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Research Article

Examining Knowledge, Skill, Stress, Satisfaction, and Self-Confidence Levels of Nursing Students in Three Different Simulation Modalities

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ABSTRACT

Purpose: The aim of this study was to compare the effect of different simulation modalities on knowledge, skill, stress, satisfaction, and self-confidence levels of students receiving undergraduate education in three nursing schools.
Method: This was an experimental study. Students applied the scenario of "Respiratory Sounds Assessment" which was prepared according to three different simulation modalities. In the study, the standardized patient, high-fidelity simulation, and partial task trainer were used as simulation modalities.
Results: An increase was observed in postpractice knowledge levels of the three groups which had similar knowledge levels before the practice. Virtual Analog Scale stress levels of the students in the standardized patient group were higher than those of others. The students' mean scores of satisfaction in learning were higher in the standardized patient group. The students in the partial task trainer group had lower scores of self-confidence in learning. Skill scores of the students were lower in the standardized patient practice than those in others.
Conclusion: Simulation-based experiences give students the opportunity of experiencing situations they may experience in the actual practice beforehand. Therefore, this may increase their performance in real practices, as reality increases in the standardized patient group.

Introduction

Modality is a term used for expressing simulation types as a part of the efficiency of simulation. Partial task trainer, standardized patient, task trainer, and manikin-based, computer-based, virtual reality, and hybrid simulation could be given as examples to modality [1].

Different modalities used in simulation-based practices have different advantages or difficulties during practice. Selection of modality and an appropriate planning of simulation determine the features that significantly change the experience of learning [2,3].

The standardized patient is a person trained for portraying a patient or another person in a scenario for practice or assessment [1]. In simulations that are performed with the standardized patient, students are expected to display appropriate communication skills, conduct interviews, make physical assessments, and design care plans while interacting with patients. Students' experience of a standardized patient simulation before the clinic gives them the opportunity of developing their interpersonal communication skills in a safe and controlled setting. The use of standardized patient enables students to develop their knowledge, skills, and critical thinking holistically [4]. It also increases

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the skill of empathy, adds a deeper point of view to the patient experience, and facilitates patient-oriented care in nursing practices [5]. Possible difficulties include high cost of this simulation modality and also the influence of standardized patient on the configuration and implementation of the process as planned [4]. Nevertheless, "standardized patient" was stated to be the most commonly used (68.0%) one in a study examining the education of 408 nursing programs [6].

High-fidelity simulation is a simulation method using a computer-based full-body manikin that is programmed for giving realistic physiological responses to students' practices [4]. In high-fidelity simulation, scenarios and practices comprehensively focus on viewing every patient and incident within an extensive framework rather than focusing on one problem [7]. It has been indicated that high-fidelity simulation develops self-confidence, self-efficacy, sense of satisfaction, clinical thinking, clinical competence, clinical judgment, and decision-making [8–12]. In addition, this method is convenient for repetitive usages. The negative aspect of this technology is that it is expensive [4].

Partial task trainer is a manikin or equipment that represents some anatomical parts of the human body and is designed for learning basic psychomotor skills. These models with low technological features are used for the training of psychomotor skills, assessment, or identification of skills by separating complex skills into parts. Using these models enables students to be competent before using their practice skills on real patients [4].

As simulation technology has developed rapidly today, investments in this technology have increased in undergraduate nursing programs in Turkey and the world [13–15]. Nevertheless, if high-fidelity simulations are considered to be costly, it is a fact that many universities, especially state universities, cannot budget for buying these models. In this case, it can be predicted that there will be a difference between the knowledge and skill competencies of nursing students who graduate from schools with and without high-fidelity simulators. For this reason, it becomes obligatory for educators in schools without a high-fidelity simulator to add less costly, innovative learning approaches to their education.

The use of innovative practices and techniques in nursing education helps students to actively participate in the learning process and helps them to develop cognitive, psychomotor, and attitudinal behaviors [16]. Today, the cost increase in the health-care system, patient safety, and ethical and legal sanctions has limited the acquisition of many skills in health education [17]. Developing clinical skills directly on the patient causes students to experience anxiety due to fear of harming the patient and making mistakes. Anxiety, on the other hand, prevents students from adequately reflecting their knowledge and skills on patient care in the clinical field. It is extremely important to ensure that the students perform clinical practices by paying attention to the values and rights of the patients to ensure patient safety [18].

