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The Effect of Problem-Based Learning for Patient Safety on Self-Leadership, Patient Safety Competencies, and Reflective Thinking of Nursing Students

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Abstract

This study is a one-group pretest-posttest design to evaluate the effect of problem-based learning (PBL) for patient safety on self-leadership, patient safety competencies, and reflective thinking of nursing students. The research was conducted from March 2 to April 15, 2022, in which 57 nursing students participated. PBL for patient safety was examined in a total of 8 sessions in the order of motivation, problem identification, task performance planning, problem-solving methods, summary and solution, presentation, and evaluation. The following topics of patient safety were selected for each team: nursing records, high-alert medication, medication error and intravenous fluid regulation, blood transfusion care, fall, bedsore, infection control, and pain management. We provided feedback on the learning process and outcomes of nursing students. According to the results, self-leadership showed a statistically significant improvement in self-expectations (t=2.60, p=0.01), goal setting (t=2.84, p<0.01), self-reward (t=3.32, p<0.01), and self-criticism (t=2.32, p=0.02). Patient safety competencies showed a statistically significant improvement in patient safety knowledge (t=13.05, p<0.001) and patient safety skills (t=4.87, p<0.001) but not in reflective thinking. The results prove that PBL for patient safety is an effective teaching-learning strategy to improve self-leadership and patient safety competencies. Future studies must develop and validate specific and long-term teaching-learning methods to improve reflective thinking.

Keywords: Nursing Students, Problem Based Learning, Patient Safety, Self Leadership, Reflective Thinking

1. Introduction

1.1 Background

The development of medical technology increased the severity of patients, enlarged the size of medical institutions, and made the medical environment more complex; this led to a steady increase in the number of

adverse events that resulted in deaths or severe injuries due to safety incidents, and, accordingly, the awareness of patient safety management increased in the health and medical environment [1]. Patient safety refers to reducing the threat of preventable harm to the minimum in the process of providing health and medical services [2], and activities for patient safety management are not only reflected in the quality evaluation of medical services but also a major issue that directly leads to patient life [3]. In particular, nurses among health and medical service personnel are at the forefront of patient safety management in the hospital setting. They are most directly linked to patient safety issues because they provide round-the-clock medical services for patients and perform direct nursing [4]. However, despite the increased importance of patient safety, more than half of the patient safety incidents reported by the WHO [5] are caused by inappropriate nursing due to carelessness [6]. This not only lays stress on the competencies of nurses related to patient safety [7] but also attaches importance to patient safety competencies as the core competencies of nursing students.

A continuous production of nursing students with competencies in patient safety management in clinical practice is needed; thus, the Korean Accreditation Board of Nursing Education reflected safety management competencies in program learning outcomes in the revision of the 4th Nursing Education Accreditation [8]. For nursing students to become outstanding nurses after graduation, they must be aware of the importance of patient safety incidents in clinical settings and acquire accurate skills to practice precise knowledge and proper actions about patient safety nursing [9]. Thus, there is a need for education to enhance patient safety competencies.

Recently, a variety of approaches have been made in teaching methods for nursing education, such as team-based learning, problem-based learning (PBL), and project-based learning. Among them, PBL is a teaching method that induces learning while learners solve practical problems that they are likely to face in practice in a self-directed and cooperative way [10]. By encouraging learners to perceive and solve the problems themselves, they are provided with the opportunity to reflect on their learning experience [11]. Thus, PBL is used as a teaching-learning method to promote reflective thinking [12,13].

Meanwhile, although institutions and organizations such as nursing colleges, professional nursing groups, and academic societies are making various efforts for patient safety [14–16], individuals must show constant interest and efforts to perceive, prevent, and manage new patient safety incidents and perform tasks to prevent recurrence of these accidents, which is why self-leadership is important. Self-leadership is a set of thinking and behavioral strategies used to exert influence on oneself and the autonomous power that leads to achieving high performance [17,18]. It can be inspired, developed, and maintained by learning and education [19], and it was proved to be increased by PBL [20].

Accordingly, this study will provide basic data for establishing teaching-learning strategies by identifying the effect PBL for patient safety has on self-leadership, patient safety competencies, and reflective thinking of nursing students.

