

Effects of a Critical Thinking Course for Korean Nurses in RN-BSN Program

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Abstract

Critical thinking is essential to implementing the nursing process requiring timely decision making. The study examined the effects of a critical thinking course for nurses in the RN-BSN program. The study used a pre- and post-test design with a control group. The experimental group was a convenience sample of 24 working nurses attending a health college. The control group was 24 fellow nurses. The nursing process-based critical thinking course was provided to the experimental group two and half hours a week for 8 weeks. Teaching methods included lectures followed by a summary and quiz, brainstorming and action learning, and lecturer feedback. A pamphlet about views of professional occupation was provided to the control group. The data were collected using self-report questionnaires and analyzed to examine differences in the test scores before and after the intervention. The scores of critical thinking disposition, problem-solving process, and clinical competence increased significantly in the experimental group but did not in the control group. The difference between the two groups was also statistically significant in critical thinking disposition, problem-solving process, and clinical competence. It is necessary that a robust educational program or training to enhance critical thinking ability of nurses are provided in clinical settings and that nurses keep going on thinking critically in their practice.

Keywords : Critical Thinking, Education, Nurse, Nursing Process, RN-BSN Program

1. Introduction

Problems related to health are often complex in modern society because professional management is required to deal with diverse needs generated from individual patient's health problems. Nurses who encounter the complexity of patient's needs should be skilled in the early recognition of those particular needs and in problem-solving by prompt, accurate, and analytical judgment^[1]. Solid judgment relies on the ability of the nurse to use a cognitive approach to sound clinical decisions about how best to meet the patient's nursing care needs^[2].

1.1 Definitions of Critical Thinking

Critical thinking is essential for handling the various situations encountered in a stressful environment of

patient care characterized by volatility, complexity, and ambiguity and for clinical decision making that directly affects patient outcomes^[3]. The American Philosophical Association (APA) defined critical thinking as purposeful, self-regulatory judgment by interpretation, analysis, evaluation, and inference; as well as based on explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations^[4]. Scheffer and Rubenfeld^[1] expanded the definition of critical thinking toward nursing through the Delphi method using the international panel of experts in nursing practice, education, and research: "Critical thinking in nursing is an essential component of professional accountability and quality nursing care. Critical thinkers have the cognitive skills of analyzing, applying standards, discriminating, information seeking, logical reasoning, predicting, and transforming knowledge." Further, critical thinkers possess the attributes of critical thinking disposition. The attributes include open-mindedness of seeking out new evidence or possibilities, fair-mindedness of the unprejudiced examination of evidence of a viewpoint different from their own belief, reflectiveness of gathering appropriate evidence to eval-

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(Received : May 30, 2019, Revised : June 13, 2019,

Accepted : June 20, 2019)

uate an issue carefully, and counterfactual thinking of pondering what would happen if the fact was considered under different conditions or perspectives^[1].

Since the APA's definition, many definitions of critical thinking have been suggested but there has been a lack of consensus^[5]. Profetto-McGrath^[6] defined critical thinking as an active, ongoing cognitive process of logical reasoning in which the individual methodologically explores and analyzes issues, interprets complicated ideas, considers all aspects of a situation, and where appropriate, follows with prudent judgment. According to Facione and Facione^[7], critical thinking is a judgment process. Its goal is to decide what to believe and what to do in a given context. Applying critical thinking to nursing practice is to demonstrate the nurse's ability to generate, implement, and evaluate approaches for dealing with client care and professional concerns^[8].

1.2 Critical Thinking and Nursing Process

The nursing process is a scientific approach for setting priorities in addressing patients' health problems and making clinical decisions^[3]. As the nursing process helps nurses have a systematic thinking process about what they do in their practice, it is used as a framework for clinical decision making^[9]. Critical thinking is importantly used in each step of the nursing process. During the assessment step, the nurse systematically gathers data to identify chief complaints and other health problems. The nurse uses critical thinking to interpret data and clarify the meaning by separating the relevant from the irrelevant. During the diagnosis and planning steps, the nurse identifies the patient's nursing care needs and sets up care plans along with nursing goals. After providing nursing interventions, the nurse evaluates the effectiveness of the interventions by using valid tools. The evaluation step or reassessment step is ongoing as the patient progresses toward goal achievement^[1,10]. Thus, critical thinking enhances clinical judgment and problem-solving skills needed in nursing practice. The nursing process model is a powerful means to facilitate such critical thinking^[10].

