

# The Effects of Simulation on Nursing Students' Psychomotor Skills

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## ABSTRACT

**Background:** Simulation-based education has positive contributions in nursing education. Using different methods of simulation has effectiveness in clinical education and also effectiveness of simulation was stated verbally by the students and the researchers.

**Objective:** The aim of this research was to examine the effect of simulation training on psychomotor skills of nursing students.

**Design:** The research sample was determined by a simple random sampling.

**Setting:** Research was carried out with students of a Nursing School in Turkey, between February and June 2016.

**Participants:** Participants of the research 82 first-grade students of this research, 65 (81.7 %) of them were female and 15 (18.3 %) were male.

**Methods:** Assessment was performed with a single-blind method using with the "Skills Checklists" that include the steps of "Performing Nasotracheal Aspiration", "Measuring Blood Pressure", "Measuring Pulse and Respiration Rate" and "Administration of Intramuscular Injection".

**Results:** According to findings of the research, there was a statistically significant difference between the experimental and control groups mean total score of skills and there was a significant relationship between total score skills and the having simulation training of students.

**Conclusion:** As a result of the research, the students nursing skills with simulation education have higher psychomotor skill scores. In addition to the traditional education methods, use of simulation tools is thought to boost skill levels.

## Keywords

Nursing education, Psychomotor skills, Simulation training, Nursing skills

## Introduction

Nursing education requires a system which covers cognitive, sensorial and psychomotor learning fields. In terms of gaining especially psychomotor skills; it is not always possible for the students to acquire proper clinical experience due to the following facts; having limited fields of clinical

practices, spending less time in the hospital because of the education system based reasons and in-patients' staying less time in the hospital [1,2]. In order to prevent this and improve the knowledge & skills in the nursing education, plenty of teaching methods and strategies have been tested. Studies have shown that the

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nursing students' education before the clinical practices and the laboratory environments are not enough for them. Hence, these studies have also emphasized the need of creating laboratory environments where technical equipments & supplies are provided and simulation training is given to the nursing students in order for them to experience patient care before they face with the patients [3-6]. Hovancsek defines the goal of simulation as 'replicating some or nearly all of the essential aspects of a clinical situation so that the situation may be more readily understood and managed when it occurs for real in clinical practice [7]. In addition, some other goals of the simulation education are to enhance learning, to intensify the practical ability, to ensure patient safety and improve patient [8,9]. Kneebone [10] describes simulation as an effective teaching method since simulation involves four key aspects of nursing education. These aspects are improving technical competence by practicing psychomotor skills once and again; providing trainings that are adapted according to the needs of the students by the academicians; including sensorial elements into the learning goals and improving their ability to make a clinical evaluation [8-11].

Search of the literature reveals that the simulation-based education has positive contributions in nursing education. In a study evaluating nursing students' practices on video clip-supported simulation which were prepared based on different situations and also evaluating their self-efficacy and communication skills on these situations, McConville and Jane [12] found that students, who take the simulation-based education, have higher scores of self-efficacy [12]. Bambini [13] analyzed in their study the effect of simulation which was used in increasing nursing students' self-efficacy and according to this study, they found a statistically significant increase in students' exam performance scores and self-efficacy levels after they experienced simulation [13]. Smith and Roehrs did a study in which they looked at the effect of simulation on nursing students' self-confidence and satisfaction levels. They found statistically significant correlation between self-confidence & satisfaction levels and problem solving approaches of the students who take simulation-based education. Reid-Searl [14] concluded from their study that high-fidelity simulation is an effective method in terms of preparing students to real clinical practices, improving their self-confidences and help reducing their anxiety [14,15]. The

