Original Article

Does preclinical first-time simulation-based arterial blood pressure training increase psychomotor skills in nursing students?

EDA ERGİN[1*], ŞEBNEM ÇINAR YÜCEL[2], HÜLYA YILMAZ[3], NİLAY ORKUN[2], LEYLA KHORSHTD[2]

Abstract

Background: Blood pressure (BP) measurement, which is frequently used in clinical practice and is known to have a significant place in determining the patient's clinical picture, is performed by nurses.

Objectives: This study aimed to examine the effect of providing arterial BP instruction via simulation on the nursing students' psychomotor skill levels.

Methods: The quasi-experimental study was conducted with a single-group pretest-posttest design between September and December 2019 at the Faculty of Nursing of a university to examine the effect of teaching with a simulator on students' psychomotor skill levels, self-esteem and satisfaction. After signing the informed consent form, students who agreed to participate in the study were asked to fill in th**e** Individual Information Form and Arterial BP Academic Achievement Test**.** The Arterial BP Academic Achievement Test (pretest) and Arterial BP Measurement Skill Performance Test (pretest) were administered to students after traditional BP training. After the initial demonstration, students were allowed to repeat this procedure on the virtual simulator for 21 days. After 21 days, students were evaluated using the Arterial BP Academic Achievement Test (posttest), Arterial BP Measurement Skill Performance Test (posttest) and Student Satisfaction and Self-Confidence in Learning Scale.

Results: No statistically significant difference was found between the pretest and posttest scores of the Arterial BP Measurement Achievement Test ($p > 0.005$); however, the mean posttest score of the Arterial BP Measurement Skill Performance Test was found to be statistically significantly higher than the mean pretest score ($p < 0.001$). A significant difference was found in students' self-confidence and satisfaction mean score regarding using simulators ($Z = -0.720$, $p = 0.472$).

Conclusion: Simulation-based arterial blood pressure training is recommended for nursing students to gain psychomotor skills in preclinical blood pressure teaching for the first time. [*Ethiop. J. Health Dev*. 2022; 36(4):000-000]

Keywords: arterial blood pressure, nursing students, psychomotor skills

Introduction

Blood pressure (BP) measurement, which is performed by auscultating the brachial artery using a sphygmomanometer and stethoscope, is the most common measurement method used in daily clinical practice (1). BP measurement is an accepted technique in the nursing profession for assessing patients' general health. Combined with history taking and examination, BP measurements determine the accuracy of diagnosis, referral to treatment and management of the nursing process (2,3).

BP measurement, which is one of the basic functions of nurses that is frequently utilized in clinical practice, affects several treatment decisions and hence plays a role in accurately assessing the health of society. In fact, it is reported that faulty readings in BP measurement negatively affect the safety and quality of patient care (4). For these reasons, BP measurement is a vital skill that should definitely be included in the nursing training curriculum and accurately learned (5).

Teaching blood pressure measurement involves both psychomotor skills and theoretical knowledge. It is difficult for nursing students to master blood pressure with auscultation. BP measurement training includes both psychomotor skills such as checking and preparation of materials, giving the correct position to the patient, detecting the brachial artery by palpation, correct placement of the stethoscope, correct use of the manometer, correct hearing of Korotkov sounds, correct evaluation of the operation performed and recording the operation on the patient observation form and theoretical knowledge (1,2,3). It is difficult for nursing students to control BP with auscultation alone. Different teaching methods are needed to develop these psychomotor skills in addition to information about BP measurement (2,3). Studies show that an unsatisfactory laboratory environment and the lack of teaching staff per student negatively affect nursing students' experiences and skill development as regards BP measurement (6,7).

Simulation is a method of learning that explains or imitates clinical situations in real life (8), and simulation training provides students with a risk-free environment wherein they integrate theory and practice without fear of harming the individual (9). In such an environment, the effects of education are maximised as students learn through experiences wherein they use their knowledge and skills and learn from their mistakes in their actions (10,11). Low-, medium- and high-reality simulators are used in the simulation and as a standardised patients (10,12,13). It is necessary to

[1] Izmir Bakircay University, Faculty of Health Sciences, Department of Nursing, İzmir, Turkey,
[2] Ege University, Nursing Faculty, Department of Nursing, Izmir, Turkey.
[3] Bursa Uludağ University, Faculty of Health Sciences, Bursa, Turkey.
*Corresponding author email-eda.ergin@bakircay.edu.tr

use all levels of simulation in nursing education to ensure a more effective training process and solve the difficulties experienced while applying theoretical knowledge in nursing, wherein the number of students is on the rise. Student participation in patient care through experiencing clinical skills in virtual, simulation, and simulated/standardised patient laboratories positively contributes to learning by helping them overcome the reality shock they experience when they first go to the hospital (12). A study that systematically investigated the research on simulation determined that the simulation-based learning method increased nursing students' self-confidence levels and knowledge-skill development. Furthermore, the study emphasised that this method improved the students' critical thinking and clinical decision-making skill levels (14).

