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Effects of Nursing Simulation Learning on Nursing Competence According to the Learner's Metacognition Level

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Abstract

This study measured the degree of metacognitive improvements after nursing simulation learning, and analyzed the effects of metacognition level-based nursing simulation learning on nursing competence, as a key strategy for effective simulation learning. Differences in learning achievement were analyzed according to learners' metacognition level after the nursing simulation learning. Statistically significant differences were observed between the three metacognition groups (F=3.53, p=0.034). After the learning, statistically significant differences were observed in clinical judgment within each metacognition group, but not between the groups (F=0.66, p=0.517). Skill performance also improved within each metacognition group as compared to that before the learning, but there was no statistically significant difference between the groups (F=0.64, p=0.531).

Keywords: *Nursing, Simulation, Competence, Metacognition, Learning*

1. Introduction

Simulation is a training that helps learners accomplish a certain task by using a model or virtual reality in an environment close to the real one. This includes observers, colleagues, patients, and video camera feedback [1]. Numerous studies have demonstrated the benefits of simulation learning. It is reported that simulation learning helps improve students' critical thinking, problem solving capacity, clinical performance, and clinical judgment because they can immediately check the results of the nursing intervention they perform and receive feedback [2][3][4].

Many Korean and international institutions for nursing education program evaluation suggest that knowledge on nursing theories, skill performance, integrated application of theory and practice, critical thinking, communication, leadership, team work, and professional behavior are essential competences that nursing students need to develop before graduation [5][6].

Nursing competence is reexamined and reorganized through performance. Competence and performance have an interdependent relationship [7], and practice is necessary for helping students to acquire and refine their nursing competences.

Simulation provides an opportunity for repeated learning, feedback, evaluation, and reflection. It is a dynamic process that encompasses the representation of reality, induction of learners' active participation, and integration of practice and theoretical learning [8]. These characteristics of simulation can realize the process of integrating knowledge, skills, and

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experiential learning. Thus, current nursing education actively applies simulation as a teaching-learning strategy to enhance students' nursing competence [9].

Metacognition pertains to understanding and controlling one's own thinking process. It is an important variable that contributes to enhancing one's the problem solving capacity [10]. The process of discovering and solving a problem induces learners' metacognition activity [11]. Learners can monitor others' judgment process in small-group discussion, which increases learners' metacognitive skills [12].

Simulation-based learning allows learners to apply metacognitive techniques. It helps them reflect their experience and integrate metacognitive learning through judgment based on critical thinking and self-reflective learning with colleagues.

This study measured improvements in metacognition level after simulation learning using clinical cases. Subjects attended a simulation learning session that was based on learners' metacognition level, and improvements of nursing competence were analyzed. This study provides important basic data needed for the development of simulation learning based on metacognition level, to finally develop a teaching-learning method that effectively enhances nursing competence.

2. Method

2.1. Design of the study

This one group pretest posttest study examined the degree of metacognitive improvements achieved after nursing simulation learning. The study attempted to investigate the effects of metacognition level-based simulation learning on learners' nursing competence.

2.2. Participants of the study

Participants were 76 senior students from the nursing department of D University in A city. At the time of the study, they were taking the nursing simulation course, understood the study purpose, and provided consent for study participation.

2.3. Study tools

2.3.1. Metacognition

This study employed a revised version of the Motivation Strategies for Learning Questionnaire (MSLQ), originally developed by Printrich, Smith, Gracia, and Mckeachie [13] and it was modified by Lee [14] to reflect the Korean culture. The revised metacognition tool with 31 questions consists of 4 questions on practice, 6 on elaboration, 5 on critical thinking, and 12 on self-regulation. Responses are made on a 5-point Likert scale, and the score ranges between 31 and 155 points. Higher scores indicate higher metacognition. The Cronbach's α reliability of the tool was .74 in the study by Lee [14], and it was .86 in the present study.

2.3.2. Nursing competence

Nursing Competence refers to the essential ability to perform specific activities or tasks required in clinical practice, as a nurse who has graduated from a nursing school, has acquired a license, and is employed at a medical institution. The term also indicates the state of having sufficient knowledge, judgement skill, techniques, and strength for such responsibilities [15]. In the present study, nursing competence refers to the capacity developed through nursing

simulation learning using clinical cases. It includes learning achievement, skill performance, and clinical judgment.

Learning achievement: Learning achievement evaluates what learners have learned after a series of education activity [16]. In this study, it refers to an evaluation score obtained on a written test. Answers to 5 essay questions were evaluated concerning the content required to solve problems in given nursing cases. One assessor evaluated the answers according to evaluation standards within the score range of 0 to 15. Higher scores indicate higher learning achievement. To ensure content validity, the written test questions were reviewed by a professor of adult nursing.

Skill performance: In this study, blood transfusion therapy necessary for the simulation scenario was evaluated based on the evaluation protocol for essential nursing fundamentals developed by the Korean Accreditation Board of Nursing Education [17]. The performance of blood transfusion therapy consists of 28 items, and each question was marked between 0 and 2. The total score ranges from 0 to 100, with higher scores indicating higher skill performance.

Clinical judgment: To evaluate clinical judgment in simulation education, this study utilized an amended and improved clinical judgment tool that was originally developed by Laster [18] and modified by Shim [18]. This tool was determined to have sufficient content validity (CVI = 0.75), as established by a group of experts. Following observation of nursing actions, the assessment results were quantified. This tool addresses four areas and includes 11 questions, with 3 on cognition, 2 on interpretation, 4 on response, and 2 on observation. Each question is rated on a 4-point scale and the range of total points is between 11 and 44, with higher scores indicating higher clinical judgment. One assessor observed and evaluated these points. In the present study, the Cronbach's alpha of the tool was .95.

