

Effects of integrated simulation program on the critical thinking disposition, problem-solving process and job performance of nursing college students.

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Abstract

The purpose of this study was to examine the effects of an integrated simulation program on the critical thinking disposition, problem-solving process and job performance of nursing students. An integrated simulation program was conducted to provide education twice a week, approximately four hours each. It was offered in five stages: theoretical lectures, prior learning by team, simulation education, team simulation and debriefing. And single-group experimental design was adopted. As for data analysis, SPSS 24.0 for Windows was employed. To test the normality of the variables, Kolmogorov-Smirnov's normality test was used, and t-test was carried out to produce results. As a result, the practice that applied the integrated simulation contributed to the improvement of the critical thinking disposition, problem-solving skills and job performance of the selected students, and the program was found to be an effective educational method. Therefore sustained efforts should be directed into the evaluation and reorganization of integrated simulation education to make it entrenched as an effective way to provide clinical education for nursing college students.

Keywords Integrated simulation, Critical thinking disposition, Problem-solving process, Job performance.

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Introduction

Need for the study

Unlike in the past, more complicated and strategic job performance is required in recent nursing environments. As the importance of the roles of nurses that provide nursing in person is increasingly stressed, it's critical for them to have a professional competency to cope with client needs in an effective way [1]. In fact, however, nursing students are just able to perform a very limited range of nursing activities in the clinical field because consumers' right to health, safety and rights are emphasized in medical environments characterized by complex changes and the advance in state-up-the-art medical equipment, and they just engage in observation-centred clinical practice [2].

Furthermore, their opportunity to practice the kind of nursing that is quite unsafe to patients is very limited, and they are found not to be fully experienced in clinical practice enough to serve as full-fledged new nurse [3]. Under the circumstances, simulation-based learning draws attention as a way to make up for such a limited clinical practice. That makes it possible to ensure the active participation of learners in safe environments by reproducing clinical situations that are similar to real ones, and that is characterized by integration between theory and practice [4].

Simulation education that is widely conducted in recent years turns out to be one of educational methods to guarantee patient safety and better clinical performance by reproducing situations that are similar to clinical ones [5].

As clinical practice is performed in the clinical field, students are not basically allowed to make any mistakes. So, not only them but their teachers are under heavy stress and pressure during that [6]. However, simulation education that reproduces clinical situations allows students to do repeated learning, to go through trial and error and to make a mistake to some extent, and that doesn't exert any direct or fatal influence on the safety and rights of patients even if students make a mistake. Therefore simulation education that uses a simulator or standardized patient is widespread in nursing education, and efforts are being made to provide successful simulation education and evaluate it by being equipped with a wide range of simulator equipment by training teachers and by developing structured modules [7].

Critical thinking, which is a cognitive means of problem solving and decision making, is a thinking to grasp the logical structure and meaning of verbal expressions and behaviors and to make the best judgment in consideration of the given concept, evidence, criteria, possible method or contexts, and that is considered to be mandatory for problem solving and decision making in the field of nursing [8].

The critical thinking and problem-solving skills of students seem to make differences to their simulation performance because the two affect their way of resolving the given problem situations in the performance stage of simulation, and the stage of debriefing in which students have a chance to check the process of performance and get feedback on their strengths and weaknesses provides an opportunity for effective self-reflection and learning. In addition, simulation produces great educational effects because it enables students to experience the whole process of nursing from patient screening to planning, performing and evaluating and to get feedback through debriefing [9].

Indeed, simulation education makes it possible to acquire knowledge and skills, to improve critical thinking and problem-solving process and ultimately to enhance job performance. Given this fact, nursing students are expected to experience practical nursing activities when simulation is applied to their nursing practice and it seems worth doing to check if there is any progress in their job performance when they improve in critical thinking and problem-solving skills.

As for domestic earlier studies, some studies have been conducted in simulation situations for each course by adopting a single-group pretest-posttest design [10-13], and others have examined the critical thinking, problem-solving skills and clinical performance of nursing students all together [14,15].

