

A Blended Learning Intervention Involving Problem-Based And Team-Based Learning To Enhance Students' Critical Thinking Skills In Child Health Nursing

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ABSTRACT

Background: Nurses must leverage their professional knowledge to make appropriate decisions to resolve care-related problems. Therefore, nursing professionals have suggested that core nursing literacy courses at universities should cover developing critical thinking skills.

Purpose: To investigate the effects of a blended learning intervention involving problem-based (PBL) and team-based (TBL) learning on students' critical thinking skills, disposition, and learning outcomes.

Methods: A quasi-experimental, single-group, pre-posttest design was adopted. The participants were recruited via convenience sampling and comprised two-year nursing students undertaking a two-credit Child Health Nursing course at a university in Northern Taiwan (N = 51). The blended PBL-TBL learning intervention was implemented in the class. Students engaged in group discussions and learning during the intervention. The data was collected using instruments such as the Critical Thinking Test Level II (CTT-II), the Critical Thinking Disposition Scale (CTDS), and a learning outcomes questionnaire.

Results and Conclusions: The students' mean overall CTT-II scores were higher after than before the intervention ($t = 0.55, p > .05$), but the difference was not statistically significant. Only the "deduction" dimension improved significantly ($t = 2.02, p < .05$). The overall CTDS scores were significantly higher after than before the intervention ($t = 6.21, p < .001$). The pre-posttest differences were statistically significant for all four dimensions (systematicity and analyticity, openness and empathy, intellectual inquisitiveness, and holistic and reflective; $p < .05$). The learning outcomes were significantly higher after than before the intervention ($t = 3.86, p < .01$). The intervention significantly benefitted the students' learning outcomes.

Implications for Practice: The students' feedback regarding the intervention was mostly positive. One challenge the tutors faced during the intervention was keeping in mind that the approach is student-centered, and they should avoid early interjections or teaching excessively. Student traits such as being overly charismatic or reserved and less interactive were also barriers to implementing the intervention. The tutors should know how to engage the students in TBL and prevent the learning responsibility from being borne by several students only. These findings can provide an empirical basis for teachers to apply blended PBL-TBL learning interventions in nursing courses.

Keywords: Child health nursing, problem-based learning, team-based learning, blended learning, critical thinking

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I. Introduction

Child health nursing is a core professional course in nursing. However, our university's two-year nursing program students have varying entry behaviors since they received their fundamental nursing education from different junior nursing colleges. Child health nursing is primarily taught through lecture-based learning in large classes. Based on their feedback, students perceive the course as a refresher, so teachers face student problems such as an unwillingness to engage in active thinking and learning and poor learning motivations. In order to overcome these barriers, the teaching method was modified by incorporating problem-based learning (PBL) into the lectures, making them an important learning activity for two-year nursing students. However, the greatest barriers to PBL are its additional human resources and space requirements since the students must be divided into several small groups for discussions. Consequently, it requires a larger budget since tutors must be hired for each group. In order to overcome these barriers, this teaching practice study implemented a blended learning intervention that integrates PBL and team-based learning (TBL) in the child health nursing course. It examines

its effectiveness in improving the students' critical thinking skills, learning motivations, and learning outcomes and outlines its strengths, weaknesses, and potential barriers in practice.

Application of PBL and TBL in nursing

PBL is an effective strategy in nursing education, as demonstrated by its ability to help students develop their competence and skills (e.g., problem-solving, critical thinking, communication, self-education, and leadership) for nursing care management.¹ When classroom learning shifts from traditional lecture-based to blended learning, such as PBL and TBL, teacher-led TBL group activities reduce group discussions in PBL, increasing the demand for tutors. These blended learning approaches have been used in some domains of healthcare education not only to facilitate teaching management but, more importantly, to effectively instill learners' learning capacity to achieve self-growth and develop professional and practical skills (Kwan & Lee, 2021).² Regarding blended learning integrating PBL and TBL, research has shown that problem-based real-life scenarios improved learners' learning efficiency and understanding of knowledge and enhanced their knowledge application and problem-solving skills. TBL, which involves heterogeneous grouping, benefits cooperation and in-depth thinking. Researchers have further noted that applying PBL and TBL in clinical medical education strengthens students' clinical reasoning skills. Both of these learning approaches are characterized by social learning and reflect scientifically supported educational approaches to maximize teaching effectiveness in large classes.²