Nurses improve their own critical thinking skills including analysis, evaluation, inference, and deductive and inductive reasoning through their clinical experience and expertise accumulated over the years^[11]. Nevertheless, many experienced nurses do not possess optimal critical thinking skills^[12]. Feng and colleagues^[13]

reported that critical thinking competence and disposition were only partially developed in spite of many years in clinical experience and a high clinical position. The authors argued the need for the development, implementation, and evaluation of education programs to strengthen the critical thinking ability of nurses in clinical settings. A course integrating nursing process and critical thinking may be necessary because these two concepts are inextricably linked^[2,9].

1.3 Studies about Critical Thinking

Many studies measured critical thinking disposition and skills to identify critical thinking ability. Searing and Kooker (2016)^[14] examined the relationships among the California Critical Thinking Disposition Inventory (CCTDI) scores, cumulative grade point averages (GPAs), and scores of Health Education Systems Incorporated (HESI) examinations designed to prepare the NCLEX-RN examination, using a retrospective review of 96 nursing students' records. They could not find meaningful relationships between critical thinking disposition and important learning outcomes. Zori et al. (2013)^[15] provided registered nurses (RNs) in a fellowship program (which provides didactic, simulated, and clinical experiences to develop competency in the clinical specialty of new graduates or experienced RNs) with the critical thinking education using videos of simulated scenarios and reflective journaling on the RNs' clinical experiences. However, they found no significant difference in critical thinking disposition between an experimental and control group and within groups over time at the baseline, week seven, and month five. Wood and Toronto (2012)^[16] assessed the influence of patient simulator practice on critical thinking dispositions of novice baccalaureate nursing students who were randomly assigned to the experimental or control group. No between-group differences were found on the overall and subscale CCTDI. Naber and Wyatt (2014)^[17] provided reflective writing intervention for a randomly assigned experimental group of senior nursing students. They let students reflect on a time when they encountered a patient with post-surgical nausea. The students were asked to write the following: the purpose of their reflective writing; what they observed and experienced in the clinical setting; what conclusions they had by the end of the experience; what definitions, principles, concepts, or theories learned in the classroom they applied;

what interventions they implemented; what pre-existing assumptions they brought to the experience; and what consequences this experience had for them or their patient. Results showed that no significant difference was found between the experimental and control groups on CCTDI and California Critical Thinking Skills Test (CCTST) total scores. However, the experimental group had a significant increase on the truth-seeking sub-scale of the CCTDI when compared to the control group. Zori et al. (2010)^[18] found a positive relationship between strength in critical thinking dispositions of nurse managers and their respective staff RNs' perceptions of the practice environment. The researchers proposed that enhancing critical thinking skills and the dispositions of nurse managers would help create positive work environments for staff RNs. Raymond and Profetto-McGrath (2005)^[19] reported that 11 full-time nurse educators from a baccalaureate nursing program in Western Canada scored highest in the inquisitiveness sub-scale of the CCTDI and in the inductive reasoning sub-scale of the CCTST. In interviews with six nurse educators, the nurse educators revealed the strategies that nurse educators could use to facilitate critical thinking in classroom and clinical settings: creating a positive and open environment; role modeling all aspects of critical thinking, including deconstruction of ideas and the resultant synthesis and reflection; examining culture and the impact various cultures have on delivering nursing care; setting and following standards of critical thinking; and fostering critical thinking dispositions, such as open-mindedness by role modeling. In summary, based on our search, although we could not present all studies here, the results of measuring critical thinking disposition and skills mostly showed no difference between experimental groups and control groups of studies implemented in Canada and United States. Thus, the extensive literature review of experimental studies about critical thinking implemented in different countries, except for Canada and United States, is required to obtain comprehensive knowledge regarding effects of interventions to improve critical thinking ability.