This study attempted to provide nursing students with integrated simulation-based education by reproducing clinical situations to determine the effects of it on their critical thinking disposition, problem-solving process and job performance in an attempt to offer some information on the development of an integrated simulation curriculum.

Purpose

The purpose of this study was to examine the effects of an integrated simulation program on the critical thinking disposition, problem-solving process and job performance of nursing students. To be specific, the purpose of the study was three-fold:

1. Investigate the effects of an integrated simulation program on the critical thinking disposition of nursing students.
2. Investigate the effects of it on their problem-solving process.
3. Investigate the effects of it on their job performance.

Methods and Materials

Design

A single-group experimental design was used in this study to determine the effects of integrated simulation-based education using a simulator on critical thinking disposition, problem-solving process and job performance.

Study participants

The subjects in this study were the seniors who were selected by random sampling from a college of nursing in an urban

community. They took courses in "adult health nursing", "child health nursing" and "maternity nursing". The appropriate number of subjects for this study was 119 at least at the .05 level of significance and with effect size .03 and power $1-\beta=$.90 when G*power program and two-sided test were used. Therefore the number of the subjects who agreed to participate in this study in writing was sufficient. Out of them, however, two students didn't fill out the given questionnaire completely, and six dropped out of the program. So the actual number of the students who participated in this study was 182.

Data collection method

Data were gathered from the nursing students from September 1 through December 20, 2016. Before that, an orientation was conducted by the researchers to explain how to proceed with the study, and the students were explained that what they were educated about would be used for this study, and that they could not give an answer if they didn't want to. Also, they were assured that the survey data would be used for the purpose of the study only, and that the survey would be conducted anonymously and not affect their academic standing. In addition, they were told that the process of practice under the given scenarios would be shot, and that the videos would be used during debriefing and for the purpose of the study. That was mentioned on the consent form. After all the explanations were given, they signed the consent form, and then a survey was conducted as a pre-test on September 1, 2016. After they finished practicing under all the three scenarios, they were evaluated on December 20, 2016.

Research proceeding procedure

This study was implemented by operating integrated simulation,

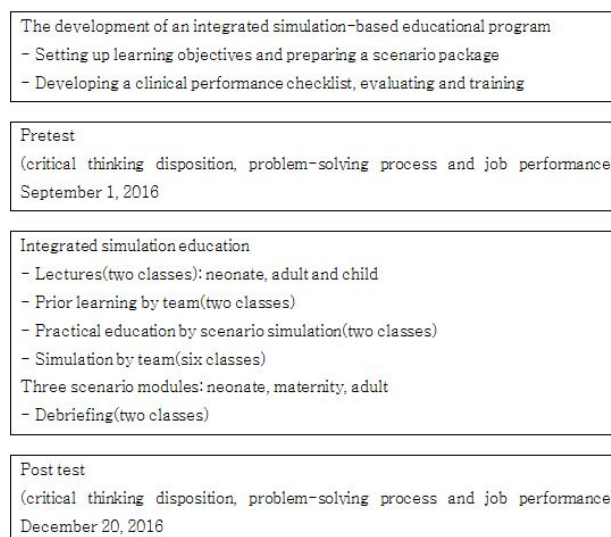


Figure 1. Research proceeding procedure

Simulation-based education

The integrated simulation education program was provided twice a week, about four hours each. It was conducted in five

stages: theoretical lectures, prior learning by team, simulation education, team simulation and debriefing. There were five students in each team, and four groups were organized. The procedures of the program are shown in Figure 1.

First, theoretical lectures were given by this researcher for two hours according to a prearranged plan to attain the objectives of the integrated simulation.

Second, prior learning by team aimed to have a better understanding of the given scenario situations by having discussions with team members to find an intervention necessary for the settlement of the problem situations. It took two hours.