When applied in medical education, TBL is theoretically rooted in the learning methods and principles of the constructivist learning theory, in which students practically apply course goals rather than only knowing them.³ In recent years, TBL has become a new modality in healthcare education as research has demonstrated its suitability. TBL enhances student engagement and teacher-student communication; students learn and share knowledge through small groups or identify answers they collectively agree with, ultimately internalizing new knowledge.^{4,5} Specifically, the first step in the TBL module is to divide the students taking a course into several groups and then implement a cycle of preparation, readiness assurance testing, and application exercise, achieving large class teaching through group discussions. The classroom lessons are centered on self-directed learning, problem-solving, collaboration, communication, and sharing. Collaborative discussions allow students to progress academically in social settings regardless of their competency level.⁶ When implementing TBL, teachers can move around and guide several group discussions in the same class, saving human resources and time and preventing teacher burnout from conveying the same information repeatedly among different groups. When classroom instruction shifts to student-centered learning, teachers spend less time dictating, and students spend more time on self-directed learning, thinking, and discussing. Teachers can focus on activity design and classroom management to promote group dynamics and gain insights into the learning status of an individual student, a group, or even the whole class. Indeed, students with varying competency levels can benefit from TBL by engaging in a knowledge-building process that involves peer interactions, co-learning, and co-teaching. Research has shown that TBL improves students' learning outcomes, particularly in collaborative learning, self-directed learning, and consolidation of learning experiences. Students also get to apply their knowledge and experiences to solve problems, igniting their passion for self-directed learning while promoting higher-order thinking skills such as synthesis, evaluation, and creation.⁷

Critical thinking skills and the PBL/TBL approaches

The nursing profession is both a science and an art. The nursing student's future is marked by rapidly evolving clinical care settings. Studies have underscored the pivotal influence of critical thinking skills in nursing education.⁸ PBL stresses that learners must objectively deduce or integrate the data they have gathered and make justified and reasonable decisions or solutions to solve situational problems. PBL is a competence-oriented approach that aims to strengthen students' evidence-based clinical nursing skills and facilitate critical thinking, teamwork, and communicative learning.^{9,10}

This study posits the following questions:

- (1) How does a blended PBL-TBL learning intervention in child health nursing influence two-year nursing students' critical thinking skills?
- (2) How does a blended PBL-TBL learning intervention in child health nursing influence two-year nursing students' critical thinking disposition?
- (3) How does a blended PBL-TBL learning intervention in child health nursing influence two-year nursing students' learning outcomes?
- (4) What are the strengths and challenges of applying a blended PBL-TBL learning intervention in child health nursing?

II. Materials and Methods

This study adopted a quasi-experimental, single-group, pre-posttest design to examine the effectiveness of a blended learning intervention involving PBL and TBL on students' critical thinking skills, critical thinking disposition, and learning outcomes. Before the intervention, the students' pre-intervention baseline scores were determined for the Critical Thinking Test Level II (CTT-II) and Critical Thinking Disposition Scale and their learning outcomes.

The participants were sophomores undertaking a two-year nursing program at a university in Northern Taiwan ($N = 51$). They were recruited via convenience sampling. The teaching practice course was a compulsory professional course titled "Child Health Nursing." The participants first completed a prerequisite knowledge test individually and as a group and were then divided heterogeneously into eight groups (each with 6–7 members). The PBL course materials were developed and implemented with the blended learning intervention in September 2022.

During the course preparation period, the teacher groups planned the lesson plan database according to different age groups and disease systems. Three clinical nursing professionals assessed the content validity index (CVI) of each completed lesson plan. Eleven lesson plans were drafted, with the CVIs from 0.84 to 0.91.