In their study, Gürol, Akpınar and Apay (2016) found that simulation training on parenteral drug applications and arterial BP measurement procedures significantly increased the students' skill levels (15). In addition, other studies reported that simulators developed basic nursing psychomotor skills and effectively improved students' self-confidence and self-efficacy levels and reducing anxiety levels during applications (4,16,17).

Since simulation in nursing education increases self-confidence and clinical decision-making skills by providing learning opportunities based on student experience, this interactive method is increasingly used during clinical training in Turkey (18). Basic problems in BP measurement include anxiety about making an inaccurate measurement, fear of harming the patient, inability to repeat on patients, inability to learn due to inadequate supervision and lack of self-confidence in students (15).

This quasi-experimental single-group pretest-posttest design study aimed to compare the effectiveness of teaching BP measurement with a simulator and traditional methods regarding skills acquisition. Teaching BP measurement using a simulator allows students to practice as much as they need in their free study time. It is believed that conducting studies on this subject will positively contribute to nursing education by increasing the nursing students' knowledge and abilities about measuring BP, improving their confidence and increasing the quality of the education programme and graduates.

The Purpose of the Research

This quasi-experimental single-group pretest-posttest design study aimed to investigate the effectiveness of using a simulator during a teaching arterial BP measurement skills on nursing students' psychomotor skill levels.

Research hypotheses

H1: Teaching using a 'simulator' to provide arterial BP measurement skill increases the nursing students' arterial BP measurement skill performance scores.

H2: Teaching using a 'simulator' to provide arterial BP measurement skill increases the nursing students' arterial BP measurement academic achievement knowledge level.

H3: Teaching using a 'simulator' to provide arterial BP measurement skill increases the nursing students' self-confidence during arterial BP measurement.

H4: Teaching using a 'simulator' to provide arterial BP measurement skill increases the nursing students' satisfaction level from the instruction.

H5: Teaching using a 'simulator' to provide arterial BP measurement skill makes it easier for the nursing students to hear Korotkoff phase sounds.

Method

Study design

The quasi-experimental (single-group pretest-posttest design) study was conducted in the skills and simulation laboratory of a Nursing Faculty of a university between September and December 2019 to examine the effects of teaching BP measurement via virtual simulation on the students' psychomotor skill levels during BP measurement. The reporting of this study followed the TREND checklist.

Setting and participants

The study universe was composed of second-year nursing students (n = 304) who attended the Faculty of Nursing at a university in Turkey and took the course module for basic nursing skills between September and December 2019. From this universe, the students (n = 238) who had not previously received arterial BP measurement skills training, did not have clinical experience, and agreed to participate in the study were included in the sample. According to the result of the GPower analysis result, thestudy's power was found to be 99% at an alpha value of 0.05.

Study procedure

The preparation phase: All second-year nursing students were provided by the researcher with a 90-minute theoretical lesson in the course module on the application of arterial BP measurement during the fall semester of the 2019 academic year. Students who accepted to participate in the study were asked to fill in the Individual Information Form and Arterial BP Academic Achievement Test after signing the informed consent form.

The implementation phase: All students were shown how to measure the arterial BP on a low-fidelity arm model using the traditional method, The students were asked to repeat the procedure.

In the traditional method, before the application, all students participating in the research were given a 90-minute theoretical lecture by the researcher about the blood pressure measurement application at the same time. According to the blood pressure measurement skill application directive, the measurement process was first shown by the instructor on the arm model of blood pressure measurement, and then the students were made to practice at least once in company with the faculty member Then they made the measurement on their own arm model.

The students' questions were then answered, and they were provided with the opportunity to practice again. Following the traditional method, students were

provided with the opportunity to apply the skills of arterial BP measurement with the virtual simulator in the classroom setting. After the demonstration, students were allowed to repeat the application on the virtual simulator for 21 days. Because it is necessary to evaluate a learned skill after at least 21 days (22,25). In this process, frequency of 3 times students was allowed to do experiments using a simulator.