study conducted by Butler [16] revealed that both high-fidelity simulation (HFS) and low-fidelity simulation (LFS) methods contribute active learning of the students. However, it was concluded that cooperation and perceived active learning skills were higher in HFS group than those in LFS group's [16]. Rodgers [16] compared the competence of the students who use HFS method with the students who use LFS method in terms of improving the skills of Advanced Cardiovascular Life Support course. According to the results of the study, students who used HFS method had a higher overall rank score and the figure reached a level of statistical significance [15]. Tuttici [16] examined the critical & reflective thinking skills and self-efficacy of the third-year nursing students who take high-fidelity simulation based education. They found that students who use HFS method had higher levels of satisfaction despite of some limitations and these were also stated verbally by the students and the researches also emphasized the effectiveness of the high-fidelity simulation in clinical education [16,17]. King [18] conducted a study in which they used standardized patient and manikin-based simulation and as a result of this study they found simulation method satisfactory and effective. Besides, they stated that standardized patients are more effective in terms of improving interprofessional communication when it is compared to manikin-based simulation [18]. In a study done by Tuzer [19] nursing students' abilities and judgments on standardized patients and high-fidelity simulations were compared. The study revealed that students who practiced with standardized patients were more successful but the difference was not significant and the students were quite happy by practicing both with high-fidelity simulators and standardized patients [19]. In accordance with all of this information, the aim of our research is to indicate the effect of the simulation-based education on nursing students' psychomotor skills.

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## Materials and Method

Universe of the research consisted of 171 students who enrolled to "Fundamentals of Nursing" course of Department of Nursing and sample consisted of 84 students who accepted to participate in this research. These 84 students divided into 3 groups with simple random sampling according to their GPA. Each 28 students from every single group were randomized via draw method and split up into

experimental and control groups. There were 14 students from each success level, so in total; 42 students were in the control group and other 42 were in the experimental group. The research was completed with 82 students; 42 out of 82 were from experimental group and 40 students from control group and two students didn't participate at the stage of evaluation. The research data was assessed on 82 students.

#### ■ Materials for data collection

- **Student description form:** It was prepared by the researchers to identify socio-demographic features of the students. 2 out of 5 questions were open ended questions. This form aimed to determine age, gender, place of residence, last graduated school and GPA.

- **Skill checklists:** These lists contain the steps of the practices regarding the skills of "Performing Nasotracheal Aspiration", "Measuring Blood Pressure", "Measuring Pulse and Respiration Rate" and "Administration of Intramuscular Injection". These lists also contain initiatives from the globally accepted books which standardized and mutually used by the lecturers of this field and prepared as a practical guide in Turkey [20-21]. These lists covered process steps of each four skills. Each process steps assessed as "Performed" or "Didn't perform" and marked in accordance with specific feature of every single process. "Skill Control Lists" assessed over 100 points. The minimum score for each application was set as 1 and the maximum score for each application was set as 100.

#### Data Collection

Data was collected between April 2016 and June 2016 at İzmir Katip Çelebi University Faculty of Health Sciences Simulation Laboratory.

#### ■ Preparation of students

After theoretical expression of all subjects in Principles of Nursing lecture and laboratory applications, students were informed about the study and aim of the research. Verbal and written informed consent was received from students who accepted to participate in this research. After the control and experimental groups were determined, "Student Description Form" was filled by the students.

#### ■ Content of simulation training

Hospital bed and real equipment's were used in the creation of the Mid Fidelity Simulation

(MFS) setting. A mid-fidelity simulator Goumard S1001 Sussie, which can be controlled by the instructor, and via which heart and lung sounds can be listened without intestinal sounds and chest movement was used. Students in experimental group took training on scenario based simulation in addition to traditional demonstration method on Goumard S1001 Sussie Mid Fidelity Simulation at İzmir Katip Çelebi University Faculty of Health Sciences Simulation Laboratory. The content of the training consisted of introducing the simulator and the skills that can be performed on the simulator. After skills were performed for once on the simulator by the instructor, students were provided to perform without interference, their questions were answered and feedback was given after their performance.

#### ■ Creating the simulation scenario

Researchers have set learning objectives regarding their skills of "Performing Nasotracheal Aspiration", "Measuring Blood Pressure", "Measuring Pulse and Respiration Rate" and "Administration of Intramuscular Injection" and in this direction, a common scenario has been designed for simulation practice. The scenario has been used for assessing the skills of the students in experimental group and control group.