In Korea, a small number of studies developed and implemented education programs to increase critical thinking skills. Kim (2015)^[20] reported improvement of the critical thinking disposition of nursing students through the nursing process education program using clinical excellence exemplars and group dynamics

including large and small group discussion. Yi (2009)^[21] reported improvement of critical thinking disposition of the five years or more experienced nurses by re-teaching the nursing process during a semester. In contrast, many studies mostly examined the relationships among critical thinking disposition, problem-solving process, self-directed learning, nursing competence, and clinical decision making of nurses^[22-28] and nursing students^[29,30]. However, little attention has been given to the effects of a critical thinking-focused nursing process education program.

1.4 The Purpose of the Study

Critical thinking disposition best reflects critical thinking^[6]. Critical thinking disposition toward critical thinking is described as consistent internal motivation or one's strong willingness to engage problems and make decisions by thinking critically^[7]. A problem-solving process requires critical thinking that refers to the ability to question and make rational decisions and that is a kind of reasoning process^[3]. The term of competence is used interchangeably with competency. Competency is defined as the knowledge, skills, ability, and behaviors that a person has to perform tasks correctly and skillfully^[31]. Developing and enhancing critical thinking improve clinical competence^[32]. The purpose of this study was to examine the effects of the nursing process-based critical thinking course on critical thinking disposition, problem-solving process, and clinical competence of nurses in the RN-BSN program.

2. Methods

2.1 Ethical Statements

The study was approved from the university's institutional review board prior to initiation of the study (GIRB-A16-Y-0013). Participants were informed about the purpose and procedure of the study, rights and withdrawal of participation in the study, and confidentiality and anonymity in the data collection and analysis. All the participants provided written informed consent before a pretest.

2.2 Study Design

This study used a pretest and posttest design with a control group. To add robustness to the study design, two tests were conducted: a normal distribution test for

two groups and homogeneity tests on the general characteristics and pretest scores of two groups at the baseline^[33].

2.3 Setting and Sample

The subjects eligible for the experimental group were nurses who took the critical thinking course of the RN-BSN program that the first researcher (Nam-Joo Je) taught and who worked at clinical settings. Subjects were recruited from the nursing school of the health college where NJJ taught the course. Of 40 nurses enrolled in the course, twenty-four nurses met the inclusion criteria and were assigned to the experimental group. The remaining 16 nurses took the course together, but they were not included in data analysis because they did not work.

The subjects eligible for the control group were fellow nurses who worked at the same hospitals as the nurses in the experimental group and who did not register any educational courses related to critical thinking and nursing process. To recruit the control group, cooperation in participating in the study was asked by a letter mailed to the nursing departments of the hospitals (two nursing homes, three general hospitals with fewer than 300 beds, four general hospitals with 300 beds or more, and a tertiary hospital). The researchers obtained permission to have access to nurses from those nursing departments through telephone calls. Twenty-six nurses were recruited from the ten hospitals, and two of them withdrew due to maternity leave. Thus, a total of 24 nurses were assigned to the control group.

The sample's size was determined by using the G* power 3.1 program.^[34] Based on an effect size ($t = .80$), a significance level ($\alpha = .05$), and statistical power of a test (.80) that are required for a *t*-test of an independent sample, the minimum sample size for this study was 42 subjects, composed of 21 for the experimental group and 21 for the control group. A total of 48 nurses (24 for each group) participated in this study.

2.4 Instruments

2.4.1 General Characteristics

The general characteristics of the participants included eight items of age, gender, marriage, religion, education, total years of clinical experience, years working at the current ward, and currently working ward.

2.4.2 Critical Thinking Disposition

Critical thinking disposition was measured using the Instrument for the Measurement of Critical Thinking Disposition in Nursing developed by Yoon^[35], with the permission of the developer. The instrument is composed of seven sub-dimensions with 27 items that include four items for sound suspicion, four for intellectual fairness, three for objectivity, three for systematicity, four for prudence, five for intellectual eagerness and curiosity, and four for self-confidence. Each item was rated on a five-point Likert scale (strongly disagree=1, disagree=2, neither agree nor disagree=3, agree=4, and strongly agree=5). The higher the score, the higher the level of the critical thinking disposition. Negative items were calculated reversely. Cronbach's α was from .84 to .89^[25,34] and .95 in this study.

