Research article

Effects of peer tutoring-based simulation education on caring for children with respiratory infections among nursing students: A mixed-methods study

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ABSTRACT

Background: Respiratory infections are common in children and can quickly deteriorate, necessitating vigilant nursing care. Simulation training provides a valuable tool for nursing students to learn how to manage children with respiratory infections. Peer tutoring has demonstrated benefits, including the creation of a safe, supportive learning environment and the perception of peer tutors as beneficial role models. This study aimed to develop a simulation education program for the care of children with respiratory infections, involving peer tutoring among nursing students, and to assess its effectiveness.
Methods: This mixed-methods study, conducted between July and December 2022, utilized surveys to gather both quantitative and qualitative data. A peer tutoring-based simulation education program for providing care to children with respiratory infections was developed specifically for nursing students. The study was implemented with 49 nursing students from a South Korean university (25 in the experimental group and 24 in the control group). The students' self-efficacy, disposition towards critical thinking, problem-solving ability, and satisfaction with practice were evaluated and analyzed using the unpaired *t*-test, the chi-square test, and repeated-measures analysis of variance. The learning experiences of the students in the experimental group were further examined using qualitative content analysis.
Results: The experimental group demonstrated greater growth in self-efficacy and satisfaction with practice than the control group. However, no significant difference was observed between the experimental and control groups in terms of changes in disposition towards critical thinking and problem-solving ability. From the nursing students who participated in the implementation, three categories were identified: "enhancement of learning," "psychologically secure environment," and "novel experience."
Conclusions: The peer tutoring-based simulation education focused on caring for children with respiratory infections effectively improved the self-efficacy and satisfaction of nursing students. This method will be utilized to enhance the learning experience of nursing students in the field of pediatric respiratory care.

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1. Background

Respiratory infections are a prevalent health issue among children, often occurring abruptly. These infections typically present with difficulty in breathing and can easily spread to the lower respiratory tract, necessitating vigilant nursing care [1]. In recent years, there has been a surge in the incidence of new respiratory infection diseases, such as coronavirus disease 2019 (COVID-19), Middle East respiratory syndrome (MERS), and severe acute respiratory syndrome (SARS). Consequently, the importance of nurses' ability to assess children's health, determine the presence of a respiratory infection, and address the health issues of children with respiratory infections has been underscored [2]. To be clinically proficient, nursing students must have confidence in their capacity to provide care to children, while also learning to implement the nursing process through critical thinking and problem-solving. However, the clinical environment offers limited opportunities for nursing students to actively care for children, who are susceptible to accidents and diseases. During the clinical practicum, nursing students often struggle to identify and manage nursing concerns related to children [3].

One approach to overcoming challenges in the clinical practicum is through simulation training. This method, which involves repeated learning through the recreation of real-life scenarios, has proven to be effective [4]. Simulation training allows nursing students to hone their skills using a high-fidelity simulator and standardized patients, all within a safe and controlled environment [5–7]. Students who have participated in these simulations have found the learning process to be enjoyable [8]. They have also reported improved learning outcomes [9], as well as increased self-confidence and problem-solving abilities [7].

Nursing students can effectively learn to care for children with health issues through the use of peer-tutoring strategies. By utilizing their peers as facilitators in their pediatric nursing clinical practicum studies, nursing students can collaboratively work to improve their clinical nursing skills while receiving constructive feedback from their peers [10]. Peer tutoring is a progressive learning method where tutors with similar experiences aid tutees in successfully adapting to their learning environment [11]. This approach cultivates a secure, supportive learning atmosphere and encourages students to view peer tutors as valuable role models [12]. A previous systematic review of peer mentoring applied to nursing students noted that peer mentoring contributes to the development of critical thinking, improvement of coping abilities, increase in self-efficacy, and reduction of stress and anxiety [13]. Based on these findings, we sought to investigate whether integrating peer tutoring into simulation-based education would be more effective than traditional simulation-based education.

In nursing simulations, tutors leverage their expertise to instruct tutees, either by explaining concepts or teaching them directly [11]. Tutees, in turn, receive hands-on assistance and support from these tutors, enabling them to navigate challenges through the process of peer tutoring [14]. Nursing students have reported a reluctance to pose questions to professors, fearing harsh judgment. However, they feel more comfortable asking questions and practicing more assertively with peer tutors, as they perceive these tutors to be fellow students [15]. Nursing students view peer tutors as invaluable mentors who not only facilitate the acquisition of knowledge but also teach them how to learn and provide a supportive network [11]. However, few studies have incorporated peer tutoring into nursing simulation education, and research comparing the effectiveness of this approach to traditional simulation education is particularly lacking. Studies utilizing peer tutoring in nursing simulations have mostly reported qualitative results [11,15].

