RESEARCH ARTICLE

Use of simulation from high fidelity to low fidelity in teaching of safe-medication practices

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Abstract

Objective: To evaluate the effects of simulation techniques on learning outcomes in the teaching of safe drug applications to first year nursing students.

Method: The semi-experimental study was conducted from February to April 2017, and comprised nursing students of Acibadem Mehmet Ali Aydinlar University. This student satisfaction and self-confidence in learning scale, medication practice via oral route checklist, and pre- and post-test for safe drug application knowledge Assessment were used for data collection. Following the theoretical lectures, case studies, task trainer practices and scenario with standardised patient were carried out. Baseline knowledge, during-the-scenario performanceand post-scenario level of student's satisfaction and self-confidence were evaluated. Data was analysed using SPSS 18.

Results: Of the 58 subjects, 51(87.9%) were female. The overall mean age of the sample was 20.69±1.02 years. There was a statistically significant difference between students' knowledge levels before and after the scenario ($p<0.05$). Mean performance scoreon safe medication practice was 65.70±5.83. A significant weak positive correlation was found between the students' scores on satisfaction with the simulation and knowledge levels as well as the performance and self-confidence scores ($p<0.05$ each). Also, there was a strong correlation between the scores on self-confidence scale and the knowledge levels ($p<0.01$).

Conclusion: Simulation had a positive effect on learning outcomes.

Keywords: Simulation, Nursing education, Skill teaching, Safemedication. (JPMA 69: 195; 2019)

Introduction

Medication practices are one of the main aspects of patient safety and have a particular importance among nursing interventions due to their legal and ethical responsibilities. A report titled 'Preventing Medication Errors' stated that 1.5 million people are harmed each year due to medication errors and these errors lead to an increase in additional medical expenses and a decrease in efficiency.[1]

Since the first year of nursing education curriculum, the target for students is to gain competence through theoretical and practical trainings on the role of nurses in safe-medication practices. Clinical teaching is quite important for the students to transform the theoretical knowledge they have received about medication practices into desired behaviour, and implement these safe practices. While clinical teaching prepares the student for the professional role, but it brings certain risks in the teaching of interventional practices that require advanced competence such as medication treatment. In the teaching of medication practicesin nursing programmes, the application is carried out with models as well as the traditional theoretical training and students are confronted with real situations of medication safety only during the clinical practice. This poses a risk for patient safety and it can negatively affect the learning experience of students.[1,2,3]

One of the important points in the reduction and prevention of medication practice errors is to enable nursing students who are preparing for the profession to express the knowledge and experience in relation to medication practices, ensure that they review the

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education received on medication practice, and identify the areas that they find insufficient.[2] New and innovative teaching methods are needed in order to achieve this.

Simulation-based teaching is used as an important teaching-learning strategy in the development of nursing clinical skills, integration of theory and practice and elimination of negative experiences of the student.[4] In studies, it has been shown that simulation-based learning improves the students' skills development, satisfaction and self-confidence.[5,6]

Simulation is defined as a training technique that changes or develops real experiences with guided practices in a completely participatory manner within a naturality created by repeating or recalling the existing aspects of the real world.[7] In simulation-based training,simulation techniques in low, medium and high levels of fidelity are used. In the development of psychomotor skills, paper-based simulation (case studies), task trainers are used aslow-fidelity simulation practices. Non-interactive computer-controlled simulators are used in medium-fidelity practices. Standardised (simulated) patients and high-level simulators that are computer-controlled and interactive are used in high-fidelity practices.[4,5,7]

In the teaching of medication practice, a different fidelity is used for simulation practices. However in literature or in standard procedures, there is no recommendation on how to use different levels of simulation practices in the trainings of safe medication.The current study was planned to evaluate the effects of simulation techniques performed in stages from low to high level of fidelity on learning outcomes.

Subjects and Method

The semi-experimental study was conducted from February to April 2017, and comprised first year students enrolled for Basic Principles and Practices in nursing course in the nursing department of Acibadem Mehmet Ali Aydinlar University. Approval was obtained from the institutional ethics committee and written consentwas taken from all the subjects.

The study was conducted in four steps, moving forward from low to high fidelity (Figure).