2.4.3 Problem-Solving Process

Problem-solving process was measured by using the Problem-Solving Process Inventory for Adults developed by Lee and colleagues^[36], with the permission of the developers. The instrument is composed of five sub-dimensions with 30 items that include six items for problem clarification, six for seeking solutions, six for decision making, six for applying the solutions, and six for evaluation and reflection. A five-point Likert scale (very rare=1, rare=2, neither rare nor frequent=3, frequent=4, and very frequent=5) was used. The high score indicates the high level of problem-solving. Cronbach's α was from .93 to .94^[22,36] and .95 in this study.

2.4.4 Clinical Competence

Clinical competence was measured using the Standardized Nurse Performance Appraisal Tool. This instrument was originally developed by the Korean Hospital Nurses Association for public use and was revised by Park^[37]. The instrument is composed of 55 items: 37 items for performance appraisal of nurses (27 items for providing nursing care, five items for supporting nursing, and five items for communication and human relationship) and 18 items to evaluate nurse's ability of and attitude to clinical competence. A five-point Likert scale (strongly disagree=1, disagree=2, neither disagree nor agree=3, agree=4, and strongly agree=5) was used for each item. The high score indicates the high level of clinical competence. Cronbach's α was from .97 to .98^[22,37] and .91 in this study.

2.5 Development of the Educational Program

The nursing process-based critical thinking course had three dimensions: critical thinking, nursing process and critical thinking, and practice of critical thinking. Based on the literature^[14-30] relevant to critical thinking and several textbooks^[38-40], the researchers set topics, detailed contents, and teaching methods to be dealt with every week for 8 weeks. Advice on the initially developed course was sought from an education professor and from two nursing professors who taught the course of critical thinking and nursing process. A final version of the course process was presented in Fig. 1.

Knowledge relevant to critical thinking and the nursing process was provided through a series of lectures. The contents of lectures were reviewed by a quiz. To practice critical thinking skills, several methods were used: brainstorming, action learning, and lecturer's feedback. The term of brainstorming was first introduced by Alex F. Osborn in 1953 through his book *Applied Imagination: Principles and Procedures of Creative Problem Solving*, and its definition has evolved over time^[41]. A Merriam Webster Dictionary defines brainstorming as "a group problem-solving technique that involves the spontaneous contribution of ideas from all members of the group; and mulling over of ideas by one or more individuals in an attempt to devise or find a solution to a problem." Osborn initially proposed four rules for the brainstorming process, but use in academia and the business world have deviated from the original rules^[41]. In the education program of this study, original and changed rules all were valuable. The following rules of brainstorming were applied: no criticism, evaluation, judgment, or defense of ideas generated during the brainstorming session; generation of as many useful, relevant, and qualified ideas as possible; the combination of ideas; and improving on each other's ideas toward creative solutions to problems. In this study, group and individual brainstorming were used to address discussion topics assigned in class.

Action learning is a dynamic, highly structured team process to address real problems by taking action and evaluating results. This approach improves the problem-solving process as well as the solutions developed by the team^[42]. In this study, action learning was used to address case studies assigned in class. This active participation in class increases exposure to other ways of thinking. Well-managed participation can result in

Week	Topic	Teaching Strategies	Time (min)
1	Introduction	Make groups	20
			5
	Professional nursing	Group brainstorming	15
		Presentation	15
Lecturer's feedback		15	
Nursing science and critical thinking	Lecture	50	
	Summary	20	
	Quiz	10	
2	Nursing process and critical thinking	Lecture	120
		Summary	20
		Quiz	10
3	Preparation for the future	Individual brainstorming	20
		Presentation	100
		Lecturer's feedback	30
4	Nursing assessment and critical thinking	Lecture	120
		Summary	20
		Quiz	10
5	Nursing diagnosis and critical thinking	Lecture	60
		Summary	15
		Quiz	10
	Care plans and critical thinking	Lecture	40
Summary		15	
Quiz		10	
6	Case studies from the Supreme Court	Action learning	60
		Presentation	60
		Lecturer's feedback	30
7	Implementation and critical thinking	Lecture	40
		Summary	15
		Quiz	10
	Nursing evaluation and critical thinking	Lecture	60
Summary		15	
Quiz		10	
8	Clinical case studies	Action learning/	60
		Presentation	60
		Lecturer's feedback	30

Note. In Korea, a one-hour class is composed of a 50-minute class and 10-minute break. Therefore, a class for two and half hours or a 150-minute class refers to a three-hour class that continues without breaks.

