Simulation Education: Its Effect on Nursing Student's Knowledge, Performance, and Satisfaction

Nagla Hamdi Kamal Khalil El-Meanawi [(1)], Hanan Ali Almanzalawi [(2)], Hayam Fathey Ahmed Eittah[(3)]
(1) Assistant professor of Medical- Surgical Nursing, Faculty of Nursing, University of Alexandria, Egypt - nagla_alternative@yahoo.com
(2) Lecturer of Medical- Surgical Nursing, Faculty of Nursing, University of Mansoura, Egypt - drhananali@yahoo.com
(3) Assistant professor of maternal and newborn health nursing, Faculty of Nursing, Menoufia University, Egypt - Hayameittah@yahoo.com

Abstract

Background: Simulation education is a bridge between classroom learning and real-life clinical experience. It helps in nursing competency before engaging in real situation with the patients to enhance patient safety. **Methods:** This study was quasi experimental design which utilized one group pretest posttest design. **Results:** the findings of current study showed better knowledge, practice, and satisfaction of nursing students after Simulated education than pre-education. **Conclusion:** Simulated education was effective in improving knowledge, satisfaction and enhancing competency of nursing students.

Keywords: Simulation, classroom learning, real-life, nursing competency

Introduction

Quality education is the base for developing competent health workers who are equipped with the knowledge, attitudes, and skills necessary to produce quality care. There is evidence, however, that health workers, including nurses, may not be adequately prepared to meet the needs of society, especially in developing countries (Com, 2016).

Simulation is potential tools that may help the nursing educators prepare the future nurses to practice in a real environment. Performance is defined as; the accomplishment of a given task measured against preset known standards of accuracy, completeness, cost, and speed (McGaghie et al., 2011)(Issenberg et al., 2005). A growing body of evidence signalize that inadequate nurse's preparation of knowledge and unsatisfactory skills mix are attached with negative outcome especially for critical ill patients. (AbdElbaky, 2018).

Simulation-based clinical education in nursing refers to a variety of activities using patient simulators, including devices, trained persons, lifelike virtual environments, and role-playing, not just handling mannequins. Additionally, it is an educational or training method that is used to "replace or amplify real experience with guided experiences".

Clinical simulation-defined by the National Council of State Boards of Nursing (NCSBN) as "an activity or event replicating clinical practice using scenarios, high-fidelity manikins, medium-fidelity manikins, standardized patients, role playing, skills stations, and computer-based critical thinking simulations"-has become an integral part of nursing education (Alexander et al., 2015)(AbdElbaky, 2018)

The advantages of simulation-based educational interventions include the ability to provide immediate feedback, repetitive practice learning, the ability to adjust the difficulty level, and opportunities to individualize learning (Alexander et al., 2015).

However, literature suggests that opportunities to practice nursing procedures on live patients are usually scarce during undergraduate programs (Powell-Cope et al., 2008)(Levett-Jones & Lapkin, 2014). This reality could have an impact on the development of competence of future newly qualified healthcare professionals, increasing the occurrence of mistakes and compromising patients' safety. (Cant & Cooper, 2010)(Lapkin et al., 2010).

Nursing educators should take into consideration that successful educational

strategies must focus on the equal development of the cognitive, psychomotor competence, and satisfaction. Therefore, an effective training strategy should always include elements that not only facilitate the acquisition of knowledge and skills, but also promote individuals' satisfaction (Ross, 2012) . Therefore, valid and reliable tools should be used to individually assess these three domains of competence. Rigorous and comprehensive assessment of knowledge, skills and self-efficacy can help to determine individuals' competence in invasive procedures such as vein puncture. (Lapkin & Levett-Jones, 2011). All simulation-based experiences require purposeful and systematic, yet flexible and cyclical planning. To achieve expected outcomes, the design anddevelopment of simulations should consider criteria that facilitate the effectiveness of simulation-based experiences (StandardsCommittee, 2016).