Theoretical training was the first step and the subjects were provided with theoretical training on safe medication practices in the direction of course curriculum. The second step was low-level fidelity during which the subjects were asked to make planning on paper by giving cases related to safe medication practices and involved taking physician's order, preparation of medication card and calculation of medication dose, and prepare laboratory

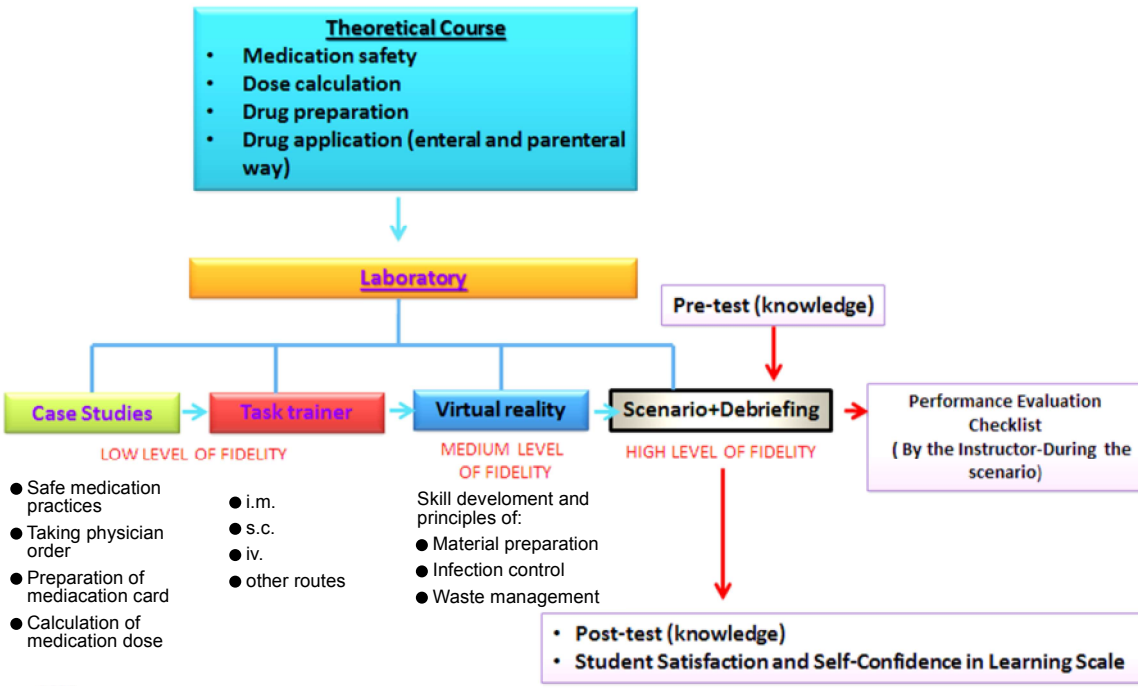

Figure: Study Design.

stations. Later on, skill training was carried out with task trainers of different medication practice routes, like intravenous (IV), intramuscular (IM) and subcutaneous (SC), and the students were encouraged to grasp the logical reasons for implementation steps with the help of questions in each station.

Medium-level fidelity was the third step where students were taught to perform vascular access with a screen-based virtual simulation programme. The target was to teach the principles of material preparation, infection control and waste management in medication practices as well as the vascular access intervention skill.

The final step was high-level fidelity at which stage, scenario-based simulation practice was performed with a standardised patient. A two target-driven scenario was implemented in accordance with qualifications of the student.

The student was asked to perform a medication treatment via oral route by adhering to the six basic principles of safe medication practice (correct patient, correct dosage, correct medication, correct route, correct time, correct record) and by establishing an effective communication with the patient.

The scenario was performed with a standardised patient with 3 different clinical conditions in the inpatient service. Similar name, having an allergy and presence of different doses and forms of the same medication on the inpatient floor were identified as a critical event in the designed clinical situation. Before the scenario, training was given to patients for the scenario flow and tips. The duration of scenario lasted 10 minutes and debriefing session lasted 30 minutes. Students were taken to the scenario in sequence according to the time flow chart and in the scenario the role was given as a nurse treating three patients.

