



# The Effect of High Fidelity Simulation Training on Critical Thinking and Problem Solving Skills in Nursing Students in Turkey

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Received 2018 September 05; Revised 2018 November 01; Accepted 2018 November 10.

## Abstract

**Background:** Nursing education is an education system that encompasses cognitive, affective, and psychomotor learning fields. The main goal in this system is to graduate nurses who can integrate theory and application, who think critically in the learning process, and who have gained effective problem solving skills. For this reason, it is important to use novel approaches that improve occupational skill in nursing education.

**Objectives:** The study was performed in order to determine the effect of the high-fidelity simulation method on the critical thinking and problem solving skills of nursing students.

**Methods:** The study used a randomized, controlled, pre-test post-test experimental research model, and enrolled 60 students. Data was collected using a student identification form, an occupational skill application checklist, the California critical thinking inclination scale and the problem solving inventory. Mean values, standard deviations, the Student *t*-test, the paired sample *t*-test and the chi-squared test were used in data evaluation.

**Results:** In comparisons within and among groups between the pre-test and post-test applications no statistically significant differences were found between the California critical thinking inclination scale and Problem Solving Inventory mean scores.

**Conclusions:** In the study, the simulation method was found not to be superior in improving the problem solving and critical thinking abilities of students compared to the traditional education method. Performing similar studies with a larger sample size comparing different education methods is recommended.

**Keywords:** Critical Thinking, Nursing Education, Nursing Student, Problem Solving, Simulation

## 1. Background

Critical thinking and problem solving are basic skills for all nurses (1). In all workplace settings, nurses are expected to think critically, solve problems effectively, and make the right decisions. Nurses obtain data on patients and their families, analyze, define the problem, plan for the solution of the problem, apply the plan, and evaluate the results. All of these skills are related to problem solving and critical thinking (2, 3). Developing all those skills during undergraduate education is an important goal for tutors (4). Nursing education is an education system that encompasses cognitive, affective, and psychomotor learning fields (5). The main goal in this system is to graduate nurses who can integrate theory and application, who think critically in the learning process, and who have gained effective problem solving skills. For this reason, it is important to use novel approaches that improve occupational skill in nursing education (6). One of the methods adopted so that

students can improve their proficiency in patient care and gain skill is simulations (7).

A simulation is a technique or tool which tries to create the characteristics of the real world to prove sufficiency and proficiency in learning (8). Thus, simulation encourages learning through empirical techniques (9). Simulations, which act as intermediaries between clinical application and theoretical courses, are considered a method for presenting a clinical condition as similar to reality as possible, thus making it easier to understand and manage when truly encountered (7). Simulation is a safe teaching method, used in recent years for the provision of technical and non-technical skills in pre-and post-graduation nursing training (10-12) and is accepted for improving nursing trainers (13).

The high number of students and low number of tutors in schools providing nursing education in Turkey, crowdedness and inadequate clinical settings, the constantly improving technical equipment in today's clinics

where patient rights are given the utmost importance, all have negative effects on the student's using opportunities to improve and apply their skills at a desired level as well as the students' effective evaluation of patient care results. In order to remove this insufficiency, the use of scenario/computerized simulations to prepare nursing students for the clinical environment is a novel approach (7). Certain studies have stressed that the use of scenario/computerized simulation is an efficient learning strategy to gain occupational skills for nursing students (4, 8, 13, 14). Alongside this, training performed through the simulation has been reported to provide a rich environment for effective clinical decision making, to increase cooperative learning, technical skill, teamwork, and role development (15), to decrease the anxiety levels of students in the first clinical application and to increase self-confidence (16). Additionally, nursing students are able to evaluate their sufficiency and improve their problem determination and solving skills through the simulation technique (4). Simulations, which cost more than mannequins and require advanced knowledge in terms of educator, have to be used and evaluated as an alternative education method with traditional skill training (6). However, no studies were found in the literature that examined the effects of the simulation method on critical thinking and problem solving skills compared to the traditional teaching method. In this context, the use of research data in shaping training programs will be more evidence-based and safe.