During PBL group discussions, industry professionals were invited to serve as tutors to facilitate the students. We invited two child health nursing professionals to serve as tutors, who tutored two groups, while internship advisors tutored the other six groups. Before the intervention, we discussed with the tutors to reach a consensus on teaching material planning and the crucial details of course implementation. We also participated in student discussions according to a PBL teacher handbook. After each lesson, we engaged in post-lesson discussions with the tutors and co-principal investigator.

The learning objectives of the core Child Health Nursing professional course in this teaching practice research are as follows: To illustrate the methods and techniques of communication between children across various age groups and their family members, to distinguish the professional nursing knowledge applied in healthcare for children across various age groups and their families, to evaluate the utilization of nursing in child health care, to express caring behaviors in child health care, and to actively learn about the knowledge and resources related to child health care. The course offers two credits over one semester, and the 36-hour course includes lectures, the blended PBL-TBL intervention (accounting for 50% of the total course hours), and evaluations.

Based on the learning objectives outlined in the teaching plan, the large class of students was divided into groups in the early stage of the blended PBL-TBL intervention. PBL was later implemented in groups in the middle and later stages, where the industry professionals (head nurses) served as tutors alongside the internship advisors to each group of students (6–members each).

The tutors observed and recorded their groups' behaviors and then engaged in post-lesson discussions with us to evaluate the students' learning performances using an evaluation rubric. This rubric was also used for peer evaluation to achieve a unified evaluation standard. Toward the end of the course, the students presented their group reports and shared their learning outcomes.

This study administered pretests and posttests before and after the intervention. Three measurement instruments with good content validity were used to gather the data: The Critical Thinking Disposition Scale, the CTT-II Scale, and the learning outcomes questionnaire.

The CTT-II Scale consists of 30 items distributed evenly across five dimensions: recognition of assumptions, inference, deduction, interpretation, and evaluation. One point is rewarded for every correct answer, and a higher score indicates a higher competence in a specific aspect. The Critical Thinking Disposition Scale consists of 20 items across four dimensions: systematicity and analyticity, openness and empathy, intellectual inquisitiveness, and holistic and reflective. It is completed in about 10 minutes by rating the items on a six-point Likert scale (1 representing "never" and 6 representing "always"). A higher score indicates a higher competence in a specific aspect. Its internal consistency, as represented by Cronbach's α , is 0.88.¹¹ The learning outcomes were evaluated using a questionnaire with good reliability and validity developed by our university's Office of Academic Affairs. It consists of 20 items rated on a five-point Likert scale (1 representing "strongly dissatisfied" and 5 representing "strongly satisfied"). A higher score indicates better self-reported learning outcomes. Its Cronbach's α is 0.88.

In order to ensure that the students understood the blended PBL-TBL learning intervention beforehand, the course syllabus and PBL learner handbook were uploaded onto a digital learning management system on the first week, and the intervention and pedagogical design were introduced to the students during the first lesson. After introducing the course description and intervention, the pretest CTT-II, Critical Thinking Disposition, and Learning Outcomes Scales were administered. After completing the intervention, the posttest scales were administered to thoroughly examine the changes in the students' critical thinking skills, disposition, and learning outcomes.

Ethical considerations: This study was approved by the Institutional Review Board and Administrative

Ethics Committee of our university.

III. Results

Regarding the research questions, this section presents the two-year nursing students' critical thinking skills, critical thinking disposition, and learning outcomes after the blended PBL-TBL learning intervention and the strengths, shortcomings, hardships, and challenges of implementing the intervention.

Effectiveness of the blended PBL-TBL learning intervention on critical thinking skills

Paired-sample *t*-tests were used to compare the pretest and posttest CTT-II scores, both overall and for each dimension (recognition of assumptions, inference, deduction, interpretation, and evaluation), to examine whether the students' critical thinking skills had improved after the intervention.