Simulation experiences offer the opportunity for accommodating diverse styles of learning not offered in the conventional clinical training. When students perceive satisfaction with the simulation experience, this realization may reschedule and increase their confidence and ability to care for actual patients(Moughrabi & Wallace, 2015)(Sowerby, 2015)

Significance of the study:

The use of new learning tools such as simulation has increased in nursing education along with today's developing technology. Applications performed with simulation provide a learning environment in which patients are provided with safer care in health care services and the environmental risk are minimized . (Shin & Kim, 2015). Simulation can offer researchers access to events that can otherwise not be directly observed, and in a safe and controlled environment. Considering the lack of Egyptian studies that addressed simulation subject in nursing specialty, this study was conducted to evaluate the effect of simulated education on knowledge, performance, and satisfaction among nursing student.

Aim of the Study

This study aimed to evaluate the effect of simulated education on knowledge, performance, and satisfaction among nursing students.

Study hypothesis:

The simulated education program was highly effective on the student's knowledge, performance, and satisfaction.

Methods:

Study design:

A quasi-experimental design, (one group pre/ post-test design) was used to conduct this study to rigorously assess the effectiveness of the educational intervention, and the effects of simulation after 3 months as a follow up assessment.

Sampling and setting:

A purposive sample was used to select 65 undergraduate nursing students. Aged (19-21) years. The study took place in faculty of nursing Mansoura University during the first semester in the academic year 2018-2019. The sample was selected from first nursing level who did not exposed to training on the selected procedures.

Inclusion Criteria:

Participants' eligibility criteria were: (1) First level of undergraduate nursing students (2) Not exposed to previous training on the selected procedures. (3) Willing to participate on the study. (4) Compliance of attending training periods.

Exclusion Criteria:

(1) Exposed to previous training on the selected procedures.

(2) Not compliance of attending training periods.

Sample size

Sample size 65 nursing students participated in the study. The number of the sample was calculated according to **Chohen (1988)** (*Statistical Power Analysis for the*

Behavioral Sciences - Jacob Cohen - Google Books, n.d.) equation

$n = = \frac{Z^2 XPXQ}{D^2}$; Where: n: Calculated sample size, Z: the z-value for the selected level of confidence= 1.96

P: Estimated prevalence in the population- 50%, Q: (1-P) = 50%, D: the maximum acceptable error (precision level) = 0.05.

In sample calculation, the repeated measures ANOVA model was considered, with a significance level of 5%, a test power of 80%, and an effect size equal to 0.20. the calculation resulted in sample size 65 students. (Cohen, 1988)

Tools of the study: Three tools were used for collecting data in this study.

Tool I. Student knowledge assessment questionnaire included: Structured multiple-choice questionnaire (pre/posttest) developed by the researchers after reviewing the related literatures. This tool used to evaluate knowledge level of the students about the selected procedures: measuring arterial blood pressure, intramuscular injection, intravenous cannulation, and inserting female urinary female catheterization. Questions were developed to test the following items: 1. Definitions, indications, complications, for each one of these procedures measuring arterial blood pressure, intramuscular injection, intravenous cannulation and inserting female urinary catheter (10 questions). 2. the most common items should be followed during the application of the procedures as how to prepare equipment (10 questions). 3. Students role during the application of procedures. The questionnaire scorings system for each correct answer scored (1) and the wrong one scored (zero). If the score less than 60% it considered unsatisfactory, but if it is 60% or more it considered satisfactory.

Tool II. Student practice check list: developed after reviewing the related literatures (17) This tool consisted of standardized steps that should be followed during the application of the previous procedures, scoring system of the practice check list was: correctly done (scored 2), in-complete done (scored 1), and not done (scored 0). to assess levels of competencies in which students engage with varying degrees of frequency and skills among them. If the students practice score was less than 60% from the total it considered unsatisfactory but if it is 60% or more it considered satisfactory.

Tool III. Students' satisfaction scale: Students' satisfaction with the clinical experience was assessed using a scale developed by the National League for nursing (2010).[18] It consists of five items that was originally designed to measure student's satisfaction with the simulation activity. Each item was scored using a 5-point Likert scale. Strongly disagree scored 1, disagree scored 2, undecided scored 3, agree scored 4, while strongly agree scored 5. Total score ranged from 5 to 25, the higher score indicates the higher satisfaction.