Self-confidence is important for both nursing students and professional nurses. Because nursing practitioners have to give confidence, there is a need to clarify the concept of confidence. Being self-confident will allow more autonomous practice and ultimately contribute to both nurse and patient satisfaction [19]. Nursing students gaining self-confidence and satisfaction before graduation enables them to achieve satisfaction in their professional lives [8,19]. In the theoretical framework of Jeffries/NLN Simulation Theory, self-confidence and satisfaction are among the most important concepts [20]. Previous studies show that using simulation modalities increases students' satisfaction and self-confidence [21,22].

Thus, the study aims to compare the effect of different simulation modalities on knowledge, skill, stress, satisfaction, and self-confidence levels of nursing students receiving education in three nursing schools with the same curricula.

Method

Study Design

The study was conducted in the randomized controlled experimental study design.

Participants

The population of the study consisted of a total of 266 undergraduates receiving the course of Internal Medicine Nursing in three nursing schools in the academic year of 2018-2019. The curriculums of three nursing schools were the same. The data were collected in the 4th week after the beginning of the academic year. Second-grade students who volunteered to participate in the study from each school were selected and included in the randomization list. Considering the school with the lowest number of students, at least 45 of the second-grade students of each school were selected. The students to participate in the study were determined according to the randomization checklist prepared in the Microsoft Excel 2016. All three schools benefit from different simulation modalities in their educational practices. Students were grouped according to the simulation modalities that their schools possess. Students selected in each school applied a single modality. A priori power analysis was not performed.

Study Tools

The data were collected using the student knowledge test, skill checklist, Virtual Analog Scale (VAS) stress level, and Student Satisfaction and Self-Confidence in Learning Scale.

Knowledge Test

This test was created by the researchers. The knowledge test consisted of 10 questions including instructional objectives of the course of respiratory system assessment and questioning instructional outputs in the relevant scenario prepared. Each of the 10 questions asked to the students in the knowledge test was 1 point. Students who got 1 point for each right answer did not lose points for wrong answers.

Skill Checklist

The checklist prepared by the researchers according to the literature to assess the skills of the students during practice was used. The skill checklist consisted of 10 steps and the Likert-type score was assesseed. The students got 2 points for the complete step and 1 point for the missing step. They did not get any points from the step they did not do.

VAS Stress Level

The VAS was used to visualize the stress levels of the students before and after practice. In the scale, they were expected to assess themselves from 1 (I am calm right now) to 10 (I am too nervous right now). The students marked on the visual scale how they felt.

Student Satisfaction and Self-Confidence in Learning Scale

The psychometric measurements of the scales developed by Jeffries [20] for the purpose of assessing student satisfaction and

self-confidence in simulation-based practices were performed by Franklin et al. [22] in 2014. Turkish validity and reliability study of the scale was performed by Unver et al. [23]. Permission from the author who made the Turkish validity and reliability of the scale was obtained to use in the study. Student Satisfaction and Self-Confidence in Learning Scale is a Likert-type scale (1 point: Strongly Disagree, 5 points: Strongly Agree). It was evaluated by calculating students' mean scores.

Data Collection

In each school, the students were informed about the scenario application after the course of respiratory system assessment by their own instructors. The student knowledge test and VAS stress levels were applied to students after informing them. During the scenario, students were evaluated with the skill checklist.

When the scenario ended, the student knowledge test, VAS stress level, and Student Satisfaction and Self-Confidence in Learning Scale were applied.

Procedure

In the study, the subject of the simulation scenario was determined as the evaluation of respiratory sounds. Relevant theoretical practices of the students were completed before the study. The students were provided basic skill trainings (identifying listening areas, discerning normal and pathological sounds) concerning respiratory sounds.

The scenario was prepared based on the criteria covered by the International Nursing Association for Clinical Simulation and Learning design standard [1].

At first, a needs analysis was performed within the scope of this standard. The reason to choose this scenario was students.' frequently encountering patients with respiratory distress in clinical areas. Measurable objectives when determining the subject were determined as patient safety, communication, and listening respiratory sounds. While preparing the scenario, it was taken into consideration for it to be suitable for three modalities and to meet the learning objectives of the students. The pilot scheme was carried out before the scenario was applied. Before the start of the scenario, the students were briefed about it. The scenarios started with the student entering the patient room and evaluating the patient's respiratory system. The scenario ended with a debriefing (Table 1).

Scenario Application

The scenarios were conducted according to three different simulation modalities as standardized patient, high-fidelity manikin, and partial task trainer. Before the scenario application, the researchers agreed to ensure the standard on scenario application and data collection steps. The students were included in the scenarios individually, and they were prevented from watching each other during the scenario application. The scenario application took about 10-13 minutes. Scenarios and learning goals are given in Table 1. Right after the scenario application, the students were included in a debriefing in groups of 8-10.