Fig. 1. A Summary of the nNursing process-based critical thinking course program.

insightful comments and interesting connections being generated by students and can foster a high level of energy and enthusiasm in the classroom learning environment^[43]. After presentations of the views converged from group brainstorming (in the first week), action

learning (in the sixth and eighth weeks), and individual brainstorming (in the third week), the lecturer's feedback was provided to groups or individuals.

2.6 Intervention

The nursing process-based critical thinking course was provided to the experimental group for 8 weeks in the classroom of the nursing school of a health college (Fig. 1). The control group was given a 2-page pamphlet about views of professional occupation.

2.7 Data Collection

For data collection in the pretest and posttest of the two groups, the researcher (NJJ) trained two nursing graduate students about the study's purpose and the method of conducting a survey using the questionnaire.

A pretest was administered to the experimental group in the classroom before starting the first class of the course and to the control group at an appointed date, within one week of the course started (Fig. 2). The posttest was administered to the experimental group after finishing the last class of the course and to the control group at a scheduled date, within one week of the course finished. For data collection from the control group, the data collectors made a schedule with individual nurses.

Each of the pretest and posttest took around 30 minutes for the participants to complete all the questionnaires required. All participants voluntarily participated in the study and were not given any compensation for the participation. Data were collected between April and June, 2016.

2.8 Data Analysis

An SPSS/WIN 21.0 program was used for statistics. The Shapiro-Wilk test was conducted to test normal distributions of the pretest scores of each group^[44]. As a result, the pretest scores of critical thinking disposition and clinical competence of the experimental group and all the pretest scores of the control group were in a normal distribution ($W=0.96-0.98$, $p=.340-.993$). The score of the problem-solving process of the experimental group was not in a normal distribution ($W=0.88$, $p=.009$).

The homogeneity of general characteristics of the experimental group and the control group was tested by using the χ^2 -test, Fisher's exact test, and t-test. To test the homogeneity on the pretest scores of two groups, the independent t-test was conducted for the data of critical thinking disposition and clinical competence in a normal distribution. The Mann-Whitney U-test was conducted for the data of the problem-solving process in a non-normal distribution^[45].

To test the effects of the course, the paired t-test and independent t-test were conducted for critical thinking disposition and clinical competence that were in a normal distribution. The paired t-test was employed to examine the difference in the pretest and posttest of each group. The independent t-test was used to examine the difference between the experimental and control groups. The Wilcoxon signed-rank test and Mann-Whitney test were conducted for the problem-solving process that was not in a normal distribution. The Wilcoxon signed-rank test was used to examine the difference in the pretest and posttest of each group^[46]. The Mann-Whitney test was used to examine the difference between the two groups^[47,48]. The paired t-test and independent t-test are parametric statistics conducted under the assumption that population parameters are normally distributed. The Wilcoxon signed-rank test and Mann-Whitney test are non-parametric statistics used when no assumption was made about the population distribution^[45,47].

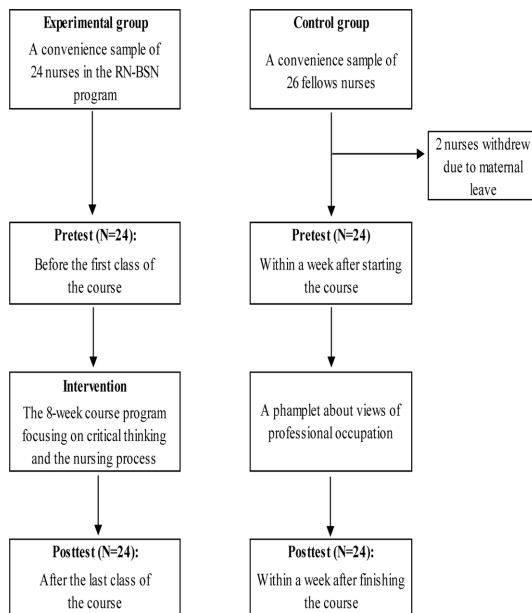


Fig. 2. A Flow of the study.

3. Results

No statistically significant differences were found in the general characteristics (Table 1) and in the pretest scores of the two groups (Table 2).