## 2. Objectives

The present study was conducted to determine the effect of the high-fidelity simulation method on the critical thinking and problem solving skills of nursing students.

## 3. Methods

In the study, a randomized, controlled, pre-test post-test experimental research model was used.

The universe of the study consisted of 191 students studying at the freshmen year of the Nursing Department between February 22nd and April 15th 2016. Sample size was calculated according to  $\alpha = 0.05$ ,  $\beta = 0.20$ , and  $1-\beta = 0.8$ ; it was calculated that 23 students should be assigned to each group. A computer-generated random number table was used to randomize pairs (containing "1 = study group" ( $n = 30$ ) and "2 = control group" ( $n = 30$ )) according to student identification number, sex and the mean scores of the California critical thinking inclination scale and the Problem Solving Inventory.

### 3.1. Inclusion Criteria

- Not receiving any education on the course content of "Nursing Basics", where occupational skills are heavily taught
- Continuing the professional skills training given by simulation method / traditional method at the time of research
- Accepting to participate in the study

### 3.2. Exclusion Criteria

- Having previously received professional skills training
- Filling California critical thinking inclination scale and Problem Solving Inventory incorrectly/incompletely
- Not wanting to participate in research

Data was collected using a student identification form, an occupational skill application checklist, the California critical thinking inclination scale and the Problem Solving Inventory.

#### 3.2.1. Student Identification Form

The researcher-made form included 8 items concerning sociodemographic characteristics (age, sex, family income, city of residence for the longest duration, rank of preference for the nursing department).

#### 3.2.2. The California Critical Thinking Inclination Scale

The scale was developed in 1990 within the context of the Delphi project by the American Philosophical Association to evaluate critical thinking levels. The validity and reliability of the 51-item Turkish scale were assessed by Kökdemir (17). The scale is a six way Likert type scale with six subdimensions, namely searching the truth, open-mindedness, analyticalness, systematicalness, self-confidence, and curiosity. The minimum score for subdimensions is 10 while the maximum is 60, and the total gives the critical thinking score. In this context, 239 points and below from the scale is considered low, 240 - 299 is considered medium, and 300 and more is considered high with regard to critical thinking inclination. The reliability alpha coefficient of the scale was found to be 0.83 in the study.

#### 3.2.3. The Problem Solving Inventory

The Turkish adaptation of the scale developed by Hepner and Petersen (1982) was performed by Sahin et al. (18). The inventory is a self-report scale that is applied to adolescents and adults to evaluate what the individuals think about problem solving behavior and approaches. The 35-item inventory is a six way Likert type scale. The scale

has three subdimensions, namely problem solving confidence, approach-avoidance, and personal control. The lowest score that can be attained is 32 while the highest is 192. Higher total scores from the inventory show that the individual perceives himself/herself as insufficient in problem solving, while lower scores show that the individual perceives himself/herself as sufficient in the same area. The reliability alpha coefficient of the scale was found to be 0.84 in the study.

The scale and forms used in the study were applied on the first and last days of the education term. In three different sessions, the study group was given occupational skill training through the use of simulations while the control group was given occupational skill training through traditional education.

The occupational skill training through simulation was given in a simulation laboratory. The laboratory had three sections. The first section is the patient room where the patient and the clinical equipment were located. The second section is the command center where a tutor from the study team ensured that the event in the scenario occurred and recorded it. The third section is the debriefing room where the video of the applications performed in the patient room was played and applications were discussed with a tutor. The simman essential simulator was appropriate for applying all scenarios and skills regarding nursing, interactive with immediate reaction to the intervention, and appropriate for tutors designing their own patient files and recording them in addition to the preexisting scenarios.

The study team prepared 13 different scenarios for the students in the study group in three sessions on perineal care (five scenarios), oral drug administration (five scenarios), and respiratory applications (three scenarios). These scenarios were given to the tutor trained on simulation training, who was responsible for training the study group before the occupational training. Before the simulation training, the students were briefed about the simulation laboratory and the training manner. In the application phase, six groups of five were formed. Students in each group completed a scenario in 10 minutes with a group competing an application in 50 minutes. Later, each student analyzed their applications in the debriefing room with other group members for 75 minutes. The occupational skill training of the students in the study group took 40 hours.