Table 1 shows the changes in CTT-II scores. While the mean overall posttest score was higher than the mean overall pretest score, the difference was not statistically significant ($t = 0.55, p = 0.58$), suggesting that the current evidence does not generally support that the intervention significantly improves students' overall critical thinking skills. When comparing the scores for each dimension, only the "deduction" dimension significantly improved ($t = 2.02, p < 0.05$), with the mean posttest score (2.68) higher than the mean pretest score (2.36). The changes in scores for the other dimensions were not statistically significant: recognition of assumptions ($t = -1.03, p = 0.31$), inference ($t = 0.59, p = 0.56$), interpretation ($t = 0.62, p = 0.54$), and evaluation ($t = -0.64, p = 0.53$). These findings show that the intervention did not significantly improve students' recognition of assumptions, inference, interpretation, and evaluation aspects of critical thinking.

Table 1. Pre-posttest comparison of the CTT-II Scale dimension and overall scores (N = 51).

CTT-II Scale dimension	Test		<i>t</i>	<i>p</i>
	Pretest (M ± SD)	Posttest (M ± SD)		
Recognition of assumptions	2.53 ± 1.52	2.36 ± 1.30	-1.03	0.31
Inference	3.41 ± 1.68	3.51 ± 1.78	0.59	0.56
Deduction	2.36 ± 1.56	2.68 ± 1.71	2.02*	0.04
Interpretation	2.05 ± 1.46	2.15 ± 1.42	0.62	0.54
Evaluation	1.98 ± 1.40	1.86 ± 1.29	-0.64	0.53
Overall score	12.32 ± 5.85	12.56 ± 5.78	0.55	0.58

Note: Scores are presented as mean (M) ± standard deviation (SD). Key: *, $p < 0.05$

Effectiveness of the blended PBL-TBL learning intervention on critical thinking disposition

Paired-sample *t*-tests were used to compare the pretest and posttest Critical Thinking Disposition Scale scores, both overall and for each dimension (systematicity and analyticity, openness and empathy, intellectual inquisitiveness, and holistic and reflective), to examine whether they had improved after the intervention.

Table 2 compares the pretest and posttest Critical Thinking Disposition Scale scores. The overall scores differed significantly between the pretest and posttest ($t = 6.21, p < 0.01$). In addition, the posttest scores were significantly higher than the pretest scores for all four dimensions: systematicity and analyticity ($t = 6.37, p < 0.01$), openness and empathy ($t = 3.91, p < 0.01$), intellectual inquisitiveness ($t = 3.47, p < 0.01$), and holistic and reflective ($t = 5.23, p < 0.01$). These findings show that the intervention significantly improved all aspects of the students' critical thinking disposition.

Table 2. Pre-posttest comparison of the Critical Thinking Disposition Scale dimension and overall scores (N = 51).

Critical Thinking Disposition Scale dimension	Test		<i>t</i>	<i>p</i>
	Pretest (M ± SD)	Posttest (M ± SD)		
Systematicity and analyticity	43.84 ± 5.81	47.12 ± 6.25	6.37**	<0.01
Openness and empathy	20.25 ± 2.72	21.41 ± 2.36	3.91**	<0.01
Intellectual inquisitiveness	14.73 ± 1.98	15.51 ± 2.20	3.47**	<0.01
Holistic and reflective	19.31 ± 2.67	20.98 ± 2.72	5.23**	<0.01
Overall score	98.14 ± 12.18	105.02 ± 12.83	6.21**	<0.01

Note: Scores are presented as mean (M) ± standard deviation (SD). Key: **, $p < 0.01$.

Table 3 compares the pretest and posttest scores for each item of the Critical Thinking Disposition Scale. The scores for 17 of the 20 items significantly increased from pretest to posttest ($p < 0.05$) posttest mean than

