Mete, S., & Uysal, N. (2010). Evaluation of psychomotor skill training at the nursing professional skill laboratory by students and instructors. *Turkish Journal of Research & Development in Nursing*, 12(2), 28-38.
- Morgan, R. (2006). Using clinical skills laboratories to promote theory-practice integration during first practice placement: An Irish perspective. *Journal of Clinical Nursing*, 15(2), 155-161.
- Ozdemir, H. (2015). Investigation of the relationship between nursingstudents' learning styles and psychomotor skills (Master Theses). [Cited 10 April 2018.] Available from URL: <https://tez.yok.gov.tr/UlusalTezMerkezi/tezSorguSunucYeni.jsp>
- Sabuncu, N., Kose, S., Ozhan, F., Batmaz, M., & Ozdilli K. (2008). Determining of the anxiety levels of the nursing students experiencing the first time the intramuscular injection. *Journal of Anatolia Nursing and Health Science*, 11(3), 27-32.
- Sagkal, T. (2014). Nursing students' knowledge about intramuscular injection. *Journal of Anatolia Nursing and Health Sciences*, 17(2), 80-89.
- Sagkal-Midilli, T., Cevik, K., & Baysal, E. (2017). Assessment of the relationship between test anxiety and the levels of knowledge and skills about laboratory practices for nursing students. *Journal of Health Science Suleyman Demirel Üniversitesi*, 8(1), 43-54.
- Seybert, A. L., & Barton, C. M. (2007). Simulation-based learning to teach blood pressure assessment to doctor of pharmacy students. *American Journal of Pharmaceutical Education*, 71(3), 1-6.
- Takmak, S. (2015). The effects of skills training and simulation on the blood pressure knowledge scores and hearing Korotkoff sounds (Master Theses). [Cited 10 April 2018.] Available from URL: <https://tez.yok.gov.tr/UlusalTezMerkezi/tezSorguSunucYeni.jsp>
- Terzi, C. (2006). Surgical site infections. *Ankem Dergi*, 20(3), 187-193.
- Usluer, G., Esen, S., Dokuzoguz, B., Ural, O., Akan, H., Arcagok, C., (2006). Guide to insulation measures. *Turkish Journal of Hospital Infections*, 10(2), 1-28.
- Uzunkoy, A. (2004). The role of the operating room surgical site infections. *Journal of Harran University Medical Faculty*, 1(1), 38-47.
- Widmer, A. F., Rotter, M., Voss, A., Nthumba, P., Allegranzi, B., Boyce, J., (2010). Surgical hand preparation: State-of-the-art. *Journal of Hospital Infection*, 72(4), 112-122.
- World Health Organization (WHO) (2009). WHO Guidelines on hand hygiene in health care. [Cited 18 February 2018.] Available from URL: http://apps.who.int/iris/bitstream/10665/44102/1/9789241597906_eng.pdf.

Yilmaz, I. A., Dursun, S., Gungor-Guzeler, E. G., & Pektas, K. (2014). Determining on anxiety level of university students: A case study. Ejoboc

(Electronic Journal of Vocational Colleges), 4(4), 16-26.

Table 3. The comparison of students’ mean scores of surgical hand scrubbing knowledge and skill and their descriptive characteristics

Descriptive characteristics	Mean score of surgical hand scrubbing knowledge						Mean score of surgical hand scrubbing skill					
	Lab-assisted training group (n=92)		Theoretical lecture group (n=50)		Test		Lab-assisted training group (n=92)		Theoretical lecture group (n=50)		Test	
	Mean	SS	Mean	SS	t test	p	Mean	SS	Mean	SS	t test	p
Age group (years)												
18-20	78.29	9.52	66.68	9.88	0.599	0.550	86.51	10.53	81.61	9.77	1.091	0.277
21-23	78.88	9.30	66.53	11.60			84.17	11.78	75.05	10.63		
<i>t test</i>	-0.258		0.049				0.910		2.229			
<i>p</i>	0.797		0.961				0.365		0.031			
Gender												
Male	75.42	9.10	65.47	9.50	-2.492	0.014	84.26	11.73	78.63	9.77	0.068	0.946
Female	79.23	9.40	67.32	11.08			86.33	10.66	79.42	11.07		
<i>t test</i>	-1.584		-0.603				-0.737		-0.255			
<i>p</i>	0.117		0.549				0.463		0.800			
High school the student graduated from												
Regular high school	78.21	11.08	66.30	8.97	-1.913	0.058	82.79	12.73	80.63	11.10	-1.645	0.102
Anatolian High School	78.56	8.65	67.10	12.58			87.33	9.65	76.85	9.35		
<i>t test</i>	-0.164		-0.263				-1.890		0.299			
<i>p</i>	0.870		0.794				0.062		0.766			