Prior to the scenario application, a pre-test was conducted to assess the level of knowledge the student had about safe medication practices. Also, during the scenario application, student's performance was evaluated by an observer using the "Medication Practice via Oral Route Checklist" which is prepared by authors in guidance by literatüre.[8,9] A post-test was conducted after the debriefing session. Students were then asked to fill the Student Satisfaction and Self-Confidence in Learning Scale.

Pre-test and Post-test for Safe Drug Application Knowledge Assessment scale consisted of 11 fill-in-the-blanks and open-ended questions for assessing the level of knowledge on safe medication practices. Questions have been prepared on the basis of six 'correct' principles on safe medication practice.The test corresponds to a total of 40 points.

Medication Practice via Oral Route Checklist is a 29-item checklist that evaluates the student's performance on scenario application. Lowest score received from the performance is 29 and the highest score is 87. An average score of 58 points is considered successful.

Student Satisfaction and Self-Confidence in Learning Scale has 13 items.[10] Turkish validity and reliability study of the scale was performed in 2017.[11] The total number of items decreased to 12 during the adaptation of the scale to Turkish language. It is a 5-point Likert type scale and consists of 'Simulation Activity' and 'Self-Confidence in Learning' subheadings. Simulation activity subhead has 5 items, while self-confidence in learning has 7 items and there are no negative expressions. Scale's Cronbach alpha value is 0.85 for 'Simulation Activity', 0.77 for 'Self-Confidence in Learning'. Overall value is 0.89. The sum of scale's sub-dimensions does not provide its total score. Scale scores are obtained by dividing the sum of the sub-dimensions by the number of items.Student satisfaction in learning and self-confidence also increase as the total score received from the scale increases.[11]

Data was analysed using SPSS18. The normality of data was tested using Kolmogorov-Smirnov test. Descriptive statistics were presented using the arithmetic mean and standard deviation, range, frequency and percentage. The results obtained were compared using student's t test and Pearson correlation test. $P<0.05$ was considered statistically significant.

Results

Of the 58 subjects, 51(87.9%) were female. The overall mean age of the sample was 20.69±1.02 years. The pre-test total score of students was 30.60±5.89 and the mean score of the post-test was 31.70±4.30 ($p=0.046$). The mean performance score of students on safe medication practice was 65.70±5.83 (Table-1). Students' mean satisfaction score was 4.29±0.47. There was a statistically non-significant relationship of low-level positive correlation with mean performance score ($p>0.05$).

A significant weak positive correlation was found between the students' scores on satisfaction with the simulation

Table-1: Descriptives (n=58).

Tools	Mean ± SD	min-max	Test*
Pretest	30.60 ± 5.89	10.5-39.5 (0-40)	t= -2.041 *p*= .046
Post test	31.70 ± 4.30	21.5-39 (0-40)	
Performance evaluation	65.70 ± 5.83	49-79 (29-87)	
Satisfaction	4.29 ± 0.47	3.2-5 (1-5)	
Self-confidence	4.18± 0.49	2.7-5 (1-5)	

* Student t test p<0.05.

Table-2: Correlation of Student Scores.

	Pre-test	Post-test	Performance	Satisfaction	Self confidence
Pre-test	1				
Post-test	**0.716****	1			
Performance	**0.488****	**0.504****	1		
Satisfaction	0.271*	0.259*	0.212	1	
Self confidence	0.203	0.161	0.318*	**0.568****	1

Pearson correlation *p<0.05 **p<0.01

and knowledge levels as well as on self-confidence scale (p<0.05 each). Strong correlation (p<0.01) between the scores on self-confidence scale and the knowledge levels was also found (Table-2).

Discussion

Both pre- and post-test total scores of the students were found to be above average. This condition can be explained by the influence of theoretical training given before the scenario practice. An increase in the minimum score received in the post-test was seen when compared with the pre-test. A statistically significant difference and also a positive correlation at a strong level were found between pre-test and post-test values. Simulation seems to have a positive effect on learning. In parallel to our findings, a study that investigated the effect of simulation application on knowledge and practice of fourth year nursing students also determined that the simulation provided a significant increase in the knowledge of students compared to didactic (slide, notation) narration.[12] This condition can be explained with the fact that in high fidelity,practice of simulation provides a rich learning experience.