the pretest mean, indicating that the students significantly improved their critical thinking skills in these areas: (2) “I try to apply new points of view or concepts” ($t = 2.47, p = 0.02$), (4) “Even when facing complex problems, I try my best to be rational and think logically” ($t = 3.90, p < 0.01$), (5) “I examine the reliability of a piece of information before using it” ($t = 2.36, p = 0.02$), (6) “I try to validate the value and reliability of a new point of view” ($t = 4.4, p < 0.01$), (7) “I consider situational factors when making decisions” ($t = 3.25, p < 0.01$), (8) “I try to clearly define a problem when handling it” ($t = 2.94, p < 0.01$), (9) “I try to determine through doubting whether or not my own point of view is convincing” ($t = 3.47, p < 0.01$), (10) “I try to ensure that I have the latest and most complete information when solving problems” ($t = 4.54, p < 0.01$), (11) “I am able to understand the feelings and opinions of others quickly during discussions and observations” ($t = 3.39, p < 0.01$), (12) “I suspend decision-making when the evidence is insufficient” ($t = 3.71, p < 0.01$), (13) “I try to outline different potential solutions when solving problems” ($t = 2.99, p < 0.01$), (14) “I correct myself immediately when there is sufficient evidence to support that my point of view is biased” ($t = 2.61, p < 0.01$), (15) “I try to identify the causes of a problem before solving it” ($t = 4.08, p < 0.01$), (16) “I try to understand the context of a recent controversy” ($t = 2.44, p < 0.02$), (17) “I try to uncover the implicit assumptions within another person’s argument” ($t = 3.94, p < 0.01$), (18) “I try to further explore novel items, events, or points of view” ($t = 3.05, p < 0.01$), and (20) “I try to predict all the possible outcomes of accommodating solutions before making a decision” ($t = 3.49, p < 0.01$). These findings demonstrate that the students’ critical thinking disposition significantly improved after the intervention. However, the scores for the remaining three items (Items 1, 3, and 19) did not significantly improve after the intervention.

Table 3. Pre-posttest comparison of the Critical Thinking Disposition Scale items (N = 51).

No.	Item	Tests		t	p
		Pretest (M ± SD)	Posttest (M ± SD)		
1	I try to examine a problem from different perspectives.	4.90 ± 0.76	5.08 ± 0.87	1.77	0.08
2	I try to apply new points of view or concepts.	4.88 ± 0.82	5.12 ± 0.79	2.47*	0.02
3	I try to respect the opinions of others during discussions.	5.27 ± 0.70	5.45 ± 0.61	1.93	0.06
4	Even when facing complex problems, I try my best to be rational and think logically.	4.71 ± 0.97	5.12 ± 0.91	3.90**	<0.01
5	I examine the reliability of a piece of information before using it.	4.92 ± 0.89	5.18 ± 0.82	2.36*	=0.02
6	I try to validate the value and reliability of a new point of view.	4.78 ± 0.92	5.16 ± 0.83	4.44**	<0.01
7	I consider situational factors when making decisions.	5.04 ± 0.77	5.31 ± 0.71	3.25**	<0.01
8	I try to clearly define a problem when handling it.	5.04 ± 0.80	5.31 ± 0.73	2.94**	<0.01
9	I try to determine through doubting whether or not my own point of view is convincing.	4.65 ± 0.89	5.14 ± 0.83	3.47**	<0.01
10	I try to ensure that I have the latest and most complete information when solving problems.	4.71 ± 0.76	5.24 ± 0.84	4.54**	<0.01
11	I am able to understand the feelings and opinions of others quickly during discussions and observations.	4.86 ± 0.83	5.22 ± 0.81	3.39**	<0.01
12	I suspend decision-making when the evidence is insufficient.	4.82 ± 0.89	5.25 ± 0.82	3.71**	<0.01
13	I try to outline different potential solutions when solving problems.	4.90 ± 0.94	5.25 ± 0.74	2.99**	<0.01
14	I correct myself immediately when there is sufficient evidence to support that my point of view is biased.	4.90 ± 0.88	5.27 ± 0.78	2.61*	=0.01
15	I try to identify the causes of a problem before solving it.	4.90 ± 0.88	5.33 ± 0.74	4.08**	<0.01
16	I try to understand the context of a recent controversy.	5.02 ± 0.71	5.29 ± 0.86	2.44*	<0.02
17	I try to uncover the implicit assumptions within another person’s argument.	4.73 ± 0.92	5.24 ± 0.79	3.94**	<0.01
18	I try to further explore novel items, events, or points of view.	4.94 ± 0.81	5.31 ± 0.73	3.05**	<0.01
19	I listen attentively to others during discussions.	5.25 ± 0.74	5.45 ± 0.67	1.94	0.06
20	I try to predict all the possible outcomes of accommodating solutions before making a decision.	4.90 ± 0.78	5.29 ± 0.81	3.49**	<0.01

Note: Scores are presented as mean (M) ± standard deviation (SD). Key: *, $p < 0.05$; **, $p < 0.01$.