1.2 Objectives

The purpose of this study is to identify changes in self-leadership, patient safety competencies, and reflective thinking through PBL for patient safety for nursing students in senior year and to provide basic data to develop PBL programs to improve patient safety competencies in the future.

2. Method

2.1 Design

This study is a one-group pretest-posttest design to identify changes in the self-leadership, patient safety competencies, and reflective thinking of senior-year nursing students through PBL for patient safety.

2.2 Period and subjects

This study was conducted on nursing students in their senior year at D University located in B city, who voluntarily agreed to participate in the research from March 2 to April 15, 2022. The researcher recruited subjects after explaining the purpose and content of the study using an online video conferencing platform. Based on previous studies [21], the number of subjects was calculated using G Power 3.1.9.2, with a significance level of 0.05, an effect size of 0.5, and a power of 0.95. As a result, the number of samples required for the study was 45, and, in this study, data from 57 out of 80 consenting subjects were used for the final analysis.

2.3 Tools

2.3.1 Self-leadership

This study used the tool developed by Manz [18] and modified and supplemented by Kim [22]. The items are classified into 6 factors, adding up to a total of 18 items: 3 items in self-expectations, 3 items in rehearsal, 3 items in goal setting, 3 items in self-reward, 3 items in self-criticism, and 3 items in constructive thinking. All items were rated on a 5-point Likert scale from "Strongly disagree" (1 point) to "Strongly agree" (5 points) with the scores ranging from a minimum of 18 points to a maximum of 90 points, in which higher scores indicate higher self-leadership. In the study by Kim [22], Cronbach's alpha was .87, while the same in this study was .90.

2.3.2 Patient safety competencies

The tool by Madigosky *et al*. [23] was revised and supplemented by Schnall *et al*. [24] to develop a tool to measure patient safety knowledge, skills, and attitudes (PS-ASK), which were translated by Park & Kim [25] into the Korean version. This study used this tool to examine a total of 17 items: 13 items in patient safety skills and 4 items in patient safety knowledge. All items were rated on a 5-point Likert scale, with skills rated from "Not skilled at all" (1 point) to "Highly skilled" (5 points), and knowledge rated from "Do not know at all" (1 point) to "Know very well" (5 points). Items on skills and knowledge ranged from 13 to 65 points and from 4 to 20 points, respectively, with higher scores indicating high patient safety skills and knowledge. In the study by Park & Kim [25], Cronbach's alpha of patient safety skills items ranged from .91 to .92, and that of patient safety knowledge items from .72 to .77. Cronbach's alpha in this study was .92 for patient safety skills and .89 for patient safety knowledge.

2.3.3 Reflective thinking level

The tool developed by Kember *et al*. [26] to measure reflective thinking categorized into four types was translated by bilinguals, after which it was revised and supplemented to be used in this study. Reflective

thinking was classified into habitual action, understanding, reflection, and critical reflection, with 4 items in habitual action, 4 items in understanding, 4 items in reflection, and 4 items in critical reflection, adding up to a total of 16 items. All items were rated on a 5-point Likert scale from "Strongly disagree" (1 point) to "Strongly agree" (5 points) with the scores ranging from 4 to 16 points for all four thinking types. Habitual action and understanding are non-reflective thinking types, with higher scores indicating lower reflective thinking levels, whereas reflection and critical reflection are reflective thinking types, with higher scores indicating higher reflective thinking levels. Cronbach's alpha in this study was .70 for habitual action, .65 for understanding, .70 for reflection, and .71 for critical reflection.