Students' mean performance score on the checklist was high and students clearly benefitted from the practice. A statistically significant relationship in low-level positive correlation was found between mean pre-test score and mean performance score. A statistically significant relationship in medium level positive correlation was found between mean post-test score and mean performance score. These results are valuable in terms of showing us the effect of different levels of simulation practices on learning.

The increase in students' mean post-test scores, and high scores they received from the performance evaluation support that practice performed in low fidelity with training and partial task simulators, high-fidelity environment and scenario application are effective methods. The realisation of full learning in nursing education depends on the integration of theoretical training and practice. In low fidelity, simulation practices support the development of students' psychomotor skills.[13,14] In addition, high fidelity simulation trainings provide a higher level of learning experience where cognitive, emotional and psychomotor learning goals are integrated and ensure adaptation to the clinic.

Students' satisfaction with the simulation activity was evaluated as high. There was no statistically significant relationship between students' mean performance score during high-fidelity simulation application and satisfaction in learning score. In contrast to our results, a study that investigated the effect of using low and high fidelity model in simulation application on satisfaction in learning, stated that satisfaction was higher in the use of high-fidelity model during simulation.[15]

When students' self-confidence was examined after the simulation application, their mean score of self-confidence in learning score was high. While it has been found that there is a statistically significant relationship in medium-level positive correlation between students' mean self-confidence score and mean simulation performance score (p<0.05), a statistically significant relationship in medium-level positive correlation was found with satisfaction in learning (p<0.001). This finding indicates that the simulation-based training planned from low to high level of fidelity positively affected the performance of the student and good performance leads to an increase in student's satisfaction in learning and self-confidence.

According to a 2013 study, student satisfaction expresses students' perceptions of a course and their experiences in the study programme.[16] High level of satisfaction leads

to higher level of permanence, continuity of learning and increase in motivation. In some descriptive studies designed to explore students' perceptions of the simulation experience, the satisfaction and self-confidence of students who were engaged in simulation for one and two consecutive years were studied. In terms of overall satisfaction, the satisfaction for students of both years was the same but the second-year students felt more confident in their performance.[17,18] Also, a study on students at the beginner's level reported that students had high satisfaction in learning and self-confidence in simulation with medium level of fidelity.[19] Based on this result, it is seen that application of simulation in the appropriate level of fidelity affects the satisfaction and self-confidence of the beginner's level students.

A study investigating the relevant factors between nursing students' satisfaction and self-confidence with high-fidelity simulation showed that design features, especially explicitly stated objectives,had a significant correlation with student satisfaction and self-confidence.[20] Another study determined that self-confidence of nursing students had increased after the high-fidelity simulation practice in learning electrocardiography (ECG) concepts.[21] In another study supporting this, multiple medium and high-fidelity simulation practice related with critical care applications were effective in increasing the self-confidence and competence of nursing students.[22]

On the contrary, in a study conducted with midwifery students, satisfaction in learning and self-efficacy levels were found to be low in simulation-based teaching.[23] Another study emphasised that in the simulation applications aimed at developing safe nursing practices of beginner's level nursing students, the students had shown a general improvement in terms of self-confidence and competence but this self-confidence could not be transferred from the laboratory to the clinical setting.[24]

Self-confidence as an attitude towards the individual is a form of self-perception whether to learn any subject based on the student's learning background. This characteristic of the student is affected from the past learning experiences, teachers and other people around during these experiences (parent, friend, sibling, etc.), attitude towards oneself and judgments.[25] While in nursing education, realisation of safe medication practices with complete participatory performance with simulation applications at different levels of fidelity positively influence the student's self-confidence, but it also reduces the risk of error on the patient.

Scenario-based simulation is a very new method for nursing education in the country and both equipment and human resources are limited. Also, the study is based on a single centre and on a single batch of first year students. The results, as such, cannot be generalised.

Conclusion

Students' knowledge levels and performances were found to be related with each other.A high level of knowledge and a successful performance during the scenario made students feel confident, which affects the level of satisfaction with the simulation experience positively.

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