In the occupational skill training given to the control group via the traditional education method, whole body, arm, and huckle models which had no technological characteristics were used. This training was given to the students by the research team, including the responsible lecturer of the course. Since the models had non-

programmable characteristics, students developed their occupational skills only through demonstrations. In the traditional education method, the students were made to apply skills guided by checklists where perineal care, oral drug administration, and respiration applications without a scenario in three sessions. The occupational skill training of the students in the control group took 24 hours.

Data was analyzed using the statistical package for social sciences (SPSS) version 22. The appropriateness of the normal distribution of the quantitative data was examined with the Kolmogorov-Smirnov test. Beside descriptive statistical methods (mean values, standard deviation), the Student *t*-test was used in quantitative data for the inter-group comparison and the paired sample *t*-test was used in comparisons within groups. The chi-squared test was used in the comparison of qualitative data. The Cronbach alpha coefficient was calculated in the reliability analysis of the California critical thinking inclination scale. Statistical significance was accepted to be  $P < 0.05$ .

Before the study, written permission was taken from the Cumhuriyet University Non Invasive Clinical Research Board of Ethics (Decision no: 2014-03/27). Each student was told that participation in the study was on a voluntary basis, and was briefed that nobody but the researcher would access the information. In this context, the written permissions of the students in the study were taken.

#### 4. Results

The mean age of the study group was  $18.70 \pm 1.17$  years, whereas the mean age of the control group was  $18.30 \pm 0.74$  years. In the study group, 63.3% of the patients were female, 50.0% preferred nursing department in the second place, and 40.0% preferred the nursing department for the job opportunities. In the control group, 66.7% were female, 43.3% preferred nursing department in the second place, and 33.3% preferred the nursing department for the job opportunities. [Table 1](#) shows that the students constituting the study and control groups were statistically similar with regard to critical thinking and problem solving skill levels and sociodemographic characteristics such as age, sex, family income, city of residence for the longest duration, and preference order for the nursing department.

[Table 2](#) shows the mean scores of the students' problem solving and critical thinking skill levels in the study and control groups during the pre-test and post-test. Accordingly, in comparisons within groups between the pre-test and post-test applications no statistically significant difference between the California critical thinking inclination scale and sub dimension mean scores and the Problem Solving Inventory and sub dimension mean scores could

**Table 1.** The Comparison of the Descriptive Characteristics of the Students<sup>a</sup>

Variables	Study Group	Control Group	Test Result
Age (mean ± SD)	18.70 ± 1.17 (min = 17, max = 23)	18.30 ± 0.74 (min = 17, max = 20)	t = 1.568/NS
California critical thinking inclination scale (mean ± SD)	247.48 ± 28.12	236.14 ± 28.20	t = 1.560/NS
Problem solving inventory (mean ± SD)	94.53 ± 17.81	95.90 ± 18.62	t = - 0.290/NS
<b>Sex</b>			X <sup>2</sup> = 0.073/NS
Female	19 (63.3)	20 (66.7)	
Male	11 (36.7)	10 (33.3)	
<b>Family Income</b>			X <sup>2</sup> = 0.096/NS
Good	8 (26.7)	9 (30.0)	
Medium	14 (46.6)	13 (43.3)	
Bad	8 (26.7)	8 (26.7)	
<b>Lived longest in</b>			X <sup>2</sup> = 0.894/NS
City	17 (56.6)	19 (63.3)	
District	8 (26.7)	5 (16.7)	
Town	5 (16.7)	6 (20.0)	
<b>Preference order for nursing department</b>			X <sup>2</sup> = 0.543/NS
First	4 (13.3)	6 (20.0)	
Second	15 (50.0)	13 (43.3)	
Third and above	11 (36.7)	11 (36.7)	
<b>Reason for preferring the nursing department</b>			X <sup>2</sup> = 5.852/NS
Love for the occupation	11 (36.7)	6 (20.1)	
Job possibilities	12 (40.0)	10 (33.3)	
Career	3 (10.0)	7 (23.3)	
To care for others	3 (10.0)	7 (23.3)	
Family wish	1 (3.3)	-	

<sup>a</sup>Values are expressed as No. (%) unless otherwise indicated.

be found. Similar findings were reached in comparisons between groups.