#### ■ Plan of the simulation practice

Before simulation session, the timing of the simulation has been determined by considering the number of the students to be assessed and materials to be used. When determining the timing of the simulation, pre-test was done and researchers decided to give 20 minutes to the students. In order to ensure the standardization, a briefing was given to the students in the experimental group and control group prior to their assessments through the simulation practice. As a scope of debrief; the goal of the simulation, the simulation laboratory, simulation method and equipments have been introduced to the students and also their questions have been answered. The scenario has been shared with the experimental group and the control group before the simulation session. Each student has practiced simulation for 20 minutes and each of them has been simultaneously assessed by one researcher with a single-blinded method. "Skill Checklists" have been used in assessing the tests. Each student who finished the simulation session has been given a feedback regarding their practice.

### Data Analysis

The data collected from the research were assessed by the researcher using SPSS (22.0) software. Defining characteristics of the students were expressed with the numbers and percentages while the ages were expressed via mean & standard deviation. For data analysis; number-percentage distribution was done, and the relation between variables were reviewed through T-test and correlation analyses. T-test for independent groups was used to determine if there was any significant difference between skill scores of control and experimental groups. Students' performance of practicing the steps on the check-lists was assessed and these assessments summarized with percentage figures. Statistical significance level was accepted as  $p < 0.05$ .

### Ethical Dimension of the Research

In order to run the research, an approval obtained from the University Ethics Committee of the Non-Interventional Clinical Studies. Before using instruments to collect data, the students who accepted to participate in the research were debriefed about the aim of the research and written informed consent was obtained from them.

### Results

Of the 82 first year nursing students participated in this research, 65 (81.7 %) of them were female and 15 (18.3 %) were male students. Among these students, 74.4% were graduated from Anatolian schools and %42.7 of them live in metropolis. The experimental group consisted of 36 (85.7%) female and 6 (14.3%) male students, while control group consisted of 31 (77.5%) female and 9 (22.5%) male students with the average age range of  $18.98 \pm 1.23$  years. Average age range in experimental group was  $18.83 \pm 0.65$  years, in control group it was  $19.15 \pm 1.62$  years. Students' GPA was  $2.46 \pm 0.50$  out of 4 points. In experimental group, their GPA was  $2.56 \pm 0.52$  points; in control group it was  $2.42 \pm 0.28$  points (Table 1).

The overall mean score of students' skills on "Performing Nasotracheal Aspiration (PNA)", "Measuring Arterial Blood Pressure (MABP)", "Measuring Pulse and Respiration Rate (MPRR)" and "Administration of Intramuscular Injection (AII)" was  $72.50 \pm 15.38$ . Experimental group's overall mean score was  $81.00 \pm 8.44$  and control group's was  $63.58 \pm 16.04$  points. Statistically

significant difference ( $p=0.00$ ) was reported between the overall mean score of the skills of the students in experimental and control groups (Table 2).

When the scores on each skill were assessed, the overall mean score on students' PNA skill was found as  $71.47 \pm 18.90$ . In control group this overall mean score was  $63.90 \pm 19.27$  while it was reported as  $78.69 \pm 15.59$  in experimental group. In addition, overall mean score on students' MABP skill was  $68.52 \pm 25.24$  points, which was found as  $57.92 \pm 28.03$  points in control group and  $78.61 \pm 17.53$  points in experimental group. Students' MPRR score was  $77.78 \pm 15.52$ . In control group, students' overall mean score on MPRR skill was  $69.52 \pm 17.10$  points and in experimental group it was  $85.64 \pm 8.27$  points. When it was looked at their AII skill, the overall mean score was  $72.25 \pm 18.49$ . Control group's score was reported as  $63.00 \pm 19.07$  while experimental group's score was  $81.07 \pm 12.89$  points (Table 2).

There is a statistically significant difference among two groups in terms of students' overall mean score of the skills on "Performing Nasotracheal Aspiration (PNA)", "Measuring Arterial Blood Pressure (MABP)", "Measuring Pulse and Respiration Rate (MPRR)" and "Administration of Intramuscular Injection (AII)" ( $p=0.00$ ;  $p=0.00$ ;  $p=0.00$ ;  $p=0.00$ ) (Table 2). Students' skill performances were examined according to their genders and it was found that female students' overall mean score of their skills on PNA, MABP, MPRR and AII was  $73.89 \pm 15.26$  points, while male students' score was  $66.33 \pm 14.89$  points. No statistically significant difference was found on students' overall mean score of their skills on PNA, MABP, MPRR and AII ( $p=0.086$ ). According to the results of the research, there was no statistically significant correlation found between students' ages & GPAs and overall mean scores of their skills ( $r=0.137$ ,  $p=0.221$ ;  $r=-0.056$ ,  $p=0.622$ ). However, statistically significant correlation was found between status of taking simulation training and overall scores of their skills ( $p=0.00$ ;  $r=0.569$ ).