In the experimental group, the level of critical thinking disposition showed a statistically significant difference (0.29 point increased; $t=2.09$, $p=.048$) between the pretest score (3.71) and the posttest score (4.00),

whereas there was no difference ($t=-0.65$, $p=.521$) between the pretest and posttest scores of the control group. The difference between the two groups were statistically significant ($t=2.04$, $p=.048$) after the course (Table 3).

The level of problem-solving process significantly increased (0.66 point increased; $z=-2.95$, $p=.003$) in the experimental group after intervention of the education program (a pretest score=3.44; a posttest score=4.10),

Table 1. A homogeneity test on general characteristics between two groups (N=48)

Characteristics	Categories	Exp. (N=24)		Cont. (N=24)		t or z	p
		n	%	n	%		
Age	< 30	14	58.3	14	58.3	1	>.999
	>= 30	10	41.7	10	41.7		
	Mean(SD)	30.29(8.69)		31.38(8.75)		-0.43	.669
Gender ^a	Male	2	8.3	1	4.2	1	>.999
	Female	22	91.7	23	95.8		
Marriage	Married	9	37.5	10	41.7	0.09	.768
	Single	15	62.5	14	58.3		
Religion	Yes	9	37.5	15	62.5	3.00	.083
	No	15	62.5	9	37.5		
Total years of clinical experience	< 5	13	54.2	12	50.0	0.08	.773
	>= 5	11	45.8	12	50.0		
	Mean(SD)	6.63(7.07)		7.99(7.08)		-0.67	.508
Years working at the current ward	<3	15	62.5	12	50.0	0.76	.383
	>=3	9	37.5	12	50.0		
	Mean(SD)	2.63(2.12)		4.27(3.49)		-1.97	.056
Current ward	General wards	11	45.8	10	41.7	0.16	.924
	Special wards(ER, OR)	9	37.5	9	37.5		
	Geriatric ward combined with a convalescent facility	4	16.7	5	20.8		

Note. Exp. = experimental group; Cont. = control group; SD = standard deviation; ER = emergency room; OR = operating room.

^aFisher's exact test.

Table 2. A homogeneity test on the pretest scores of two groups (N=48)

Variables	Exp. (N=24)	Cont. (N=24)	t or z	p
	Mean(SD)	Mean(SD)		
Critical thinking disposition	3.71(0.45)	3.70(0.34)	0.16	.872
Problem-solving process	3.44(0.53)	3.54(0.48)	-1.05	.293 ^a
Clinical competence	4.04(0.40)	3.99(0.39)	0.49	.628

Note. Exp. = experimental group; Cont. = control group; SD = standard deviation.

^aMann-Whitney U test.

Table 3. Comparison of measurement of dependent variables in two groups (N=48)

Variables	Group	Pre Mean (SD)	Post Mean (SD)	Post-Pre Mean (SD)	Paired <i>t</i> -test		Independent <i>t</i> -test	
					<i>t/z</i>	<i>p</i>	<i>t/z</i>	<i>p</i>
Critical thinking disposition	Exp.	3.71 (0.45)	4.00 (0.39)	0.29 (0.67)	2.09	0.048	2.04	.048
	Cont.	3.70 (0.34)	3.63 (0.46)	-0.07 (0.53)	-0.65	0.521		
Problem-solving process	Exp.	3.44 (0.53)	4.10 (0.56)	0.66 (0.84)	-2.95	0.003 ^a	-2.49	.013 ^b
	Cont.	3.54 (0.48)	3.46 (0.57)	-0.08 (0.73)	-0.42	0.678 ^c		
Clinical competence	Exp.	4.04 (0.40)	4.43 (0.38)	0.39 (0.60)	3.12	0.005	2.86	.006
	Cont.	3.99 (0.39)	3.91 (0.44)	-0.08 (0.50)	-0.72	0.478		

Note. Exp. = experimental group; Cont. = control group; SD = standard deviation.

^aWilcoxon signed-ranks test.

^bMann-Whitney test.

whereas there was no difference ($z=-0.42$, $p=.678$) between the pretest and the posttest scores of the control group. In the posttest, the two groups showed a statistically significant difference ($z=-2.49$, $p=.013$).

The level of clinical competence presented a statistically significant difference (0.39 point increased; $t=3.12$, $p=.005$) between the pretest (4.04) and posttest scores (4.43) of the experiment group, whereas there was no difference ($t=-0.72$, $p=.478$) between the pretest and posttest scores of the control group. In the posttest, the two groups showed a statistically significant difference ($t=2.86$, $p=.006$).