Gaumard brand virtual simulator S222.989 BP arm model was used as the training simulator for the BP measurement skill. The model had the following features: has a programmable palpable radial pulse when the cuff pressure is lower than selected systolic BP, Korotkoff is audible between systolic and diastolic pressures from K1 to K4 (K5 is silent), Korotkoff sounds are automatically muted when the auscultation gap is selected, Korotkoff sounds are automatically adjusted based on the selected heart rate and cuff lowering air, contains Korotkoff conventional stethoscope sounds in the antecubital region and includes a reality system with programmable BP auscultation method and CE certificate.

The evaluation phase: Twenty-one days after the implementation, students participating in the study were evaluated with the help of the Arterial BP Academic Achievement Test (posttest), Arterial BP Measurement Skill Performance Test (posttest) and Student Satisfaction and Self-Confidence in Learning Scale (Fig.1).

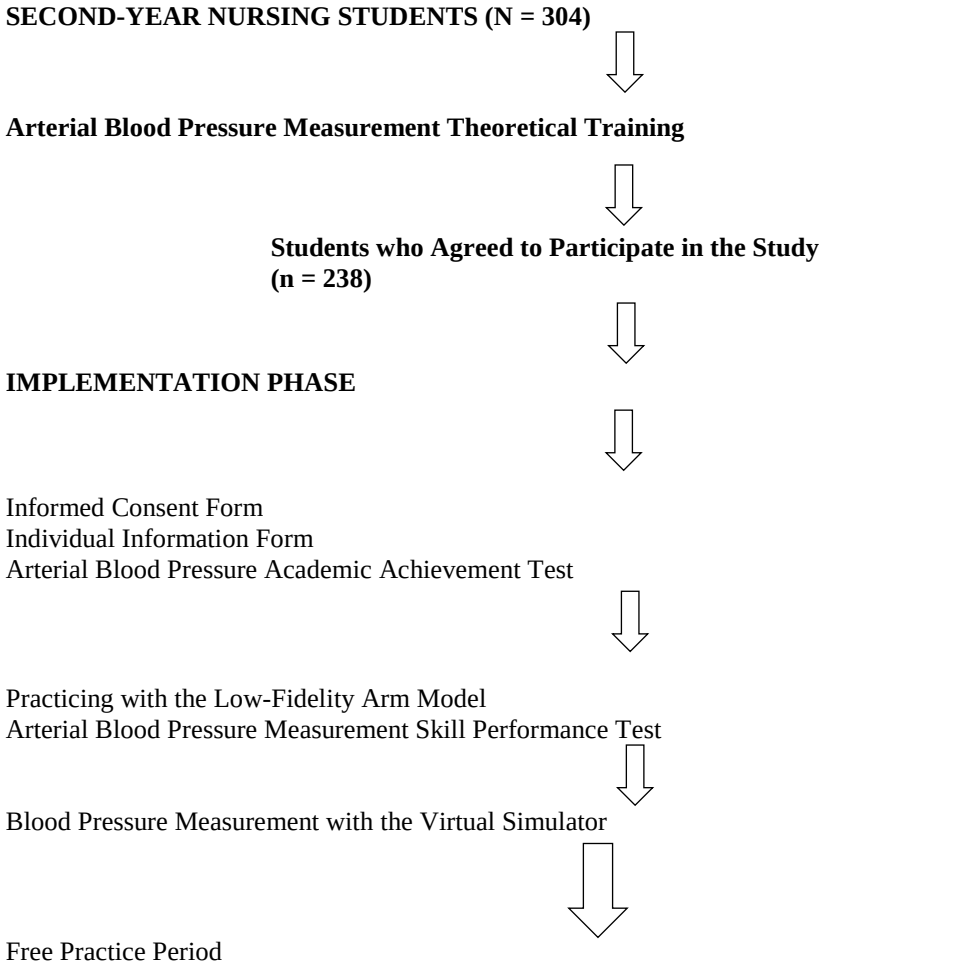

Figure 1. Consort chart

Data collection

The Individual Information Form used in data collection was prepared by the researchers It included four items in determining the socio-demographic characteristics of participating students, such as age, gender, the status of considering oneself suitable for the nursing profession and the status of having chosen the nursing profession willingly.