## 5. Discussion

As a result of the measurements, no difference was observed between the traditional training method and the simulation method with regard to problem solving and critical thinking. In other terms, the effects of both methods were found to be similar. Thus, hypotheses 1 and 2 were rejected.

Nursing training aims to make it possible to integrate theoretical information in the books with real life and to improve certain skills of the students such as communication, critical thinking, and problem solving (19). Especially because of the rapid developments and changes in the clinical field, it is very important for students to use their critical thinking abilities for optimal patient care and

clinical decision making, just as it is important for them to improve their problem solving skills to cope with problems in safe patient care (19, 20). In the present study, the students' critical thinking and problem solving skills were at a medium level before and after occupational skill training. Another study conducted in Turkey reported similar results in terms of critical thinking and problem solving skills of nursing students (21-24). This finding reveals the necessity to include more applications to support students' critical thinking and problem solving skills in theoretical and applied courses.

Simulation, which is increasing in popularity in nursing education, provides an opportunity for logical thinking in clinical problems and decision making without the potential of actually harming a patient (13). Especially through debriefing, which is an important step of simulation applications, students can become aware of what they learn, how they solve critical applications during sce-

**Table 2.** The Comparison of the Critical Thinking and Problem Solving Skills of the Groups in the Pre-Test and Post-Test

Scales	Study Group (Mean ± SD)	Control Group (Mean ± SD)	t <sup>a</sup> /P
<b>California Critical Thinking Inclination Scale</b>			
<b>Searching for truth</b>			
Pre-test	37.38 ± 8.23	36.00 ± 5.86	0.748/NS
Post-test	35.19 ± 7.41	35.52 ± 9.00	-0.156/NS
t <sup>b</sup> /P	1.276/NS	0.297/NS	
<b>Open mindedness</b>			
Pre-test	39.25 ± 5.15	36.30 ± 7.87	1.714/NS
Post-test	37.69 ± 7.74	38.22 ± 6.81	-0.280/NS
t <sup>b</sup> /P	1.004/ NS	-1.200/ NS	
<b>Analyticalness</b>			
Pre-test	44.81 ± 5.56	41.93 ± 6.83	1.788/NS
Post-test	43.39 ± 7.40	43.48 ± 8.76	-0.043/NS
t <sup>b</sup> /P	0.967/NS	-0.853/NS	
<b>Systematicalness</b>			
Pre-test	41.44 ± 6.17	38.55 ± 5.68	1.886/NS
Post-test	39.00 ± 6.77	40.05 ± 7.29	-0.581/NS
t <sup>b</sup> /P	1.506/NS	-1.196/NS	
<b>Self-confidence</b>			
Pre-test	40.38 ± 8.68	40.04 ± 5.06	0.182/NS
Post-test	41.76 ± 7.77	42.28 ± 9.83	-0.229/NS
t <sup>b</sup> /P	-0.679/ NS	-1.321/NS	
<b>Curiosity</b>			
Pre-test	44.20 ± 8.44	43.29 ± 7.81	0.436/NS
Post-test	45.00 ± 8.96	43.50 ± 10.82	0.585/NS
t <sup>b</sup> /P	-0.438/NS	-0.107/NS	
<b>General</b>			
Pre-test	247.48 ± 28.12	236.14 ± 28.20	1.560/NS
Post-test	242.04 ± 35.98	243.07 ± 39.34	-0.106/NS
t <sup>b</sup> /P	0.723/NS	-1.059/ NS	
<b>Problem Solving Inventory</b>			
<b>Problem solving confidence</b>			
Pre-test	30.80 ± 9.43	31.60 ± 9.64	-0.325/NS
Post-test	27.26 ± 8.20	28.50 ± 8.70	-0.565/NS
t <sup>b</sup> /P	1.787/NS	1.593/NS	
<b>Approach-avoidance</b>			
Pre-test	43.93±8.80	44.53 ± 8.76	-0.264/NS
Post-test	42.96 ± 9.04	44.10 ± 10.43	-0.449/NS
t <sup>b</sup> /P	0.445/ NS	0.301/ NS	
<b>Personal control</b>			
Pre-test	19.80 ± 4.82	19.76 ± 4.00	0.029/NS
Post-test	18.96 ± 2.45	19.66 ± 3.14	-0.961/NS
t <sup>b</sup> /P	0.973/NS	0.120/NS	
<b>General</b>			
Pre-test	94.53 ± 17.81	95.90 ± 18.62	-0.290/NS
Post-test	89.20 ± 16.99	92.26 ± 19.51	-0.649/NS
t <sup>b</sup> /P	1.374/NS	1.058/NS	