Effectiveness of the blended PBL-TBL learning intervention learning outcomes

Paired-sample *t*-tests were used to compare the pretest and posttest learning outcome scores, both overall and for each item, to examine whether the students’ learning outcomes had improved after the Child Health Nursing course. The mean overall learning outcomes score changed significantly from pretest to posttest ($t = 3.86, p < 0.01$), indicating that the intervention significantly benefited the students’ learning outcomes.

Table 4 compares the pretest and posttest scores for the Learning Outcomes Scale items. The scores increased significantly from pretest to posttest for 11 items, showing that the students’ learning outcomes significantly improved in these areas after the intervention: (3) “I feel extremely confident about giving on-stage presentations” ($t = 2.01, p = 0.05$), (8) “I actively initiate discussions in a group” ($t = 5.58, p < 0.01$), (9) “I try different problem-solving methods” ($t = 2.83, p = 0.01$), (11) “I always find information or seek help from my professors when I do not understand something” ($t = 3.34, p = 0.01$), (12) “I express my opinions in group discussions” ($t = 3.27, p = 0.01$), (13) “My comments in group discussions are respected” ($t = 3.22, p = 0.01$), (14) “I analyze problems through critical thinking” ($t = 4.21, p < 0.01$), (15) “I am able to practically apply the knowledge that I acquired” ($t = 3.48, p = 0.01$), (16) “I prepare for a lesson by previewing” ($t = 4.25, p < 0.01$), (18) “I try to persuade classmates with different opinions” ($t = 2.80, p = 0.01$), and (20) “I assess the strengths and drawbacks of my professors’ or classmates’ opinions before forming my own” ($t = 4.21, p < 0.01$).

Table 4. Pre-posttest comparison of the learning outcome questionnaire item and overall scores (N = 51).

No.	Item	Tests		t	p
		Pretest (M ± SD)	Posttest (M ± SD)		
1	I take my own initiative to learn	4.24 ± 0.74	4.27 ± 0.96	0.26	0.79
2	I do not evade proposing differing opinions during group discussions.	4.24 ± 0.68	4.37 ± 0.98	0.96	0.34
3	I feel extremely confident about giving on-stage presentations.	3.65 ± 1.02	3.94 ± 1.17	2.01*	0.05
4	I tend to avoid complex problems.	3.14 ± 1.18	2.84 ± 1.45	-1.68	0.10
5	I always see things from different perspectives.	4.06 ± 0.73	4.27 ± 0.96	1.38	0.18
6	I know my strengths and weaknesses in learning.	4.22 ± 0.61	4.41 ± 0.85	1.43	0.16
7	I perform better in making individual groups than in group reports.	2.37 ± 1.04	2.25 ± 1.20	-0.78	0.44
8	I actively initiate discussions in a group.	3.65 ± 0.89	4.24 ± 0.81	5.58**	<0.01
9	I try different problem-solving methods.	4.06 ± 0.86	4.39 ± 0.72	2.83**	<0.01
10	I empathize with people who have different backgrounds than me.	4.29 ± 0.64	4.49 ± 0.70	1.87	0.07
11	I always find information or seek help from my professors when I do not understand something.	3.96 ± 0.82	4.39 ± 0.72	3.34**	<0.01
12	I express my opinions in group discussions.	4.06 ± 0.73	4.41 ± 0.75	3.27**	<0.01
13	My comments in group discussions are respected.	4.18 ± 0.68	4.51 ± 0.67	3.22**	<0.01
14	I analyze problems through critical thinking.	4.04 ± 0.82	4.43 ± 0.73	4.21**	<0.01
15	I am able to practically apply the knowledge that I acquired.	4.00 ± 0.77	4.33 ± 0.74	3.48**	<0.01
16	I prepare for a lesson by previewing.	3.37 ± 1.02	3.92 ± 1.00	4.25**	<0.01
17	I am able to complete a proposal or report with my teammates on time.	4.49 ± 0.58	4.55 ± 0.67	0.60	0.55
18	I try to persuade classmates with different opinions.	3.67 ± 0.89	4.06 ± 0.93	2.80**	<0.01
19	I feel that the solutions derived by discussing with my classmates are better than those derived by myself.	4.08 ± 0.87	4.25 ± 0.84	1.54	0.13
20	I assess the strengths and drawbacks of my professors’ or classmates’ opinions before forming my own.	4.12 ± 0.77	4.49 ± 0.64	4.21**	<0.01
	Overall score	77.86 ± 9.89	82.84 ± 10.96	3.86**	<0.01