Arterial BP Academic Achievement Test: Dikmen and Filiz (2017) developed the 20-item test to determine students' knowledge level regarding BP measurement

(19). The lowest score that can be obtained from the test is zero, and the highest score is 100. Dikmen and Filiz (2017) performed the validity and reliability of the test; the form consists of 26 steps of BP measurement. The total Cronbach's alpha coefficient of the scale is 0.76. (19).

Arterial BP Measurement Skill Performance test: In this study, the Arterial BP Measurement Skill Performance Test was used to evaluate the students' BP measurement skills. During the assessment, the students were given scores suitable for each step. The highest score obtained from the form is 100, and the lowest score is zero. Higher scores point to a higher BP measurement skill level of a student. The status of students to hear Korotkoff sounds, BP value set in the BP virtual simulator and Korotkoff sound heard by the students were recorded in the skill performance form.

Student Satisfaction and Self-Confidence Scale: Ünver et al (2017), performed the validity and reliability of the in Learning Scale published by the National Nursing Association (20). The scale consists of 13 items in two sections: Satisfaction with Current Learning and Self-Confidence in Learning. There are five items in the Satisfaction with Current Learning section and eight in the Self-Confidence in the Learning section. The items in the five-point Likert-type scale are rated on a scale ranging from strongly disagree and strongly agree (20).

Ethical considerations

The Faculty's Ethics Committee approved the research (Approval No. 99166796-050.06.04-). The study conformed to the principles stated in the Declaration of Helsinki. Written permissions were obtained from the institutions where the study was conducted, and written and verbal consents were obtained from the students included in the study.

Data analysis

Statistical analysis was performed using IBM SPSS 22.0 package program in the Windows 10 computer program environment. The variables were summarised in terms of the following values: unit number (*n*), percentage (%), mean ($\bar{x}$) and standard deviation (SD). Levene's test was used to control the homogeneity of the variances, and Shapiro–Wilk test was used to test the normality of the data. *T*-test was utilized to analyse dependent and independent variables in quantitative data conforming to the normal distribution. Pearson's correlation analysis expressed the relationship between scale scores. In all data, α error level $p < 0.05$ was considered statistically significant.

Results

Participants' characteristics

Table 1 presents the socio-demographic data of the students included in the study. The participating students' had a mean age of 20.30 + 0.97 (range, 18–25) years. Of the participants, 89.9%, 69.7% and 50.44% were female students regarded the nursing profession as suitable for them and found to choose the nursing profession willingly, respectively (Table 1).

Table 1. Socio-Demographic Characteristics of the Research Group Students (n = 238)

Characteristic	Research Group (n = 238)	
	n	%
Age (M ± SD)	20.30 ± 0.973	
Sex		
Female	214 (89.9)	
Male	24 (10.1)	
Appropriate for the nursing profession		
Yes	166 (69.7)	
Partly	63 (26.5)	
Preferred the nursing profession		
Yes	120 (50.4)	
No	31 (13)	
Partly	87 (36.6)	

Note: M, mean; SD, standard deviation

Pre/ posttest score

The participating students' mean pretest and posttest achievement scores were 62.03 ± 12.33 and 62.81 ± 10.71, respectively (t = 0.772, p = 0.441). No statistically significant difference was observed between the pretest and posttest scores of the arterial BP measurement achievement test ($p > 0.005$); however, the mean posttest score of the Arterial BP Academic Achievement Test was significantly higher than the mean pretest score ($p < 0.001$) (Table 2).

Table 2. Difference Distribution between Students' Arterial BP Academic Achievement Pretest and Posttest Scores

	Research Group (n = 238)		
	M	SD	Statistical Analysis

Pretest score	62.03	12.33	t = −0.772 p = 0.441
Posttest score	62.81	10.71	

Note: M, mean; SD, standard deviation; *t*, Independent sample t test

Psychomotor skill score

Psychomotor skill scores of the students included in the study were 80.32 ± 11.2 and 86.18 ± 12.21 before and after the implementation with the simulator, respectively. Consequently, the analysis found that the psychomotor skill score for BP measurement increased after using the simulator (t = 5.627, p = 0.001) (Table 3).