When it was looked at some steps that were applied correctly by the students; 72.9% of experimental group correctly did the step of "Verification of the patient's identification using minimum two patient identifiers" while 50% of control group completed this correctly. In experimental group, 65.12% of the students

**Table 1: Demographics of the students.**

Defining Characteristics	Experimental Group		Control Group	
	Number	%	Number	%
Age (Mean $\pm$ SD)	18.83 $\pm$ 0.65		19.15 $\pm$ 1.62	
<b>Gender</b>				
Female	36	85.7	31	77.5
Male	6	14.3	9	22.5
<b>Schools that They Graduated from</b>				
Normal High School	3	7.1	5	12.5
Anatolian High School	32	76.2	29	72.5
Other*	7	16.7	6	15
<b>Place of Residence</b>				
Metropolis	21	50	14	35
City	9	21.4	7	17.5
Town	9	21.4	16	40
Village	3	7.1	3	7.5
<b>TOTAL</b>	<b>42</b>	<b>100</b>	<b>40</b>	<b>100</b>

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**Table 2: Overall mean scores of skills of the students in experimental and control groups.**

	Experimental Mean $\pm$ SD	Control Mean $\pm$ SD	p
<b>Skills Overall Score</b>	81.00 $\pm$ 8.44	63.58 $\pm$ 16.04	p=0.00
<b>Performing Nasotracheal Aspiration</b>	78.69 $\pm$ 15.59	63.90 $\pm$ 19.27	p=0.00
<b>Measuring Arterial Blood Pressure</b>	78.61 $\pm$ 17.53	57.92 $\pm$ 28.03	p=0.00
<b>Measuring Pulse and Respiration Rate</b>	85.64 $\pm$ 8.27	69.52 $\pm$ 17.10	p=0.00
<b>Administration of Intramuscular Injection</b>	81.07 $\pm$ 12.89	63.00 $\pm$ 19.07	p=0.00

correctly completed the step of “Explaining the operation to the patient” while in control group 50% of the students correctly completed this step. “Ensuring Patient Confidentiality” step was correctly completed by 86.5% of the students in experimental group and 75% of the students in control group.

## Discussion

In our research, statistically significant difference was found among overall mean scores on skills of students in experimental and control group and their overall mean scores on each skill. In addition, there was significant correlation between the status of taking simulation training and overall mean scores of their skills. Even though the students take their courses from the professionals; classic teaching methods do not meet the learning needs of students and also do not provide the permanence and consistency. These findings support the fact that in higher education, learning cannot be achieved with instructor-based and rote-learning based concepts. Even though simulation is commonly used in nursing education, the studies mainly investigate the effect of simulation on students' satisfaction and self-confidence but there are very limited studies in the literature that view the

contribution of simulation on basic psychomotor skills of nurses. Search of the literature in this context shows that, Alinier [3] did a study to understand the effect of scenario-based simulation practices on nursing students' clinical skills & competences. In the objective structured clinical examination which was done after the simulation session, the performance difference between experimental and control groups was found statistically significant. Similar to this, Rodgers [15], assessed the effect of simulation method on improving the skills of the students' Advanced Cardiovascular Life Support course and found that students who took simulation-based training had a higher overall mean score and the result was also found statistically significant [15]. In Salyers' study in which 36 nursing students participated, web-enhanced computer-based simulation experience and traditional clinical experience were compared. Knowledge score of the students who took web-based training was statistically significant compared to the students who took training with traditional method but there was no significant difference between two groups in terms of performing the skill [22].