Analysis of the Data

The data were analyzed using the SPSS 22.0 (IBM Corp., Armonk, NY, USA). The Kolmogorov–Smirnov test was performed to determine whether the data were normally distributed or not. One-way analysis of wariance and *t* test were used because the intragroup and intergroup comparisons for continuous variables were normally distributed. The Scheffe test was performed as a post hoc test. The significance level was accepted as $p < .05$, which was "statistically significant".

Ethical Consideration

Consent from the students and an Canakkale Mart University's ethics committee approval were obtained before the study (Approval no. 18920478-050.04.04-E.1800171747). Institutional permit was obtained separately from 3 schools where the study was conducted. Verbal permission was obtained from the sample group students by paying attention to the principle of voluntary participation in the study, after giving information about the purpose of the study, what is expected of them, and their legal rights. They were assured that the information obtained would be kept confidential.

Results

Among the students who were included in the study, 99 (71.2%) were women and 40 (28.8%) were men. The age average of the students was 19.60 ± 0.68 years. In all three groups, the age average of the students was similar ($p = .873$). There was a significant difference between the test scores of the three groups before and after the practice ($p < .05$). Pretest results of knowledge levels of the three groups were similar ($F = 0.73$, $p = .484$). After the practices, posttest results of knowledge levels of the three groups were also found to be similar ($F = 1.48$, $p = .231$) (Table 2).

VAS stress scores of the three groups were similar before the practice ($F = 0.82$, $p = .442$). After the practices, there was a significant difference between the groups in terms of VAS stress scores ($p = .012$). After the practice, stress level of the standardized patient group was found to be significantly higher than that of the other two groups ($p < .05$). In the practices performed with the high-fidelity manikin and partial task trainer, there was a significant difference between the groups in terms of VAS stress scores before and after the practice, and prepractice stress levels of both groups decreased after the practice ($p < .05$). VAS stress scores of the students were similar before and after the practice performed with the standardized patient ($t = -13$, $p = .896$) (Table 3).

There was a significant difference between skill scores of the students that were assessed during the practice ($p < .05$). In the practice which was performed with the standardized patient, skill scores of the students were significantly lower during the practice compared with high fidelity and partial task trainer ($p = .001$) (Table 4).

There was a significant difference between the groups in terms of the scores of satisfaction in learning ($p < .05$). After the practice, satisfaction mean scores of the standardized patient group were found to be significantly higher than those of the other two groups ($p < .05$) (Table 5).

There was a significant difference between the groups in terms of the students' scores of self-confidence in learning ($p = .001$). In the practice which was performed with the partial task trainer, the students' scores of self-confidence in learning were significantly lower than those of the other groups ($p = .001$) (Table 5).

Discussion

In the study, an increase was observed in knowledge levels of the three groups after the practice which had similar knowledge levels before the practice. This result of the study simply confirmed the hypothesis "in different simulation modalities, there is no significant difference between the students in terms of knowledge levels".

Table 1 *Scenario Flow of Respiratory Sounds Assessment.*

Scenario			
File name: Respiratory Sounds Assessment			
Scenario duration: 10 mn.		Analysis duration: 20 mn.	
Patient information			
Patient's name surname: Hüseyin Yılmaz			
Gender: male man		Age: 45 years	
Primary medical diagnosis: chronic obstructive pulmonary disease (COPD)		Medical history: hypertension for 15 years, COPD for 5 years	
Continuously used drugs: Spiriva 1x1puff inh, Ipratom 4x1 nebul, midlonide 2x1puff inh, 6x2 puff Ventolin when distressed			
Present medical story:			
The patient was admitted to the emergency service due to respiratory distress. He was taken from the emergency service to the chest diseases service to be hospitalized for treatment.			
Social history:			
The patient works as a mineworker.			
Knowledge competences		Skill and attitude competences	
1 Definition of respiratory tract		• Listen to respiratory sounds	
2 Respiratory physiology		• Taking medical history in the respiratory tract	
3 Function of respiratory tract			
4 Normal lung sounds			
5 Abnormal respiratory sounds			
6 Respiration types			
Simulation learning outputs			
1 Providing patient safety			
2 Communicating			
3 Listening to respiratory sounds			
Primary purpose of the scenario: Listening to respiratory sounds of the patient with COPD suffering from respiratory distress			
Simulator manikin/manikins needed			
Standardized patient/high-fidelity simulator/partial task trainer			
Report to be submitted to the participant before the simulation			
You work in the chest diseases service. Admit the patient brought from the emergency service to the clinic for hospitalization. You will listen to his respiratory sounds.			
Preliminary informing			
☐ Sharing information related to the simulator			
☐ Understanding expectations/goals related to the scenario			
☐ Obtaining permissions for videos/photos (if available)			
☐ Providing the expected timetable			
☐ Telling the role of the participant			
Scenario progress			
Timing	Manikin/standardized patient actions	Expected interventions	Clues
Introduction 1 −3 mn.	Standardized patient/high-fidelity simulator: The patient coughs and could barely breathe. He answers the questions of the nurse. Partial task trainer: No intervention	Nurse: • Receives the patient. • Introduces herself. • Washes her hands. Explains the procedure to the patient.	Standardized patient/high-fidelity simulator: If the nurse skips introducing herself, the patient asks, “What is your name, dear?” Partial task trainer: No intervention
3 mn. -10 mn.	Standardized patient/high-fidelity simulator: He answers the questions of the nurse.	Nurse: • Auscultates the front and back area of the lung. • Discerns abnormal respiration (wheezing). • Records data. • Collects materials. Informs the patient.	Standardized patient/high-fidelity simulator: If the nurse misses out the wheezing, he says, “That wheezing really annoys me”. If the nurse skips giving information as she leaves, he asks, “How am I dear? Am I all right?” Partial task trainer: No intervention
Analysis session			
Reaction stage	Identification stage	Analysis stage	Summarization stage
How did you feel? How do you feel right now?	What did you do for your patient? What were the goals of the scenario?	What do you think you do the best? What would you change if you had another chance to do?	In sum, what kind of inferences have you attained? What are the key points we have learned from this scenario?