<sup>a</sup> Student t-test.<sup>b</sup> Paired sample t-test.

nario applications, and what their emotions and behavior are regarding analyzing their own thoughts (12, 25). Thus, learning through simulation is very important in the utilization and improvement of critical thinking abilities (14). However, in our study, the simulation method was found to be ineffective in the development of the critical thinking and problem solving abilities of students. In contrast, a study on the effect of high fidelity simulation with the nursing process on learning problem solving in freshman nursing students reported significant increases in the information levels, communication, critical thinking, and problem solving abilities of students (1). In a study by Park et al. (20), after two weeks of skill improvement through simulation, improvements were observed in the problem solving and critical thinking of students compared to the start. In another study, after the training performed with high fidelity simulation, almost all the students stated that their critical thinking abilities improved (14). In a qualitative study by Hope et al. (9), students stated that their humanistic care provision and problem solving skills improved through learning with a simulation. In a randomized study, two hours of simulation training improved the critical thinking abilities of students compared to the control group, especially in the dimensions of analyticalness and searching for truth (26). In a study where the perceptions of students and tutors on the use of simulations in nursing education were examined, the simulation method improved critical thinking skills for safe patient care (11). Other studies have found that simulation training for nursing students improved critical thinking and problem solving skills, as well (4, 15, 27-30).

Despite the findings of these studies, which were obtained through only skill training with the simulation method in a mostly qualitative frame, some studies have found that the simulation method has no effects on improving critical thinking and problem solving abilities. In a study that examined the effect of the simulation method applied in treatment focused training for the emergency and intensive care nursing course on problem solving and critical thinking, the problem solving skills of students in the study group improved compared to the control group, with no changes in critical thinking skills (31). In a study by Kim et al. (32), the critical thinking ability of the study group improved compared to the control group after 10 weeks of simulation training, with problem solving skills being similar to the control group. In a study conducted by Kim and Choi (33) with 41 nursing students over 12 weeks, no differences were observed between the problem solving and critical thinking skills of the students before and after the training. In another study, the simulation method improved the skill and knowledge of nursing students with no changes in problem solving skills (34).

Another important finding obtained in the present study is that there was no difference between the simulation method and traditional education in developing the problem solving and critical thinking skills of the students. A study reported no difference between the simulation method and the traditional method in nursing knowledge and competence of the students, however, the simulation method was more effective in gaining professional skills (35). According to those findings, which are parallel to our findings, it is necessary to continue research on the subject. The main problem in nursing education is how to improve the problem solving and critical thinking skills of the students. In this context, it is important to develop efficient, cost-effective and safe education methods based on evidence-based data.

#### 5.1. Limitations of the Study

The present study has a sampling limitation since it was conducted with students studying at a single nursing department. The self-reports of the students regarding their problem solving and critical thinking skills are limited to the data collection forms. The students learned a limited number of skills through simulation in the Nursing Basics course, and the traditional education method was used in the development of other skills. Additionally, the lack of data in the literature regarding the comparison of the traditional education and simulation methods in the development of the problem solving and critical thinking skills of students created a limitation in the discussion of findings.