Table 3. Distribution of Psychomotor Skill and Self-Confidence Scores

		Research Group (n = 238)		Statistical Analysis
		MR	**SD**	
Psychomotor skill score	**Pretest**	80.32	11.25	t = 5.627 p < 0.001
	Posttest	86.18	12.21	
		MR	**SD**	**Statistical Analysis**
Self-confidence score		30.56	3.86	R^2 = 0.776
Satisfaction score		21.89	2.84	p < 0.001

Note: MR, mean rank; SD, standard deviation; *t*, Independent sample t test; R, Pearson's correlation analysis

Self-confidence and satisfaction score

The mean score for student satisfaction with the method used in the scope of this study was 21.89 + 2.84, and the mean self-confidence score of students was 30.56 + 3.86. Pearson's correlation test showed a significant difference in terms of median students' self-confidence and satisfaction scores in using the simulator (r^2 0.776; p<0.001) (Table 3).

Discussion

Retaining recently acquired information and applying new skills is a complex cognitive process (21). In nursing education, vocational skills laboratories facilitate this cognitive process by combining theoretical knowledge and practical skills (22). Among basic nursing skills, information about the theoretical aspects of BP measurement is significant to perform this skill (21) successfully. This study determined that the training provided using the simulator did not make a difference in the students' knowledge scores regarding BP; however, it was effective in increasing the psychomotor skill scores.

The students easily forget what they have learned after the theoretical training when it is performed via a lecture and direct instruction method; hence, the training proves to be a failure in the end (23). However, in this study, it was observed that the student's knowledge scores on the subject remained the same, and no decrease was observed in the knowledge scores 21 days after the training was provided using the simulator. This finding led us to conclude that the simulator training provided positively affected the retention time. In addition, it can be argued that a significant increase was achieved in psychomotor skill scores since the method reinforced the theoretical knowledge realistically by emphasising the points that need to be focused on during skill training. In the literature, Yılmaz and Çınar (2020) found that while teaching BP measurement skills to first-year nursing students, the use of low-fidelity simulation did not make a significant change in the students' psychomotor skills, and no significant difference was noted between traditional education and training using the simulator (5). In their study, Takmak and Kurban (2019) determined no difference between the pretest and posttest knowledge scores (4).

Technology advancements have offered better and newer methods of teaching nursing practices and improving clinical skills (24,25). It is interesting to use different methods to teach generation Z students who encounter technology early (26,27). This study utilized the simulator, one of these technologies, and the traditional BP measurement skills training method. The study's results demonstrated that the simulator training increased the students' psychomotor skill scores. The studies conducted with the simulator argue that the simulator is effective in creating behavioural change (17,28). The BP measurement simulator enables students to apply skills realistically, such as palpating the skin on a realistic arm image model, providing the appropriate measurement position and placing the cuff accurately. Therefore, it may have contributed more to skill acquisition. Moreover, the realistic sounds that simulate the Korotkoff sounds during the implementation may have provided the best hearing and enabled students to perform the procedure more carefully while performing the skill.

With respect to the previous studies, the study conducted by Abdullah and Mohammed (2017) to

provide nursing students with skills by using the simulator and traditional method found that the psychomotor skill score of the group that received training with the simulator was higher (2). A semi-experimental study performed by Takmak and Kurban (2019) to determine the effect of skill training and simulation on the BP knowledge score and hearing Korotkoff sounds of first-year nursing students reported that skill and practical training using a low-fidelity simulator did not make a significant difference in the students' mean knowledge test scores (4). Studies conducted by Korhan et al. (2018), Ayhan et al. (2019), Larue et al. (2015) and Ross (2012) comparing simulation and traditional methods found that the students who received training using the simulation method had higher psychomotor skills than those who received training using the traditional method (29–32).

Skill training in nursing education before clinical practice increases students' self-confidence by improving their skills (22). This study concluded that the training provided with the simulator increased student satisfaction and self-confidence about the method used. For students to develop self-confidence, skills must be learned after theoretical training. The fact that training using the simulator helped increase the students' psychomotor skill scores in BP measurement and helped them acquire relevant skills may have resulted in increased self-confidence. In addition, students may have been satisfied with the method they used because it was a practical method, and they had the opportunity to practice it. A study conducted by İsmailoğlu et al (2018) determined that the self-confidence level of the group trained using the simulator was quantitatively higher. In their study, Ayhan et al. (2019) found that the students who received training using the simulation method had higher self-confidence and satisfaction scores (17,30). Terzi et al. (2019) concluded that the high-fidelity simulation method had a positive effect on the students' self-confidence and self-efficacy (16).