Similarly, Goldenberg et al. reported that simulation training before clinical experience provided increase in students' cognitive,

psychomotor, communication, discussion, learning skills and also making a decision in critical situations skill. The result of the study was similar to those in other studies [23]. Flood and Higbie, analyzed the effect of two different methods (simulation and verbal lecture) on skill of performing blood transfusion. It was observed that the scores of the students who participated only in simulation training without taking any theoretical information was significantly lower than the scores of the students who took theoretical information and then participated in the simulation training [24]. In both studies which examined the effect of simulation on gaining basic nursing skills, it was observed that students' psychomotor skill levels were increased after the simulation training [25,26].

In the literature, it is stated that performing a psychomotor skill has two components, one of which is to perform the skill steps correctly and the other is communication with the patient in this process. Nursing education aims to develop psychomotor skills as well as sensorial skills. Ensuring patient safety and respecting patient rights form the basis of all the practices involved in nursing education. It is time consuming to gain these sensorial skills. Therefore students should be able to gain these qualifications before real patient care. In this respect, when the application steps that students correctly performed while performing the simulation session are examined, it is seen that the students of the experimental group have a higher score on correctly performing the "Verification of the patient's identification using minimum two patient identifiers" than control group students. Verification of the patient's identification using minimum two patient identifiers ensures that nursing practices are carried out safely. It was observed that the students in the experimental group who had simulation training verified identities by both from the patient wrist and communication with the simulator. However, the students in the control group did the identity recognition from the patient wrist during the application but did not communicate with the patient. In addition to the influence

of psychomotor skill development process, the simulation is important for the students to learn a culture of patient safety.

The ratio of correct implementation of "Explaining the operation to the patient" by students in experimental group was higher than the control group. Informing patients about the operation by nurses allow patients participation for application and also protects the patient rights. It also allows ensuring patient autonomy and decreases their concerns that may arise from the operation to be performed. The reason of low "Explaining the Operation to the Patient" ratio at the students in control group is, they performed their skills on a low-reality model which cannot respond to them.

The ratio of correct implementation of "Patient confidentiality" by students in experimental group was higher than the ratio in control group. Not considering or violation of an individual's privacy during the practice of health professionals can cause a person to feel unworthy and lose confidence and lead to feel uncomfortable and restless at any time during the hospitalization. Therefore, it is essential for nursing students to consider patient rights in all their practices. It can be thought that the students who could not carry out the step of "Patient confidentiality" had not perceived the implementations given in the scenario as they require privacy.

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## Conclusion

As a result of our research, the students who took simulation training have higher psychomotor scores by using the simulation method in addition to the traditional basic skill training. In this context, it is thought that using simulation for gaining fundamental knowledge, skill and behavior particular to nursing, can contribute to students' knowledge, skill and self-confidence. Besides, in this direction, the simulation training before real patient care can be useful and effective for students to be prepared for real clinical experience and also can improve students' skill on clinical practices.

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Simulation-based nursing education is a pedagogical approach, helping to expose students to various real-life scenarios and practice their clinical skills (National Council of State Boards of Nursing, 2019). Simulation-based educational interventions have shown positive effects, especially in students' psychomotor domain (Kim, Park, & Shin, 2016). Although simulation focuses on providing students with opportunities to practice in real-life situations, the deliberate practice emphasizes ways for students to improve their individual performance. Deliberate practice stresses the important Psychomotor skill. The ability to carry out a predetermined task efficiently and effectively using correct movements. It is more than the ability to perform; it also includes the ability to perform proficiently and consistently under varying conditions. The model allows for testing the impact of simulation on students and acts as a guide to help nursing and midwifery faculty in designing, implementing and evaluating high-fidelity simulations (Jeffries & Rizzolo, 2006). The main components of the model are the teacher, the student, the educational practices, the simulation design characteristics and the outcomes (Jeffries, 2007). In psychomotor domain simulation-based nursing as educational intervention was highly effective. Kim et al. [12] also evidence the impact of simulation-based education when not relative to fidelity level, so it is important to use a proper level of simulation to meet all the educational goals and outcomes. The aim of this study was to evaluate the effect of using simulation-based training on nursing students' communication skill, self-efficacy, and clinical competence. These findings demonstrated that competence and self-efficacy regarding specific medical and critical care nursing were significantly higher after participating in the simulation program.