Ethical considerations:

Primary approval was obtained from the research ethic committee in the nursing college to carry out the study, with an explanation of the aim and the importance of the study to the centers' authorities. Also, written approval permission was obtained from the administrator of target setting.

The students were required to provide written informed consent before study enrollment. The objectives and the nature of the study were explained to the students. The researchers emphasized that participation in the study was voluntary; anonymity and confidentiality were assured.

Tool validity and reliability

Tools were submitted to three experts in the field of nursing education, maternity, and medical surgical nursing; they performed an evaluation of the conceptual and semantic equivalence of the questionnaire to verify the content validity, clarity, and comprehension of a questionnaire. All modifications were carried

out according to the experts' judgment. Test–retest reliability was determined to test the internal consistency of the tools. This involves the administration of the same instruments to the same participants under similar conditions on two or more occasions. Scores from repeated testing were compared using Cronbach's alpha coefficient method. This was found to be R=0.98.

Pilot study

A pilot study was carried out after developing the tools and before starting the data collection phase. The pilot study was carried out on 10% of the sample (7 students) who were not included in the main study sample. Based on the results of the pilot study, rephrasing of some questions was performed to ensure clarity of the questions and so that they could be understood easily by the participants.

Procedures:

Preparation phase:

The selected procedures were measuring arterial blood pressure, intramuscular injection, intravenous cannulation, and inserting female urinary female catheterization, these procedures are selected based on the available simulators for them (adult ACLS Manikin), and (Apollo Manikin) to provide a chance for competent practice. This is often done in a lecture theatre, with large groups of students (up to 60 at the time) and using either PowerPoint presentations, video demonstrations. Live demonstrations were performed by the lecturer in a high-fidelity simulator in the simulation labe, students can practice the procedure under direct supervision. the student's achievement evaluated before and after attending the simulation-based program.

The study was conducted within the period from July 2019 to November 2019. Researchers developed the simulated education program based on relevant literature related to applying Evidence Based Practice during previous procedure. Permission from the faculty of nursing to conduct the study was obtained after explanation of the aim of the study. Educational methods: PowerPoint presentation, prepared by the researchers after reviewing the related literatures, and WHO standards.

It includes definition, purposes, and indications, steps used during applying the most used procedure. The preventive measures that should be followed during their application to prevent its complications and infection. The checklist used for these procedures were adopted from WHO standards. Procedure manual was developed by the researchers included the previously mentioned items that presented in the power point and provided to the participants before the education program.

Videos present the ideal procedure steps and the application of the various EBP. Simulation manikin(adult ACLS Manikin), and (Apollo Manikin) provides the opportunity to demonstrate and re-demonstrate measuring arterial blood pressure, Intramuscular injection, as well as intravenous cannulation, and insertion of urinary catheter according to EBP.

Implementation phase:

Educational program was carried out by:

1) Arranging the subgroup: For better understanding and performance, the total sample was divided into 6 groups (five included 10 students and one group included 15 students).
2) A pre-test questionnaire (tool 1) was used at beginning of study to assess their knowledge level before beginning of the study to be used as base line data to be compared with the post-test.
3) Theoretical explanation was done at the class. Theoretical explanation was done on 8 sessions for each group of students to cover the previously mentioned items that illustrated in the procedure manual. The procedure manual was handed for every student. The duration of each session was 2 hours. Each session divided as 20 minutes for discussion, 30 minutes for the theoretical explanation using the PowerPoint presentation, then 30 minutes of discussion and video presentation of the related procedure.

Scenario:

The simulation training did start with a brief overview of the simulation-based training and a detailed orientation to the simulation environment. The scenario was explained and clarified to each group of the students. First the researcher starts to apply the procedures on the manikins then allow the students to reapply the steps of each procedure while, the researcher observe the performance of each student and recorded it in the check list in order to evaluate the competency of each student. The simulation training was followed by a debriefing of self-

review via comments on the individual's performance by the investigator.

Evaluation phase:

After ending of the simulated educational program, evaluation of the student's knowledge was done using the posttest questionnaire immediately after ending of the educational program and follow up evaluation was done after three months. The result of it was compared with the pre- test questionnaire (tool 1). Evaluating the effect of the simulated educational program on student's performance and satisfaction during applying the procedures were done using (tool 2 and 3) immediately after ending of the educational program, then follow up was done after three months.