4. Discussion

This study provided the nursing process-based critical thinking course and analyzed the differences in critical thinking disposition, problem-solving process, and clinical competence between the experimental group and the control group. The 8-week program used theoretical lectures, individual and group activities including brainstorming and action learning, and lecturer's feedback. By following the program, participants were found to have significantly improved levels of critical thinking disposition (3.71 to 4.00), problem-solving process (3.44 to 4.10) and clinical competence (4.04 to 4.43) in comparison to a control group.

In previous studies, critical thinking ability and problem-solving ability most affected the clinical competence of nurses and, further, were essential for improving professional clinical competence of nurses^[23,25,49]. Because of the importance of critical thinking skills that ensures nurses' ability to provide safe, effective care to patients^[50], the researchers of previous studies emphasized the need for an educational program to enhance critical thinking ability as well as problem-solving ability and clinical competence of nurses in clinical settings^[3,13,28].

The course of this study included several teaching methods. The lecture followed by a summary and quiz enhanced the students' understanding of critical thinking, the nursing process, and their relationship. Brainstorming and action learning encouraged the nurses' critical thinking disposition through discussions about the topics and exercises of the clinical case studies assigned in class. Lecture feedback after every brainstorming and action learning helped students to self-evaluate and reflect on their learning. Kaddoura^[50] implemented a qualitative study to explore the perceptions of new graduate nurses about how a six-month Essentials of Critical Care Orientation (ECCO) program in the intensive care unit improved their critical thinking skills. The ECCO program is a hospital-based program first distributed in 2002 by the American Association of

Critical Care Nurses (AACN) and an online nursing education program that contains content modules of a body system approach, real-life scenarios, and case studies, with accompanying self-assessment checkpoints and multiple-choice tests to evaluate learning. The new graduate nurses perceived that the content was informative for obtaining critical care knowledge and that the scenarios and case studies promoted their critical thinking skills. Jang and Park^[51] reported an improvement of the problem-solving ability of the nurses by using the teaching methods of action learning and lecture. They emphasized that the action learning approach was particularly useful for improving the nurses' problem-solving abilities. Yi^[21] reported improvement of critical thinking disposition in nurses with five or more years of experience by re-teaching the nursing process during a semester.

Critical thinking ability is developed through not temporary education but continuous education as well as the steady efforts of individual persons^[2,9]. Critical thinking ability is one of the key competencies for professional nurses who should think critically to become competent, safe, and skillful healthcare providers^[50]. Critical thinking ability is not improved when nurses use the nursing process in a robotic way and where nurses focus on routine, task-oriented methods to provide only efficient patient care^[10]. Core cognitive critical thinking ability needs to be trained in the framework of the nursing process^[10].

4.1. Limitations

This study had several limitations. First, the results of this study are restricted to the convenience sample of nurses participating in this study. It limits the generalization of the results of this study. Second, this study implemented the posttest immediately after the course but did not implement follow-up tests. As time passes, the effects of the course may differ from initial results. A further study is required to conduct follow-up posttests to see how long the effects of the course last and to assess the need for re-education. Lastly, there was the potential for threats to internal validity including maturation, testing effects, and selection biases^[52]. These threats might affect the intervention effects. Maturation refers to changes by natural growth. The longer the time from the beginning to the end of a program, the greater the maturation threat. This study took half semester

from beginning to end. Testing effects occur in repeated measurements using a same questionnaire in the pretest and posttest. Our participants might have remembered the correct answers. Selection bias refers to the difference seen in posttest scores due to pre-existing differences between the groups rather than the impact of the program itself. A pre-existing difference might be the experimental group's strong motivation that might be generated during participating in the study^[52]. In the control group, the posttest scores were lower than the pretest scores. This was not explored in this study. A further study to identify the reasons is needed.

5. Conclusions

Providing the nursing process-based critical thinking course resulted in improvement in the levels of critical thinking disposition, problem-solving process, and clinical competence of nurses working in clinical settings. This study indicates that it is necessary that nurses have to keep going on thinking critically and a robust educational program or training to enhance critical thinking ability of nurses needs to be offered in clinical environment.

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