In the literature, it is supported that all three simulation modalities contribute to students' knowledge levels. Although in the study of Tüzer et al. [24] it was emphasized that the standard patient was more effective in increasing the level of knowledge, in the study of Smithburger et al. [25] it was stated that the use of high-fidelity manikin was more effective. As in our study, it has been shown in the literature that there is no significant difference between simulation modality and students' getting and storing information [26 ,27]. All these study results support that there is no difference in terms of the contribution of 3 different simulation modalities to the knowledge level of students. It is seen that the increasing costs of simulators with high validity are not directly

Table 2 *Pretest and Posttest Mean Scores of Knowledge Levels of the Students (N = 139).*

Score	Standardized patient (n=48)		High-fidelity manikin (n=45)		Partial task trainer (n = 46)		Statistical test	P
	Min-Max (0-10)	$\overline{X}$±SD	Min-Max (0-10)	$\overline{X}$±SD	Min-Max (0-10)	$\overline{X}$±SD		
Pretest	3-9	5.77 ± 1.70	3-8	5.42 ± 1.22	1-8	5.72 ± 1.49	0.73	.484
Posttest	2-10	6.31 ± 1.50	4-9	6.02 ± 1.18	3-9	6.52 ± 1.46	1.48	.231
	t = −2.74		t = −2.60		t = −5.21			
	p = .009*		p = .012*		p = .001*			

*p < .05.
Note. ANOVA = analysis of variance; SD = standard deviation.

Table 3 *Stress Levels of the Students Before and After the Practice (N = 139).*

	Standardized patient (n=48)	High-fidelity manikin (n=45)	Partial task trainer (n = 46)	Statistical test	p	Post hoc
	$\overline{X}$±SD	$\overline{X}$±SD	$\overline{X}$±SD			
Before practice	5.06 ± 2.23	5.64 ± 2.43	5.23 ± 2.02	0.82	.442	
After practice	5.10 ± 2.82	4.11 ± 2.47	3.65 ± 1.70	4.55	.012*	Standardized patient group > partial task trainer group Standardized patient > high-fidelity manikin group
	t = −13	t = 2.74	t = 4.35			
	p = .896	p = .009*	p = .001*			

*p < .05.
Note. ANOVA = analysis of variance; SD = standard deviation.

proportioned to the simultaneously increasing learning outcomes. The important point for nurse educators here is that the students' level of knowledge increases when any simulator that is independent from the simulation model and suitable for the learning goal is used and when the scenario steps are fully implemented. In line with the results of this study, it is recommended for nurse educators to choose simulators that are suitable for the learning objectives.