Statistical analysis:

Data were tabulated, coded, and transformed into a specially designed form to be suitable for computer entry process. Data were entered and analyzed using SPSS, version 22. Graphics were calculated using Excel program. Quantitative data were expressed as mean and SD and analyzed using a t test for comparison of the same group on pretest and posttest. Qualitative data were expressed as number and percentage. These were analyzed using the $\chi 2$ test for a 2×2 table. Pearson correlation was used to explain the relationship between normally distributed quantitative variables. A P value at 0.05 was used to determine the significance as follows:

- P value more than 0.05 was considered to be statistically insignificant.
- P value less than or equal to 0.05 was considered to be statistically significant.
- P value more than or equal to 0.001 was considered to be highly statistically significant.

Results

Table (1): Frequency distribution of student's knowledge level related to the procedures (N=65)

Items	Unsatisfactory (< 60%)		Satisfactory (> 60%)		Mean ± SD
	N	%	N	%	
Pre educational knowledge (baseline data)	**65**	**100**	**0**	**0**	**15.91+ 6.66**
Post educational knowledge	**8**	**12.3**	**57**	**87.7**	**38.55 + 11.14**
Follow up knowledge	**10**	**15.4**	**55**	**84.6**	**39.48+ 9.83**
F	**130.9**				
P	**0.000****				

Table (1): Represents that all students (100 %) had unsatisfactory knowledge about the procedures before receiving the simulated education. But after giving it, their level of knowledge improved to satisfactory level (87.7%) and at follow up program to (84.6).

Table (2): Frequency distribution of student's application during procedures (N=65).

Item	Pre program		Post program		Follow up		F	P
	Unsatisfactory N Less than 60%	Satisfactory N =more than 60%	Unsatisfactory N= Less than 60%	Satisfactory N =more than 60%	Unsatisfactory N= Less than 60%	Satisfactory N = more than 60%		
Measuring arterial blood pressure	45 (69.2)	20 (30.8)	0	65 (100)	4 (6.2)	61 (93.8)	107.3	0.000
Mean+_SD	11.82+7.46		11.82+7.46		11.82+7.46			
Intramuscular injection	55 (84.6)	10 (15.4)	7 (10.8)	58 (89.2)	6 (9.2)	59 (90.8)	190.1	0.000
Mean + SD	9.48 + 3.34		15.9 + 2.19		15.92+2.29			
Intravenous cannulation	57 (87.7)	8 (12.3)	3 (4.6)	62 (95.4)	9 (13.8)	56 (86.2)	127.24	0.000
Mean+ SD	11.18 + 3.42		18.97 + 2.43		18.28 + 3.28			
Insertion of urinary catheter	50 (76.9)	15 (23.1)	3 (4.6)	62 (95.4)	8 (12.3)	57 (87.7)	80.49	0.000
Mean+ SD	16.31 + 9.64		31.80 + 5.50		30.32 + 7.33			

Table (2): Shows only (30.8 %) of the students follow the steps during measuring arterial blood pressure, (23.1%), and only (12.3) of the students in inserting female urinary catheter and

intravenous cannulation. But after receiving the simulated education the majority of the students perform the previously mentioned procedure in satisfactory way at the post simulated education and follow up phase in high percentage there were statistically significant difference between the three different phases presented by P value (0.000).

Table (3): Frequency distribution of student's satisfaction level of the post and follow up evaluation related to the procedures (N=65)

Satisfaction scale items	Post program				Follow up				F	P
	Unsatisfactory (< 60%)		Satisfactory (≥ 60%)		Unsatisfactory (< 60%)		Satisfactory (≥ 60%)			
	N	%	N	%	N	%	N	%		
The teaching methods used in simulation were helpful and effective	3	4.6%	62	95%	2	3.1%	63	96.9%		
Mean + SD	19.2+2.11				19.99+0.82				354.1	0.000**
Simulation provided me with a variety of learning materials and activities to promote my learning	2	3.1%	63	96.9%	1	1.5%	64	98.5%		
Mean + SD	19.99+0.82				15.88+0.99				629.1	0.000**
I enjoyed how my instructor taught by simulation	3	4.6%	62	95%	4	6.2%	61	93.8%		
Mean + SD	19.2+2.11				7.75+0.96				354.1	0.000**
The teaching material used in the simulation was motivating and helped me to learn	4	6.2%	61	93.8%	4	6.2%	61	93.8%		
Mean + SD	7.75+0.96				7.75+0.96				590.4	0.000**
The way my instructor taught the simulation was suitable to the way I learn	3	4.6%	62	95%	2	3.1%	63	96.9%		
Mean + SD	19.2+2.11				19.99+0.82				629.1	0.000**