Note 1: Scores are presented as mean (M) ± standard deviation (SD). Key: *, $p < 0.05$; **, $p < 0.01$.

Note 2: Items 4 and 7 are reverse-coded and reverse-scored.

To summarize, this teaching practice study aimed to examine the effectiveness of a blended PBL-TBL learning intervention in a Child Health Nursing course. Its results demonstrated that after the intervention, the students’ CTT-II deduction dimension, critical thinking disposition, and learning outcomes scores significantly exceeded their baseline pretest scores. Based on these findings, there is insufficient evidence to support that the intervention improved the students’ overall critical thinking skills. However, it did significantly improve their critical thinking disposition and overall learning outcomes.

Students’ feedback on learning and tutors’ reflection on teaching

(1) Students’ feedback on learning

Most of the students’ feedback was positive; they felt that the active thinking, literature search, and discussions involved in the learning process required more time and effort. One student mentioned that:

“Although PBL is tiresome, it feels good to brainstorm. I learned how to provide nursing care to a sick child by integrating inference and systematic thinking, and reflect on whether evidence-based learning was present in all of my previous learning experiences.”

The students had overwhelmingly positive responses to the industry professionals serving as tutors. Several students expressed that:

“The industry professionals were extremely professional, and we learned a lot from them. They were happy to share their clinical experiences and guided us in thinking when we hit a brick wall or went off-topic during our discussions. They also encouraged us to speak our minds.”

“During the PBL discussions, we got to listen to different opinions. The head nurses shared their clinical experiences and consolidated the clinical practices and theories. We learned about the different dimensions of clinical cases and engaged in in-depth thinking. PBL combines both textbook and clinical instruction, and I have gained excellent learning experiences from it.”

“I was able to experience and understand more about the teaching contents as the industry professionals guided us to align closer with clinical practice. The head nurses were congenial, and we did not feel stressed around them. I learned a lot about clinical practice from them, and I do not have to worry much about my future clinical placement in the pediatric department. Even though there is still a lot of apprehension, I do feel less stressed out about it.”

These responses showed that while more tutors were required during group discussions, the industry professionals not only facilitated the students to envision clinical scenarios but also shared their clinical experiences and guidance. As a result, the students enhanced their multifaceted thinking and aligned more closely with clinical practice.

Several students gave negative feedback since they were concerned about being incompetent or that more time was required to engage in self-directed learning and searching and synthesizing the literature. One student expressed that:

“After lessons, we need to collect, synthesize, and read the data in preparation for the next discussion. I worry about not contributing much to the team and dragging down our report.”

Several students claimed the tutors spent too much time lecturing during the group discussions. As one student put it:

“During group discussions, the tutors should not interject our thoughts with their explanations so often, as this shortens our discussion time.”

(2) Tutors’ reflection on teaching

The blended PBL-TBL learning intervention was suitable for two-year nursing students with a fundamental knowledge of nursing. While PBL and TBL have their respective challenges, they complemented each other in the blended learning intervention applied in this study. In PBL, the students enhanced their self-directed learning and questioning and answering skills. In TBL, they improved their utilization of cognitive information through problem-solving activities. TBL also mitigated the considerable human resources and spatial requirements of PBL.