2.4 Procedures

In this study, PBL for patient safety was examined in a total of 8 sessions. Learners were grouped into teams after receiving the orientation about PBL in Session 1, after which they participated in the pretest survey. In Session 2, each team discussed the following topics under patient safety: nursing records, high-alert medication, medication error and intravenous fluid regulation, blood transfusion care, fall, bedsore, infection control, and pain management. In Session 3, the subjects wrote a proposal about the division of roles among team members, a team activity report, and the PBL process. PBL was carried out in the process of motivation, problem identification, task performance planning, problem-solving methods, summary and solution, presentation, and evaluation. In Sessions 4–5, the subjects carried out team activities autonomously. They were to specify each member's role during the team discussions so that they would have a sense of responsibility for their roles. Each member was to become the leader at least once, and the detailed situations were to be written in the team-based discussion report. In Session 6, the subjects wrote interim reports presenting the need for patient safety management activities on the relevant topic, problem-solving methods derived from group discussions, and a list of references and materials. In Session 7, they wrote final reports on why they selected the topic, the details of task performance and results, plans to use the results as well as anticipated effects. In Session 8, they gave final presentations on patient safety management activities and shared their feelings about the PBL class, after which they participated in the posttest survey.

The instructor provided feedback on the activities of each team in each session and guided the learners to summarize what they learned when writing the proposal in Session 3, interim report in Session 6, and final report in Session 7 and evaluate and analyze the team and individual activities. Moreover, they were to write a reflective journal according to the structured format so that they can find what must be improved and make a study plan in the future (Table 1).

Table 1. Performance contents according to the PBL process of learners and instructors

Session	Learner	Instructor
1	Orientation, grouping, pretest survey	Lecture about patient safety management, orientation about PBL class
2	Selecting topics of patient safety management by the team	Feedback on topic selection
3	Writing PBL proposal, writing an individual reflective journal	Feedback on the content of the proposal
4	Team-based self-regulated activities and report submission	Checking discussion reports of each team
5	Team-based self-regulated activities and report submission	Checking discussion reports of each team
6	Writing PBL interim report, writing an individual reflective journal	Feedback on the content of the interim report
7	Writing PBL final report, writing an individual reflective journal	Feedback on the content of the final report
8	Final presentation and feedback, posttest survey	Final presentation and discussion

2.5 Data analysis

The data of this study were analyzed using IBM SPSS/WIN 28.0.

1) General characteristics of subjects were analyzed in frequency, percentage, mean, and standard deviation.

2) Self-leadership, patient safety competencies, and reflective thinking of subjects were verified using mean and standard deviation.

3) Pretest-posttest comparison of the self-leadership, patient safety competencies, and reflective thinking of subjects to test the effect of PBL was analyzed using a paired t-test.

2.6 Ethical considerations

For ethical considerations of the subjects, prior to commencing the survey, the researcher explained the purpose, process, and method of the research. They, further, guaranteed the confidentiality of personal information, the anonymity in research participation, no disadvantages due to consent or refusal to participate (evaluation and grades related to class, etc.), and that the data collected would be used for research purposes only and disposed of after storing for 3 years after research. The subjects were also informed that they may discontinue anytime they want in the middle of the research. Their consent to participate voluntarily was confirmed before the online survey (URL) began, and the survey would no longer be displayed if the subject disagreed. All participants were given a small gift of acknowledgement (coffee coupon) after the research.

3. Results

3.1 General characteristics of subjects

Table 2 shows the general characteristics of the subjects in this study. There were 48 female (84.2%) and 9 male participants (15.8%), and the average satisfaction with the major was 4.07±0.68 out of 5 points. Out of the 57 subjects, 38 (68.7%) had no self-leadership education experience, 6 (10.5%) showed low, 42 (76.7%) showed average, and 9 (15.8%) showed high leadership levels. A majority of the participants (42 subjects; 73.7%) responded that they have patient safety education experience, and 5 (8.8%) had little patient safety knowledge, 30 (52.6%) had some knowledge, 20 (28.6%) had abundant knowledge, and 2 (2.9%) had highly

abundant knowledge. Less than half of the respondents (23 subjects; 40.4%) responded that sophomore year was the best time to receive patient safety education, followed by senior year (14; 24.6%), junior year (13; 22.8%), and freshman year (7; 12.3%).