Third, as for simulation education, the students divided what they had to do in preparation for the items to be practiced under the scenarios, and simulation education was provided after they practiced it.

Fourth, simulation by team was conducted by two researchers under the scenarios to help the students practice how to perform their roles to provide intervention. Before it started, they were informed that every process would be videotaped for use in debriefing. It was conducted in the same way as the pre-evaluation of clinical performance, and each team was given 15 min to perform under one scenario. It took about an hour for the four teams to perform under the scenario. This researcher started the simulation program in the control room and informed the students of it. Each of the teams performed under the four scenarios, and it took six hours for every team to finish it.

Fifth, as to debriefing, every student watched the video clips of the whole simulation process to ask each other what they were good and poor at, what was difficult to do and how others performed what's hard for them to do, and every team member was asked to give answers to the questions. Each team was given 15 min to do that, and it took six hours for them to finish it.

Instrumentation

Critical thinking disposition: The instrument used to assess critical thinking disposition was Yoon (2008)'s inventory [16], which consists of 27 items: four on prudence, five on intellectual enthusiasm and curiosity, four on confidence, four on intellectual fairness, three on systemicity, four on sound skepticism and three on objectivity. A five-point Likert scale was used; and one point and five points respectively were given to "very rarely" and "quite often". A higher score indicates stronger critical thinking disposition. As for reliability, the Cronbach alpha coefficient of it was .87 in Yoon's study and .95 in this study.

Problem-solving process: The instrument used to assess problem-solving process was Lee et al., Adult Problem-Solving Process Inventory [17]. It is composed of five areas and 30 items: six on clarifying the problem, six on seeking a solution, six on decision making, six on implementing the solution and six on evaluating and reflecting. One point and five points were given respectively to "very rarely" and

"quite often" and a higher score indicates better problem-solving skills. As for reliability, the Cronbach alpha coefficient of it was .93 at the time when it was developed, and it was .95 in this study.

Clinical performance: The instrument used to assess clinical performance was Choi revised version. That was used after it was reviewed by two clinical practice professors in advance. It consists of five subareas and 45 items: 11 on nursing process, 11 on nursing skills, eight on education/collaborative relationships, six on interpersonal relationships/communication and nine on professional development. A five-point scale was used. Five points and one point were respectively given to "very good" and "very poor". A higher score indicates better clinical performance. The Cronbach alpha coefficient of it was .96 at the time when it was developed, and it was .92 in Choi study [18]. In this study, it was .94.

Data analysis method: The collected data were analyzed by SPSS 24.0 for Windows in the following way. To test the normality of the variables, Kolmogorov-Smirnov's normality test was carried out, and paired-samples t-test was used to produce results.

Results

General characteristics

As Table 1 shows the general characteristics of the subjects, the female students numbered 164 (90.1%), which outnumbered the male students numbered 18 (9.9%). By age, 141 students (77.5%) were 24 years old or younger and 41 students (22.5%) were at the age of 25 or over. As to academic background at the time of college entrance, the largest group that numbered 117 (64.3%) was high-school graduates, followed by 30 junior-college graduates (16.5%) and 35 college graduates (19.2%).

By the type of residence, the biggest group that numbered 75 (41.2%) lived in their own houses, followed by 48 dormitory dwellers (26.4%), 53 self-boarding students (31.9%) and one student (0.5%) who resided in a relative's or friend's house. Concerning satisfaction level with college life, the greatest group that numbered 100 (54.9%) were neither satisfied nor unsatisfied, followed by 39 unsatisfied students (21.4%), 28 satisfied ones (15.4%), 11 very unsatisfied ones (6.0%) and four quite satisfied ones (2.2%).