The situational problems proposed in the intervention enabled the students to examine their previous experiences and synthesize their prior knowledge with the newly acquired information. Compared to lecture-based learning in large classes, most students felt that this learner-centered approach allowed them to adjust their learning time and pace, improve their thought processes, and discover the joy of self-directed learning. Role switching was challenging for the tutors since they had to switch from conveyors of knowledge to in-person instructors who guided students in critical thinking. During the group discussions, they had to avoid making early interjections or providing excessive information and control the urge to teach frequently. They had to constantly remind themselves that the intervention was learner-centered and that they should listen more and guide the students to engage in multifaceted thinking. One tutor mentioned that:

“When serving as a PBL or TBL tutor, I sometimes could not contain my urge to correct or lecture students, and I was worried that these actions consequently took up the students’ discussion time. I even received negative responses from the students.”

Student traits were another challenge during the intervention since some students were overly charismatic to the point that they were unwilling to listen to others, while others were more reserved and communicated and interacted less with their peers. Therefore, the tutors must figure out how to enhance the students’ learning engagement and prevent the learning responsibility from only being borne by several students. During their final oral and written reports, the students could reestablish and share what they had learned, observe the strengths of other teams, and understand and reabsorb the implications of the situational problems in which they had yet to participate.

IV. Discussion and Conclusion

This study provided preliminary evidence supporting the effectiveness of a blended PBL-TBL learning intervention applied in a Child Health Nursing course. It significantly improved the students' CTT-II deduction dimension, critical thinking disposition, and learning outcomes. Applying a student-centered approach that combines TBL and PBL in the Child Health Nursing course was more cost-effective than applying PBL alone. Jamshidi et al. stated that nursing teachers used PBL to improve nursing students' clinical and cognitive skills.¹² Compared to traditional teaching, PBL was more effective in enhancing students' critical thinking, but further research is needed on its effects on problem-solving skills and self-confidence.^{13,14} TBL-related studies have demonstrated its significant and positive effects on competence and satisfaction, particularly in knowledge, self-leadership, communication, critical thinking, and problem-solving skills. TBL also improved nursing students' academic achievements and all-around abilities. However, a meta-analysis found that TBL effectively improved nursing students' learning outcomes. While it supported its implementation in nursing education, it stressed that more high-quality studies are required to enhance the transferability of its findings.^{15,16,17} Unlike these studies, our study found that the blended PBL-TBL learning intervention did not significantly improve the students' critical thinking skills but did significantly improve their critical thinking disposition and learning outcomes.

We recommend applying the blended PBL-TBL learning intervention in advanced learning for nursing students with the prerequisite knowledge and clinical experiences. The students should prepare themselves for the lessons beforehand and clearly understand the PBL learning process to achieve their learning goals through situated clinical problems and inferences. The tutors should respect each learner's background during their guidance. Role switching was a challenge tutors faced during the intervention since they had to switch from conveyors of knowledge to in-person instructors who guided students in critical thinking. Therefore, the PBL tutors should be fully trained to assist the students effectively to achieve their learning objectives. Several students could immerse themselves in PBL learning since they had related experiences in junior college. However, others without such experiences were used to one-way instruction and could not adapt to PBL or were perplexed by it. More thorough guidance and pre-lesson preparation are required to enable them to achieve their learning objectives with their peers. Since teacher feedback is pivotal in PBL, the PBL tutors should be fully trained to instruct the students effectively to achieve their learning objectives. If the students deviate from the topic, the tutors should provide feedback to recover them, empower them to reassess the topic, maintain focus on the topic in a timely manner, or guide them to make good use of learning resources such as electronic databases and online academic searches. These strategies can help the students synthesize theories and deepen their learning, promoting their interactions with peers and tutors and evoking their potential. The students can learn problem-solving by having shared learning objectives and participating in activities in social situations. Active listening, communicating, and expressing are more important than passive learning in TBL. These findings highlight the advantages of PBL and collaborative TBL in large classes.

V. Limitations and recommendations

This study did not include a control group since the students were all from the same class in a two-year nursing program. Therefore, its results cannot be generalized to other disciplines or educational systems, and can only provide an empirical basis for teachers to apply blended PBL-TBL learning interventions in nursing courses.

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