Table 2. General characteristics (N=57)

Categories		n(%)	M±SD
Gender	Female	48(84.2)	
	Male	9(15.8)	
Major Satisfaction			4.07±0.68
Self-leadership training experience	Yes	19(33.3)	
	No	38(66.7)	
Patient safety education experience	Yes	42(73.7)	
	No	16(26.3)	
Required grade for patient safety education	Grade 1	7(12.3)	
	Grade 2	23(40.4)	
	Grade 3	13(22.8)	
	Grade 4	14(24.6)	
leadership level	Low	6(10.5)	
	Middle	42(73.7)	
	Height	14(24.6)	
Patient safety knowledge level	A little Knowledgeable	6(28.6)	
	Somewhat Knowledgeable	30(52.6)	
	Knowledgeable	5(23.8)	
	Very Knowledgeable	4(19.0)	

3.2 Effect of PBL activities on self-leadership

Table 3 shows the effect of PBL for patient safety on self-leadership in this study. The mean of self-leadership increased with statistical significance from 3.85±0.49 before PBL to 4.05±0.46 after PBL (t=4.14, $p<0.001$). Subdomains showed a statistically significant increase in self-expectations (t=2.60, $p=0.01$), goal setting (t=2.84, $p<0.01$), self-reward (t=3.32, $p<0.01$), and self-criticism (t =2.32, $p=0.02$).

Table 3. Self-leadership of the Subject (N=57)

Variables		Pre (M±SD)	Post (M±SD)	t	p
Self leadership		3.85±0.49	4.05±0.46	4.14	<0.001
	Self expectation	3.84±0.65	4.06±0.61	2.60	0.01
	Rehearsal	3.97±0.64	4.07±0.85	1.01	0.32
	Goal setting	3.95±0.64	4.19±0.64	2.84	<0.01

Self reward	4.18±0.64	4.44±0.52	3.32	<0.01
Self criticism	3.58±0.96	3.80±0.92	2.32	0.02
Constructive	3.59±0.70	3.74±0.79	1.60	0.12

3.3 Effect of PBL activities on patient safety competencies

Table 4 shows the effect of PBL for patient safety on patient safety competencies in this study. In patient safety knowledge, the mean showed a statistically significant increase from 2.35±0.67 before PBL to 3.68±0.62 after PBL (t=13.05, p<0.001). In patient safety skills, the mean showed a statistically significant increase from 3.25±0.68 before PBL to 3.62±0.56 after PBL (t=4.87, p<0.001).

Table 4. Changes in patient safety capabilities (N=57)

Variables	Pre (M±SD)	Post (M±SD)	t	p
Patient Safety Competence	3.04±0.61	3.63±0.52	8.69	<0.001
Patient safety knowledge	2.35±0.67	3.68±0.62	13.05	<0.001
Patient safety skill	3.25±0.68	3.62±0.56	4.87	<0.001

3.4 Effect of PBL activities on the reflective thinking level

Table 5 shows the effect of PBL for patient safety on the reflective thinking level. In the reflective thinking level, there was no statistically significant difference in all subdomains of habitual action (t=-0.85, p=0.40), understanding (t=1.52, p=0.14), reflection (t=1.85, p=0.07), and critical reflection (t=0.05, p=0.96).

Table 5. Changes in the level of reflective thinking   (N=57)

Variables	Pre (M±SD)	Post (M±SD)	t	p
critical reflection	3.82±0.58	3.82±0.61	0.05	0.96
reflection	3.78±0.56	3.92±0.63	1.85	0.07
understanding	4.04±0.51	4.16±0.43	1.52	0.14
habitual behavior	2.56±0.74	2.65±0.84	-0.85	0.40

4. Discussions

In this study, PBL for patient safety significantly improved self-leadership, and the study by Park [21] also proved that PBL for nursing students improved self-leadership. In the study by Dong [27] conducted on nursing

students using the same tool, self-leadership scored 3.63, but the score for the same was 3.69 in the study by Park [21], 3.83 in this study, 3.51 in the study by Seo [28] on nurses. The findings show that the subdomains with the lowest and highest score are constructive thinking and self-reward for the following studies: Dong [27] (3.32 and 4.11), Park [21] (3.25 and 4.23), this study (3.58 and 4.17), and Seo [28] (3.30 and 3.74).