Limitations

The effect on practice was not fully evaluated because not all study participants had the opportunity to perform BP measurements in the clinic. The BP measurement skills of the students who made up the sampling group cannot be generalised to the whole universe. The study's results will be limited to evaluating BP measurement skills on the plastic arm model.

Conclusion

This study concluded that the training provided using the simulator did not affect the students' knowledge scores regarding BP measurement; however, it was effective in increasing their psychomotor skill scores. Hence, the students' satisfaction and self-confidence increased. In line with these results, it is recommended to conduct studies with larger groups and other nursing skills to better evaluate the effectiveness of the simulation in BP measurement. Furthermore, it is suggested to conduct further studies in which all of the application steps are observed, wherein two different observers and precautions evaluate the same student are observed for the possibility that experimental and control groups can be affected by each other.

Acknowledgements

We are grateful to all the nursing students who took part in the study.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding sources

This study was supported as a research project numbered 20633 with the decision of Ege University Scientific Research Projects Coordinator.

References

1. Y. Hameed R, R. Allo R. Assessment of Nurses' Practices Concerning Blood Pressure Measurements. Mosul J Nurs. 2018;6(1):1–7.
2. Abdullah WH, Iman A. M. Effectiveness of Simulation-Based Blood Pressure Measurement on Practice Competency among 2 nd Year Nursing Students. IOSR J Nurs Heal Sci. 2017;06(02):22–34.
3. Gordon CJ, Frotjold A, Fethney J, Green J, Hardy J, Maw M, et al. The effectiveness of simulation-based blood pressure training in preregistration nursing students. Simul Healthc. 2013;8(5):335–40.
4. Takmak Ş, Kuzu Kurban N. Düşük Gerçekli Simülasyonun Kan Basıncı Bilgi Puanı ve Korotkoff Seslerini Duymaya Etkisi. Acibadem Univ Saglik Bilim Derg. 2019;10(4):756–62.
5. Yılmaz D, Çınar HG. The Effect of Simulator Use in Blood Pressure Measurement Training on Nursing Students' Psychomotor Skills. 2020;20(1):104–10.
6. Baillie L, Curzio J. A survey of first year student nurses' experiences of learning blood pressure measurement. Nurse Educ Pract [Internet]. 2009;9(1):61–71. Available from: http://dx.doi.org/10.1016/j.nepr.2008.05.003
7. Cant RP, Cooper SJ. Use of simulation-based learning in undergraduate nurse education: An umbrella systematic review. Nurse Educ Today [Internet]. 2017;49:63–71. Available from: http://dx.doi.org/10.1016/j.nedt.2016.11.015
8. McAllister M, Levett-Jones T, Downer T, Harrison P, Harvey T, Reid-Searl K, et al. Snapshots of simulation: Creative strategies used by Australian educators to enhance simulation learning experiences for nursing students. Nurse Educ Pract [Internet]. 2013;13(6):567–72. Available from: http://dx.doi.org/10.1016/j.nepr.2013.04.010
9. Kimhi E, Reishtein JL, Cohen M, Friger M, Hurvitz N, Avraham R. Impact of simulation and clinical experience on self-efficacy in nursing students: Intervention study. Nurse Educ. 2016;41(1):E1–4.
10. Sarı D, Erdem H. The use of high fidelity simulation in nursing education: A literature review. J Hum Sci. 2017;14(4):3690.