2.4. Data collection

We provided sufficient explanation concerning the study purposes, procedure, and confidentiality measures to the participants prior to the simulation, and obtained their written consent for study participation. A research assistant individually explained to the participants how they were expected to fill out the questionnaire. He distributed the questionnaire before and after the simulation-based learning, and the study participants hand-wrote their responses. For data collection, participants had a learning session with simulations that represented 3 clinical cases using pretest prior to the simulation-based learning on clinical cases, a high-efficiency simulator, and a standardized patient. A posttest was conducted afterwards.

2.5. Data analysis

Collected data were analyzed using the SAS 9.2 program. A frequency analysis was conducted on the characteristics of the participants, using real numbers and percentage. A t-test and an ANOVA were conducted to test the effects of learners' metacognition level before and after the learning on nursing students' clinical competence. The Scheffe test was conducted for post-hoc analyses.

3. Result

In regard to the general characteristics of the participants, majority (n=42) were 21 years old (55.3%), 21 were 22 years old (27.6%), and 13 were aged 23 years or older (17.1%). Further, majority of them were female (n=68, 89.5%). Most of the participants responded that they were satisfied with the nursing major (n=75, 98.7%) [Table 1].

Table 1. Characteristics of the study participants

Category		n (%)
Age (years)	21 or younger	42 (55.3)
	22	21 (27.6)
	23 or older	13 (17.1)
Gender	Women	68 (89.5)
	Men	8 (10.5)
Nursing major	Satisfied	75 (98.7)
	Normal	1 (1.3)
	Dissatisfied	0

3.1. Study participants' metacognition level

The average metacognition score of the participants was 3.59 before and 3.57 after the simulation-based learning. Thus, there was no significant difference in the metacognition scores before and after the learning. Based on the average metacognition score of the participants, those with a score of 3.80 points or higher were assigned to the high level group, those with scores from 3.40 to 3.80 points to the intermediate level group, and those with scores lower than 3.40 to the low level group. Each group showed statistically significant differences in the extent of changes in metacognition scores before and after the metacognition level-based learning (F=11.85, p=<0.001). The low metacognition group showed the highest degree improvement in the metacognition score after the simulation learning, and the difference was statistically significant (t=-3.36, p=0.002). The high and intermediate level groups did not demonstrate any statistically significant differences, although their metacognition scores decreased slightly after the learning.

Table 2. The metacognition ability of the study participants

Metacognition Group	Pre-test	Posttest	t (p)	F (p)
	M±SD	M±SD		
Total	3.59±0.44	3.57±0.35	0.47 (0.642)	11.85 (<0.001)
Low	3.11±0.29	3.35±0.25	-3.36 (0.002)	
Middle	3.63±0.13	3.56±0.31	1.08 (0.288)	
High	4.06±0.25	3.81±0.34	3.14 (0.004)	

3.2. Differences in nursing competence by metacognition level

This study analyzed learning achievement, skill performance, and clinical judgment to investigate the degree of improvement in nursing competence after the simulation learning. Table 3 shows the results of the analysis on the degree of improvements observed in each group based on metacognition level.

In this study, learning achievement improved after the learning in all three metacognition level groups, namely, high, intermediate, and low metacognition level. Statistically significant differences were observed in all the three groups (t=-5.75, p<0.001; t=-11.67, p<0.001; and t=-6.76, p<0.001, respectively).

Differences in the extent of improvement in learning achievement also showed statistically significant differences among the metacognition level groups (F=3.53, P=0.034). Specifically,

the intermediate level group showed the greatest improvement, followed by the low and high metacognition groups, respectively.

Skill performance improved in all the three metacognition level groups after the simulation learning, but there was no statistically significant difference both within and between the high, intermediate, and low groups (F=0.64, p=0.531).

Clinical judgment improved in all the three groups after the learning, and there were statistically significant differences within each group (high: t=-9.66, p<0.001; intermediate: t=-11.38, p<0.001; low: t=-11.50, p<0.001). The low metacognition group showed the highest degree of improvement in clinical judgment after the learning, but it was not significantly different from the degree of improvement achieved by the intermediate group. Thus, there were no statistically significant inter-group differences in clinical judgment (F=0.66, P=0.517).

The study results showed that the nursing competence of the low and intermediate groups largely increased through the metacognition level-based nursing simulation learning, whereas the high metacognition group did not show any remarkable differences in the degree of improvement, although the group did exhibit some improvements in nursing competence owing to the simulation.

Table 3. Differences in nursing competence by metacognitive ability

Variable	Metacognition Level	M±SD		t (p)	F (p)	Scheffe
		Pretest	Posttest			
Learning achievement	High	5.34±1.75	8.38±1.80	-6.76 (<.0001)	3.53 (0.0343)	High <Intermediate
	Intermediate	5.14±1.22	9.46±2.08	-11.67 (<.0001)		
	Low	6.08±2.10	8.93±1.90	-5.75 (<.0001)		
Skill performance	Low	7.64±1.58	7.64±1.55	0.00 (1.0000)	0.64 (0.5315)	-
	Intermediate	6.96±1.55	7.50±1.29	-1.45 (0.1581)		
	High	7.04±1.69	7.65±1.37	-1.31 (0.2042)		
Clinical judgment	Low	2.35±0.15	3.19±0.33	-11.50 (<.0001)	0.66 (0.5174)	-
	Intermediate	2.40±0.18	3.13±0.30	-11.38 (<.0001)		
	High	2.38±0.16	3.15±0.34	-9.66 (<.0001)		

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