The results of previous studies as well as this study proved that items on constructive thinking of nursing students and nurses showed the lowest score. "Constructive thinking" refers to a positive thinking pattern that perceives a tough situation not as an obstacle but as an opportunity, practicing constructive maintenance and management by finding opportunities rather than obsessing with obstacles [29]. To improve the constructive thinking of nursing students and nurses, there must be training to promote cognitive strategies so that they can form a positive mindset. In this study, there was a significant improvement in self-expectations, goal setting, self-reward, and self-criticism among behavioral strategies of self-leadership [18]. Jang [30] revealed a significant correlation between self-expectations and goal setting among subfactors of self-leadership with nursing performance, and Lee [31] proved that self-expectations among subfactors of self-leadership affected clinical practice skills. Thus, nursing students in their senior year, whose self-leadership skills such as self-expectations and goal setting improved through PBL, are expected to produce positive results in nursing performance and clinical practice.

In this study, PBL for patient safety was operated as a team activity with a focus on topics such as nursing records, high-alert medication, medication error and intravenous fluid regulation, blood transfusion care, fall, bedsore, infection control, and pain management, which resulted in a significant improvement in patient safety knowledge and patient safety skills. Patient safety knowledge is the extent to which one is aware of proper safety in treating or nursing a patient [32], and patient safety skills refer to the method and ability to handle an object [33]. In previous research, the mean of patient safety knowledge was 2.68 and that of patient safety skills was 3.26 [20], and the same for this study were 2.36 and 3.25, respectively, proving that the patient safety knowledge of nursing students is average, and patient safety skills are slightly above average. Patient nursing knowledge is a necessary competency for nursing students; thus, a plan is required to provide opportunities for students to improve actual knowledge in identifying problems, planning task performance, and establishing problem solutions in the procedures of PBL in the future. Furthermore, as Park [20] suggests methods to evaluate actual activities on patient safety competencies (knowledge, attitude, skill), future studies must evaluate team activities in each topic of PBL through actual activities.

In this study, PBL for patient safety did not affect reflective thinking. In the four categories of reflection presented by Kember *et al*. [26], habitual action and understanding are non-reflective thinking, reflection and critical reflection are reflective thinking, and reflection and critical reflection are based on learning experience [26, 34]. Understanding, which had the highest score in this study, is defined as theoretically learning about concepts or topics; thus, it is not a reflection that performs meaningful learning through learning experience [26]. Therefore, while learners in this study understand the concept of "patient safety," they did not actually experience patient safety prevention activities, which is why there was no reflection.

According to Koszalka & Grabowski [35] and Yeo [36], merely providing a PBL environment does not automatically induce reflective thinking, and meaningful learning activities through reflection do not occur even though PBL is providing a learning environment where there could be reflective thinking and active learning. As Lew & Schmidt [37] also report that the effect of reflective journals on the increase in learners' reflection level is insignificant, this study also showed that writing a reflective journal according to the structured format was not effective. This is due to the limited time in promoting reflective thinking because it is carried out irregularly during the semester. In PBL, learners understand how their learning and problem-solving strategies can be reapplied through reflective thinking and connect the newly acquired knowledge to

their existing knowledge [38,39]. There must be a teaching strategy to promote reflective thinking for PBL to affect reflective thinking. PBL, as a teaching strategy that can promote reflective thinking of learners, suggests the use of scaffolding in a demonstration [40] and the use of tutors with facilitation skills [41]; thus, future studies must consider using scaffolding or tutors to promote reflective thinking.

5. Conclusions and suggestions

Self-leadership and patient safety competencies showed a significant improvement in this study after conducting PBL for patient safety on nursing students in senior year. There was a significant difference in self-expectations, goal setting, self-reward, and self-criticism among subitems of self-leadership, and a significant difference in patient safety knowledge and patient safety skills of patient safety competencies. However, reflective thinking did not show a significant difference. Although PBL for patient safety can be considered an effective teaching-learning strategy that can improve self-leadership and patient safety competencies, continuous research is required because reflective thinking needs a more long-term approach.

The subjects of this study are limited to students attending a single nursing college; thus, the results cannot be generalized, which is why additional research is needed. We would like to make the following suggestions based on the results of this study. First, the scope of the subjects must be expanded to apply PBL and validate the effects in future research. Second, long-term research must be conducted to develop and improve the reflective thinking of nursing students.

Acknowledgment

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