#### 5.2. Conclusions

In the present study, the simulation method was found not to be superior in improving the problem solving and critical thinking abilities of students to the traditional education method. The results of our study, as well as others, show that the improvement of the problem solving and critical thinking skills of nursing students continues to be a subject for improvement and consideration. In this context, it is recommended to prepare training programs for students to gain critical thinking and problem solving skills, the theoretical education given to the students not to be memorizing and questioning in the clinical field to gain the ability to decide. Also, performing such studies with larger sample groups comparing different education methods would contribute to determining the effective learning methods to improve the problem solving and critical thinking skills of students.

#### Acknowledgments

We would like to thank all nursing students in School of Susehri Health High, Cumhuriyet University.

## Footnotes

**Conflict of Interests:** The authors declare no conflict of interests.

**Ethical Considerations:** The study protocol was approved by the Research Ethics Committee of Cumhuriyet University (Decision number: 2014-03/27).

**Funding/Support:** Scientific research project fund of Cumhuriyet University, Grant/Award Number: STKMYO-003.

## References

- Burns HK, O'Donnell J, Artman J. High-fidelity simulation in teaching problem solving to 1st-year nursing students: A novel use of the nursing process. *Clin Simul Nurs*. 2010;**6**(3):e87-95. doi: [10.1016/j.ecns.2009.07.005](https://doi.org/10.1016/j.ecns.2009.07.005).
- Lyons EM. Examining the effects of problem-based learning and NCLEX-RN scores on the critical thinking skills of associate degree nursing students in a southeastern community college. *Int J Nurs Educ Scholarship*. 2008;**5**(1):1-17. doi: [10.2202/1548-923X.1524](https://doi.org/10.2202/1548-923X.1524).
- Cranley LA, Doran DM, Tourangeau AE, Kushniruk A, Nagle L. Recognizing and responding to uncertainty: A grounded theory of nurses' uncertainty. *Worldviews Evid Based Nurs*. 2012;**9**(3):149-58. doi: [10.1111/j.1741-6787.2011.00237.x](https://doi.org/10.1111/j.1741-6787.2011.00237.x). [PubMed: [22233501](https://pubmed.ncbi.nlm.nih.gov/22233501/)].
- Wang AL, Fitzpatrick JJ, Petrini MA. Use of simulation among Chinese nursing students. *Clin Simul Nurs*. 2013;**9**(8):e311-7. doi: [10.1016/j.ecns.2012.03.004](https://doi.org/10.1016/j.ecns.2012.03.004).
- Mete S, Uysal N. [Implementation of an education model for nursing skills development]. *Dokuz Eylul Universitesi HemSirelik Fakultesi Elektronik Dergisi*. 2009;**2**(3):115-23. Turkish.
- Terzioğlu F, Kapucu S, Ozdemir L, Doztepe H, Duygulu S, Tuna Z, et al. [Nursing students' opinions about simulation method]. *Hacettepe Universitesi Saglik Bilimleri Fakultesi Hemsirelik Dergisi*. 2012;16-23. Turkish.
- Sunal N. [The role of simulation in nursing education]. *Saglik Dusuncesi ve Tip Kulturu Dergisi*. 2013;**27**:20-1. Turkish.
- Durham CF, Alden KR. Enhancing patient safety in nursing education through patient simulation. In: Hughes RG, editor. *Patient safety and quality: An evidence-based handbook for nurses*. Rockville: Agency for Healthcare Research and Quality; 2007.
- Hope A, Garside J, Prescott S. Rethinking theory and practice: Pre-registration student nurses experiences of simulation teaching and learning in the acquisition of clinical skills in preparation for practice. *Nurse Educ Today*. 2011;**31**(7):711-5. doi: [10.1016/j.nedt.2010.12.011](https://doi.org/10.1016/j.nedt.2010.12.011). [PubMed: [21237536](https://pubmed.ncbi.nlm.nih.gov/21237536/)].