Regarding satisfaction with the department of nursing, the largest group that numbered 78 (42.9%) were neither satisfied nor unsatisfied, followed by 48 satisfied students (26.4%), 39 unsatisfied ones (23.6%), seven quite satisfied ones (3.8%) and six very unsatisfied ones (3.3%). By academic standing, the greatest group that numbered 116 (63.7%) was in the middle tier, followed by 34 lower-tiered students (18.7%) and 32 upper-tiered ones (17.6%). In terms of satisfaction with the simulation education, the biggest group that numbered 68 (37.4%) was neither satisfied nor unsatisfied, followed by 83

satisfied students (45.6%), 12 unsatisfied ones (6.6%), 17 quite satisfied ones (9.3%) and two very dissatisfied ones (1.1%).

Table 1. General Characteristics

	Demographics	N (%)
Gender	Male	18 (9.9)
	Female	164 (90.1)
Age (y)	24 or under	141 (77.5)
	25 or over	41 (22.5)
Academic background	High school graduate	117 (64.3)
	Junior college graduate	30 (16.5)
	University graduate	35 (19.2)
Residence type	One's own house	75 (41.2)
	Self-boarding	48 (26.4)
	Dormitory	58 (31.9)
	Relative's house	1 (0.5)
Academic standing	Upper	32 (17.6)
	Middle	116 (63.7)
	Lower	34 (18.7)
Satisfaction with college life	Quite satisfied	4 (2.2)
	Satisfied	28 (15.4)
	Neither satisfied nor unsatisfied	100 (54.9)
	Unsatisfied	39 (21.4)
	Very unsatisfied	11 (6.0)
Satisfaction with the department of nursing	Quite satisfied	7 (3.8)
	Satisfied	48 (26.4)
	Neither satisfied nor unsatisfied	78 (42.9)
	Unsatisfied	43 (23.6)
	Very unsatisfied	6 (3.3)
Satisfaction with the simulation	Quite satisfied	17 (9.3)
	Satisfied	83 (45.6)
	Neither satisfied nor unsatisfied	68 (37.4)
	Unsatisfied	12 (6.6)
	Very unsatisfied	2 (1.1)

Effects of integrated simulation program on critical thinking propensity and troubleshooting process, ability to do business

As Table 2 shows, the nursing college students got $3.47 \pm .48$ in the pretest and $3.58 \pm .52$ in the post-tests, and the difference was statistically significant ($t=-2.023$, $p=.045$). Their scores in problem-solving process was $3.13 \pm .51$ in the pretest and 3.45

$\pm .46$ in the post-test, and the difference was statistically significant ($t=-5.616$, $p<.001$). In job performance, they got $3.32 \pm .41$ in the pre-test and $3.63 \pm .49$ in the post-test, and the difference was statistically significant ($t=-6.277$, $p<0.001$).

Table 2. Effects of Integrated simulation program on Critical thinking propensity and Troubleshooting process, Ability to do business

	Pre	Post	diff	t	p
Critical thinking propensity	$3.47 \pm .48$	$3.58 \pm .52$	$-.11 \pm .71$	3	0.045
Troubleshooting process	$3.13 \pm .51$	$3.41 \pm .46$	$-.29 \pm .69$	-5.61	$p<.001$
Ability to do business	$3.32 \pm .41$	$3.63 \pm .49$	$-.31 \pm .67$	-6.27	$p<.001$

Discussion

This study attempted to develop an educational program for integrated nursing using an integrated simulation program to test its effect on critical thinking disposition, problem-solving process and clinical performance to provide empirical data on how to offer better practical simulation education for nursing college students.

The subjects in this study got $3.47 \pm .48$ in the pre-test and $3.58 \pm .527$ in the post-test. The score was above average and was similar to the scores of the nursing college students in Hur et al. study [19]. Therefore critical thinking faculty should be stressed in nursing simulation education, and this education seems to be one of major variables to affect problem-solving skills and job performance. Konw et al. argued that simulation class which is similar to real situations reflects critical thinking faculty necessary for nursing education and thereby serves to improve problem-solving skills and job performance [20]. Critical thinking faculty makes it possible to apply, analyse and piece together information and to infer from it instead of merely performing nursing duties without a critical eye in the given situation, and the improvement of critical thinking faculty that can lead to the best judgment is crucial. Also, it's important to nurture nurses who have critical thinking disposition and are quite willing to make the most out of their critical thinking faculty.