One of the most important results of this study which was conducted using three different simulation modalities was that VAS stress levels of the students in the standardized patient group were higher than those of others after the practice. In the literature, it is suggested that stress level increases in simulation-based experiences [28]. The general expectation at that point was that stress scores decreased when the stressful condition was removed. In addition, the fact that stress scores of the students in the standardized patient group remained high could be explained with higher level of fidelity in the standardized patient than others. In the study by Ignacio et al. [29], it was stated that because the fidelity perception was higher in the simulation which was performed with the standardized patient, the students had higher stress levels. Horsley and Wambach [30] emphasized that faculty member presence in the simulation laboratory caused anxiety to increase before and after simulation, but this did not have a negative effect on students' satisfaction and performance. Stress in the standardized patient group is higher than that of the other groups in accordance with the results of our study and the literature basis mentioned earlier. Therefore, we recommend nurse trainers to pay attention to this issue in line with the results. In particular, we suggest that it will be more effective to use partial task trainer simulators primarily in psychomotor skill practices. It is recommended that nurse educators prefer to use standardized patients primarily in cases where nontechnical skills such as communication other than a technical skill will be taught. This high stress level caused by the standardized patient compared with other methods is actually a situation that the student will actually experience in the clinical setting. In this respect, it is evaluated that the standardized patient method will positively contribute to the student's controlling stress in real fields of application.

In this study, the skill scores of the students were significantly lower in the application performed with the standard patient compared with the high fidelity and partial task trainer. In the literature, there are studies supporting the use of high-fidelity simulators that increase students' skills [31 ,32], as well as studies

Table 4 *Skill Scores of the Students (N = 139).*

Score	Standardized patient (n = 48)		High-fidelity manikin (n = 45)		Partial task trainer (n = 46)		Statistical test	p
	Min-Max (0-20)	$\overline{X}$±SD	Min-Max (0-10)	$\overline{X}$±SD	Min-Max (0-10)	$\overline{X}$±SD		
Skill scores	2-18	9.68 ± 3.23	9-20	15.66 ± 2.66	4-20	14.76 ± 4.35	40.87	.001*
Post hoc	Partial task trainer group > standardized patient group High-fidelity manikin group > standardized patient group							

*p < .05.
Note. ANOVA = analysis of variance; SD = standard deviation.

Table 5 *Distribution of Mean scores of the Student Satisfaction and Self-Confidence in Learning Scale (N = 139).*

	Standardized patient (n=48)	High-fidelity manikin (n=45)	Partial task trainer (n = 46)	Statistical test	p
	$\overline{X}$±SD	$\overline{X}$±SD	$\overline{X}$±SD		
Satisfaction with current learning	4.48 ± 0.68	4.01 ± 0.85	3.68±0.80	12.25	.001*
Post hoc	Standardized patient > partial task trainer group Standardized patien > high-fidelity manikin group				
Self-confidence in learning	4.22 ± 0.48	4.06 ± 0.69	3.50±0.68	16.89	.001*
Post hoc	Standardized patient group > partial task trainer group High-fidelity manikin group > partial task trainer group				

*p < .05.
Note. ANOVA = analysis of variance; SD = standard deviation.

showing that there is no difference [18]. Our experience is that the stress created by the standard patient method on the student also negatively affects their skill performances. Low skill performances in standardized patient group ought not to be perceived as negative by nurse educators in terms of effectiveness of this method. Considering the fact that learning from their mistakes is the basis of the simulation-based learning experiences, the rate of students making mistakes in real practice decreases. Although this is not revealed in this study, our experience shows this. In addition, it is recommended that nurse trainers ought to examine this with future studies.

Mean scores of the students' satisfaction in learning were higher in the standardized patient group than those in the other two groups. Mean scores of self-confidence in learning were lower in the partial task trainer group than those in other groups. In the literature, it is stated that students using the simulation method have higher satisfaction and self-confidence levels [31 ,33 ,34]. In some comparative studies, on the other hand, it is stated that students using high-fidelity simulation methods have higher scores of satisfaction and self-confidence scale than students using low- and moderate-fidelity simulation methods [7,8,21].

Conclusion

In all three modalities, it was observed that knowledge levels of the students increased. It is possible to state that standardized patient increases stress of students more than other practices and thus reduces skill levels related to stress. Simulation-based practices give students the opportunity of experiencing conditions in the actual practice beforehand. In this respect, the stress-related decrease which was observed in skill scores of the standardized patient group suggested that practices may be effective in reducing the level of stress faced by students in the clinical practice and increase their performance in the actual practice. In addition, students' satisfaction and self-confidence are higher in scenarios carried out with standard patient. For this reason, simulation-based practice with standard patient can be recommended in preclinical training. In future studies, it is suggested to investigate the reflections of the aforementioned three different simulation modalities on the clinical practice.

Conflicts of interest

The authors declare no conflict of interest.

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Author contributions

S.U.C., V.K., and D.Y designed the study, anaylsed the data, and prepared the manuscript. S.U.C., V.K., D.Y., H.K., and S.A. collected the data. All authors approved the final version for submission.

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