- Solnick A, Weiss S. High fidelity simulation in nursing education: A review of the literature. *Clin Simul Nurs*. 2007;**3**(1):e41-5. doi: [10.1016/j.ecns.2009.05.039](https://doi.org/10.1016/j.ecns.2009.05.039).
- Ganley BJ, Linnard-Palmer L. Academic safety during nursing simulation: Perceptions of nursing students and faculty. *Clin Simul Nurs*. 2012;**8**(2):e49-57. doi: [10.1016/j.ecns.2010.06.004](https://doi.org/10.1016/j.ecns.2010.06.004).
- Coutinho VRD, Martins JCA, Pereira F. Structured debriefing in nursing simulation: Students' perceptions. *J Nurs Educ Pract*. 2016;**6**(9):127. doi: [10.5430/jnep.v6n9p127](https://doi.org/10.5430/jnep.v6n9p127).
- McAllister M, Levett-Jones T, Downer T, Harrison P, Harvey T, Reid-Searl K, et al. Snapshots of simulation: Creative strategies used by Australian educators to enhance simulation learning experiences for nursing students. *Nurse Educ Pract*. 2013;**13**(6):567-72. doi: [10.1016/j.nepr.2013.04.010](https://doi.org/10.1016/j.nepr.2013.04.010). [PubMed: [23707534](https://pubmed.ncbi.nlm.nih.gov/23707534/)].
- Mompoin-Williams D, Brooks A, Lee L, Watts P, Moss J. Using high-fidelity simulation to prepare advanced practice nursing students. *Clin Simul Nurs*. 2014;**10**(1):e5-e10. doi: [10.1016/j.ecns.2013.07.005](https://doi.org/10.1016/j.ecns.2013.07.005).
- Maas NA, Flood LS. Implementing high-fidelity simulation in practical nursing education. *Clin Simul Nurs*. 2011;**7**(6):e229-35. doi: [10.1016/j.ecns.2010.04.001](https://doi.org/10.1016/j.ecns.2010.04.001).
- Khalaila R. Simulation in nursing education: An evaluation of students' outcomes at their first clinical practice combined with simulations. *Nurse Educ Today*. 2014;**34**(2):252-8. doi: [10.1016/j.nedt.2013.08.015](https://doi.org/10.1016/j.nedt.2013.08.015). [PubMed: [24060462](https://pubmed.ncbi.nlm.nih.gov/24060462/)].
- Kokdemir D. *Belirsizlik durumlarında karar verme ve problem cozme [dissertation]*. Ankara: Ankara Universitesi Sosyal Bilimler Enstitusu; 2003. Turkish.
- Sahin N, Sahin NH, Heppner PP. Psychometric properties of the problem solving inventory in a group of Turkish university students. *Cogn Therapy Res*. 1993;**17**(4):379-96. doi: [10.1007/BF01177661](https://doi.org/10.1007/BF01177661).
- Kim J, Park JH, Shin S. Effectiveness of simulation-based nursing education depending on fidelity: A meta-analysis. *BMC Med Educ*. 2016;**16**:152. doi: [10.1186/s12909-016-0672-7](https://doi.org/10.1186/s12909-016-0672-7). [PubMed: [27215280](https://pubmed.ncbi.nlm.nih.gov/27215280/)]. [PubMed Central: [PMC4877810](https://pubmed.ncbi.nlm.nih.gov/PMC4877810/)].
- Park SN, Chu MS, Hwang YY, Kim SH, Lee SK. Effects of integrated nursing practice simulation-based training on stress, interest in learning, and problem-solving ability of nursing students. *J Korean Acad Fundamental Nurs*. 2015;**22**(4):424-32. doi: [10.7739/jkafn.2015.22.4.424](https://doi.org/10.7739/jkafn.2015.22.4.424).
- Celik S, Yilmaz F, Karatas F, Al B, Karakas NS. [Critical thinking disposition of nursing students and affecting factors]. *Saglik Bilimleri ve Meslekleri Dergisi*. 2015;**2**(1):74-85. Turkish.
- Ozdelikara A, Bingol G, Gorgen O. [Critical thinking tendency of nursing students and factors influencing this]. *Florence Nightingale Hemsirelik Dergisi*. 2012;**20**(3):219-26. Turkish.