Table 3: Demonstrates the Frequency distribution of student's satisfaction level of the post and follow up evaluation related to the procedures. When students asked about, I enjoyed how my instructor taught the clinical training, represents that all students (95%), (93.8%) had satisfactory level, after receiving the simulated education, and at follow up program evaluation.

Table (4): Correlation between knowledge, procedural practice, and satisfaction among the students (N= 65)

Variable	Knowledge	Procedural practice	Performance
Knowledge	1	0.291 0.133	0.627 0.61
procedure practice	-	1	0.261 0.179
Satisfaction	-	-	1

Table (4): Revealed that, there were a positive correlation between knowledge, procedural practice and student's performance after delivering of the simulated education about the procedures.

Discussion

Simulation education allows for the development of students cognitive, affective, and psychomotor skills in a realistic replication of a health care setting. The aim of this study was to evaluate the effect of simulated education on knowledge, performance, and satisfaction among nursing students. The finding of this study revealed that the students achieved higher scores after simulation program than preprogram; accordingly, this finding matched to the proposed study hypothesis.

The data of current study showed the range of students age was from 19-21 years and 80% of sample was female students. The findings revealed the lecture and clinical simulation enhance the acquisition of theoretical concepts about arterial blood pressure, intramuscular injection, intravenous cannulation and inserting female urinary catheter. This was consistent with prior research studies carried out by(Gomes Silva et al., 2020) (Nuraini et al., 2015) that had evaluated the effect of simulation based education on nursing students' practical achievements and indicated a higher clinical performance post simulation.

Additionally, (Beal et al., 2017) and (McCoy et al., 2011) revealed that; clinical simulation was effective strategy for improving practical performance but have little effect on knowledge acquisition when compared with other educational methods.

Regarding the student knowledge and practice the finding of current study showed highly statistically significant difference between the three different phases (pre-program, post-program and follow up of simulated education program) at P value of (0.000). in the congruence of this finding was (Cerra et al.,2018) who stated that simulation training had higher effects sizes on nursing students' knowledge and performance.

The finding of present study showed great satisfaction among students in post simulation program and after 3 month of follow up than before the program , in the same the line of this finding was (Zapko et al., 2018) who revealed that students were satisfied with the experience of simulated education, felt confident in their practice, and felt the simulations were based on good educational practices and were crucial for learning. Additionally (Marzouk, 2015) who studied Effectiveness of simulated delivery room classes on practical achievement and satisfaction of maternity nursing students demonstrated that the simulation classes is an effective training method for enhancing the students' practical achievement and satisfaction. Also the study carried by (Saied, 2017) revealed that Studentswere satisfied with the simulation experience and their self-confident scores were higher after the simulation session. Furthermore Mattson Hall, (2013) who studied Effects of High Fidelity Simulation on Knowledge Acquisition, Self-Confidence, and Satisfaction with Baccalaureate Nursing Students Using the Solomon-Four Research Design; stated that the students were very satisfied with the simulation learning activity

The result of current study Revealed a positive correlation between knowledge, student'sperformance after delivering of the simulated education program. in same line of this finding (AbdElbaky, 2018) stated that, there were apositive correlation between EBP knowledge, procedural intervention and general performanceafter the simulation education program.

Conclusion:

Simulated education is effective in improving nursing student's knowledge, satisfaction, and enhancing competency ofnursing students.

Recommendation:

- Multiple instructional strategies besides simulation are recommended to maintain nursing students' learning interests to achieve optimal learning outcomes of the course across a semester.
- Further research on large sample size to enhance external validity

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