11. Ahn H, Kim HY. Implementation and outcome evaluation of high-fidelity simulation scenarios to integrate cognitive and psychomotor skills for Korean nursing students. Nurse Educ Today [Internet]. 2015;35(5):706–11. Available from: http://dx.doi.org/10.1016/j.nedt.2015.01.021
12. Sezer H, Orgun F. Using simulation in nursing education and simulation model [Internet]. Vol. 33, Journal of Ege University Nursing Faculty. 2017. p. 140–52. Available from: https://dergipark.org.tr/en/pub/egehemsire/issue/32885/283062
13. Tuzer H, Dinc L, Elcin M. The effects of using high-fidelity simulators and standardized patients on the thorax, lung, and cardiac examination skills of undergraduate nursing students. Nurse Educ Today [Internet]. 2016;45:120–5. Available from: http://dx.doi.org/10.1016/j.nedt.2016.07.002
14. Şendir M, Doğan P. Use of Simulation in Nursing Education: A Systematic Review. Florence Nightingale Nurs J. 2015;23(1):49.
15. Gürol A, Akpinar RB, Apay SE. The Effect Of Sımulatıon Applıcatıons On The Skıll Levels Of Students. Kocatepe Med J. 2016;17(3):99–104.
16. Terzi B, Topbaş E, Bingöl G, Aydoğdu Mavi SG. Comparison of the effects of two different teaching methods in blood pressure measurement training: a randomized controlled study. Blood Press Monit. 2019;24(6):294–8.
17. Günay Ismailoğlu E, Zaybak A. Comparison of the Effectiveness of a Virtual Simulator with a Plastic Arm Model in Teaching Intravenous Catheter Insertion Skills. CIN - Comput Informatics Nurs. 2018;36(2):98–105.
18. Cioffi J. Clinical Simulations: Development And Validation. Nurse Educ Today. 2001;21:477–486.
19. Filiz NY, Dikmen Y. THE EFFECT OF JIGSAW IV LEARNING TECHNIQUE ON ACADEMIC ACHIEVEMENTS AND PSYCHOMOTOR SKILL PERFORMANCES REGARDING ARTERIAL BLOOD PRESSURE APPLICATION IN NURSING STUDENTS. 2017.
20. Unver V, Basak T, Watts P, Gaioso V, Moss J, Tastan S, et al. The reliability and validity of three questionnaires: The Student Satisfaction and Self-Confidence in Learning Scale, Simulation Design Scale, and Educational Practices Questionnaire. Contemp Nurse [Internet]. 2017;53(1):60–74. Available from: http://dx.doi.org/10.1080/10376178.2017.1282319
21. Keleekai NL, Schuster CA, Murray CL, King MA, Stahl BR, Labrozzi LJ, et al. Improving Nurses' Peripheral Intravenous Catheter Insertion Knowledge, Confidence, and Skills Using a Simulation-Based Blended Learning Program: A Randomized Trial. Simul Healthc. 2016;11(6):376–84.
22. Boztepe H, Terzioğlu F. Skill Assessment In Nursing Education. J Anatolia Nurs Heal Sci. 2012;16(1):57–64.
23. İşman A. Period Before Letter. Distance Education (1st Edition). 2005.
24. Midik Ö, Kartal M. Sımulatıon-Based Medıcal Educatıon. Marmara Med J. 2010;23(3):389–99.
25. Hansen MM. Are nursing students' clinical skills competency and self-confidence levels improved via video iPods? A randomized controlled pilot study. J Nurs Educ Pract. 2011;1(1):32–41.
26. Duncan I, Yarwood-Ross L, Haigh C. YouTube as a source of clinical skills education. Nurse Educ Today [Internet]. 2013;33(12):1576–80. Available from: http://dx.doi.org/10.1016/j.nedt.2012.12.013
27. Kelly M, Lyng C, McGrath M, Cannon G. A multi-method study to determine the effectiveness of, and student attitudes to, online instructional videos for teaching clinical nursing skills. Nurse Educ Today [Internet]. 2009;29(3):292–300. Available from: http://dx.doi.org/10.1016/j.nedt.2008.09.004
28. Jamison RJ, Hovancsek MT, Clochesy JM. A Pilot Study Assessing Simulation Using Two Simulation Methods for Teaching Intravenous Cannulation. Clin Simul Nurs [Internet]. 2006;2(1):e9–12. Available from: http://dx.doi.org/10.1016/j.ecns.2009.05.007
29. Esra Akın K, Derya Uzelli Y, GO C, Dilemek H, Arabaci LB. The Effects of Simulation on Nursing Students Psychomotor Skills. Int J Clin Ski. 2018;12(1):185–91.
30. Ayhan H, Çınar Fİ, Şahin SY, Demirtaş A, Özkan Y, Bakçek Ö, et al. Evaluation of The Students Opinion on Simulation Practices of Medical and Surgical Nursing Courses. Univ Heal Sci J Nurs. 2019;1(2):66–75.
31. Larue C, Pepin J, Allard É. Simulation in preparation or substitution for clinical placement: A systematic review of the literature. J Nurs Educ Pract. 2015;5(9):132–40.
32. Ross JG. Simulation and Psychomotor Skill Acquisition: A Review of the Literature. Clin Simul Nurs [Internet]. 2012;8(9):e429–35. Available from: http://dx.doi.org/10.1016/j.ecns.2011.04.004