- Yuksel A. [Nursing students' self evaluation of problem solving skills and related factors]. *J Hacettepe Univ Fac Nurs*. 2015;**2**(1):37-49. Turkish.
- Ancl G. Problem-solving training: Effects on the problem-solving skills and self-efficacy of nursing students. *Eurasian J Educ Res*. 2016;**16**(64):231-46.
- Chronister C, Brown D. Comparison of simulation debriefing methods. *Clin Simul Nurs*. 2012;**8**(7):e281-8. doi: [10.1016/j.ecns.2010.12.005](https://doi.org/10.1016/j.ecns.2010.12.005).
- Wood RV, Toronto CE. Measuring critical thinking dispositions of novice nursing students using human patient simulators. *J Nurs Educ*. 2012;**51**(6):349-52. doi: [10.3928/01484834-20120427-05](https://doi.org/10.3928/01484834-20120427-05). [PubMed: [22533501](https://pubmed.ncbi.nlm.nih.gov/22533501/)].
- Foronda C, Gattamorta K, Snowden K, Bauman EB. Use of virtual clinical simulation to improve communication skills of baccalaureate nursing students: A pilot study. *Nurse Educ Today*. 2014;**34**(6):e53-7. doi: [10.1016/j.nedt.2013.10.007](https://doi.org/10.1016/j.nedt.2013.10.007). [PubMed: [24231637](https://pubmed.ncbi.nlm.nih.gov/24231637/)].
- Roberts JD. Problem-solving skills of senior student nurses: An exploratory study using simulation. *Int J Nurs Stud*. 2000;**37**(2):135-43. [PubMed: [10684955](https://pubmed.ncbi.nlm.nih.gov/10684955/)].
- Hur HK, Park SN, Shin YH, Lim YM, Kim GY, Kim KK, et al. [Development and applicability evaluation of an emergent care management simulation practicum for nursing students]. *J Korean Acad Soc Nurs Educ*. 2013;**19**(2):228-40. Korean. doi: [10.5977/jkasne.2013.19.2.228](https://doi.org/10.5977/jkasne.2013.19.2.228).
- Ahn H, Kim HY. Implementation and outcome evaluation of high-fidelity simulation scenarios to integrate cognitive and psychomotor skills for Korean nursing students. *Nurse Educ Today*. 2015;**35**(5):706-11. doi: [10.1016/j.nedt.2015.01.021](https://doi.org/10.1016/j.nedt.2015.01.021). [PubMed: [25746614](https://pubmed.ncbi.nlm.nih.gov/25746614/)].
- Ko E, Kim HY. Effects of multi-mode simulation learning on nursing students' critical thinking disposition, problem solving process, and clinical competence. *Korean J Adult Nurs*. 2014;**26**(1):107-16. doi: [10.7475/kjan.2014.26.1.107](https://doi.org/10.7475/kjan.2014.26.1.107).
- Kim DH, Lee Y, Hwang MS, Park JH, Kim HS, Cha HG. [Effects of a simulation-based integrated clinical practice program (SICPP) on the problem solving process, clinical competence and critical thinking in a nursing student]. *J Korean Acad Soc Nurs Educ*. 2012;**18**(3):499-509. Korean. doi: [10.5977/jkasne.2012.18.3.499](https://doi.org/10.5977/jkasne.2012.18.3.499).
- Kim JM, Choi YS. [Effect of practice education using the simulator, critical thinking, problem solving ability and nursing process confidence of nursing students]. *J digit Converg*. 2015;**13**(4):263-70. Korean. doi: [10.14400/JDC.2015.13.4.263](https://doi.org/10.14400/JDC.2015.13.4.263).

34. Lee MS, Hahn SW. [Effect of simulation-based practice on clinical performance and problem solving process for nursing students]. *J acad soc nurs educ*. 2011;17(2):226-34. Korean. doi: [10.5977/JKASNE.2011.17.2.226](https://doi.org/10.5977/JKASNE.2011.17.2.226).
35. Hayden JK, Smiley RA, Alexander M, Kardong-Edgren S, Jeffries PR. The NCSBN national simulation study: A longitudinal, randomized, controlled study replacing clinical hours with simulation in prelicensure nursing education. *J Nurs Regulat*. 2014;5(2):3-40. doi: [10.1016/S2155-8256\(15\)30062-4](https://doi.org/10.1016/S2155-8256(15)30062-4).