In problem-solving process, the subjects got $3.13 \pm .51$ in the pre-test and $3.45 \pm .46$ in the post test. This score was above average, and this finding corresponds to the finding of Yang et al. study that investigated nursing college students [21]. Problem-solving skills that are required in nursing practice is an ability that nurses should have to make the right judgment in clinical emergency situations to solve the given problem. Nurses should try to solve the given problem properly in clinical situations, and their own efforts for better problem-solving skills and the preparation of standard problem-solving guidelines are both necessary [22].

In job performance, they got $3.32 \pm .41$ in the pre-test and $3.63 \pm .49$ in the post-test. The score was above average, and the finding of the study coincides with the finding of Eom et al. study [10] and that of Yoo study [13] that training which

utilizes standardized patients is more effective in enhancing clinical performance than traditional training. Job performance is a basic ability that students should have to acquire during integrated simulation class, and they should be given an opportunity to show what they can do and improve it in complicated or urgent clinical simulation situations.

A wide variety of educational methods should be attempted in consideration of the theme and level of integrated simulation practice to achieve the objectives of education through repeated learning, and a wide range of resources available should be utilized as much as possible. To maximize the job performance of nurses, it seems necessary to implement simulation practice using standardized patients to evaluate its usefulness to prove its effects [11].

In this study, simulation was conducted after scenarios were prepared using the integrated simulation program, and what results it produced at different times was analyzed after a single group was selected. The students who underwent the simulation training showed improvements in job performance, problem-solving skills and critical thinking faculty, and it could be said to show that the simulation training was effective. Rodger et al.'s study found that multi-mode simulation and high-fidelity simulation education which respectively used standardized patients and SimMan were both effective at increasing problem-solving skills, critical thinking disposition and job performance. The finding of the study corresponds to the finding of this study [23].

Among general characteristics, there were significant differences between the pre-test and post-test scores of the subjects in this study in job performance and problem-solving process according to academic standing.

Cooper et al. study lends credibility to the findings of this study because it also found that the simulation scores of the students varied with their academic year, and that their academic standing affected overall simulation job performance [24]. Therefore teachers should provide an opportunity for students to check and improve what they can do by gaining experience of more complicated clinical or simulation situations.

In addition, practical integrated simulation programs that could produce positive effects should be provided for students to have a better perception on problems taking place in clinical situations, to acquire how to offer appropriate nursing for patients, to foster their critical thinking faculty and to solve problems in collaboration with other team members [25].

In order to generalize the integrated simulation program as an effective method of clinical education for nursing college students, sustained efforts should be directed into the evaluation and reorganization of integrated simulation education. That is expected to boost the effectiveness of clinical training.

Conclusion and Suggestion

In this study, whether there were any differences in educational outcome among the students in the department of nursing in a

college located in Gangwon Province who engaged in integrated simulation practice after a pre-test and a post-test were conducted. And this study is of significance in that it found they showed improvements in critical thinking faculty, job performance and problem-solving skills after they took the integrated simulation classes.

The findings of the study ascertained that practice by integrated simulation is one of effective educational methods because it served to improve the critical thinking disposition, problem-solving process and job performance of the students, though the typical method of practice also could contribute to the attainment of educational objectives.

As there is a rapid-growing demand for full-fledged new nurses, seniors need to be provided with plenty of learning opportunities by taking integrated simulation classes. At the same time, they should be allowed to acquire diverse experience in learning by integrated simulation and to be given a chance to fully show what they can do.

Given the findings of the study, there are some suggestions on future research efforts: First, a wide variety of variables that could produce educational effects should be investigated. Second, simulation-based education should be conducted for a longer period of time to analyze educational effects more precisely. Third, a larger number of subjects who are going to receive simulation-based education should be selected to make repeated research.

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