The objective of this study was to develop a simulation-based education program for the care of children with respiratory infections, facilitated by peer tutoring among nursing students. We then evaluated the program's effectiveness in enhancing the nursing students' capabilities. This included a quantitative evaluation to assess whether tutoring-based simulation education effectively improved the capabilities of nursing students compared to traditional nursing simulation. The outcome variables were self-efficacy, critical thinking, and problem-solving, which a previous systematic review reported as effects of peer tutoring [13], and we
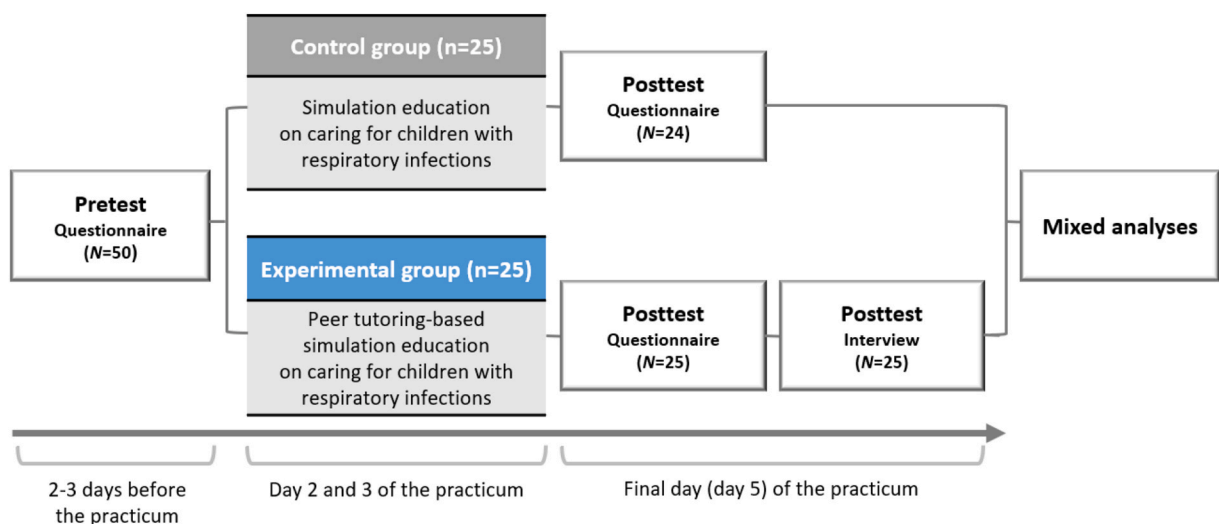

Fig. 1. Research design.

additionally assessed satisfaction with practice.

The hypotheses for this study were as follows: we anticipated that, compared to the control group, the experimental group would show (1) a more significant improvement in self-efficacy, (2) a more substantial advancement in critical thinking, (3) a more significant improvement in problem-solving, an (4) a greater advancement in satisfaction with practice.

2. Methods

2.1. Study design

This mixed-methods study used surveys to obtain both qualitative and quantitative data. A quasi-experimental study with a non-equivalent control group pretest-posttest design was conducted at a single university located in South Korea to investigate the impact of peer tutoring-based simulation education on caring for children with respiratory infections (Fig. 1). Throughout this study, we adhered to the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) reporting guidelines, as outlined by Des Jarlais et al. [16].

2.2. Setting and sample

Two clinical practice faculty members (CPFs) and three clinical nursing instructors (CNIs) at two nursing colleges, one general hospital, and two pediatric hospitals in South Korea were recruited for the analysis stage through convenience sampling. Fifty-six nursing students (6 senior students in the analysis stage, 50 junior students in the implementation stage) at a nursing college in South Korea were also recruited through convenience sampling. Participants who freely consented to take part in the study in writing were enrolled from July through December 2022.

The inclusion criteria in the analysis stage were CPFs and CNIs who had supervised a pediatric nursing practicum, and senior students who had completed a pediatric nursing practicum. Conversely, CPFs and CNIs who had not overseen a pediatric nursing practicum were excluded, as were students who either declined to take part in the study or had not completed a pediatric nursing practicum. For the implementation stage, the inclusion criteria were junior students currently enrolled in a 45-h, one-credit pediatric ward practicum. Students who chose not to participate in the study or did not complete a pediatric practicum were excluded.

The number of participants was calculated using the G Power 3.1.9.7 program, incorporating repeated-measures ANOVA and within-between interactions. Drawing from prior research [6], we input an effect size of 0.25, a significance level of 0.05, a power of 80 %, a correlation coefficient of 0.30, and two measurements. This resulted in a required sample size of 23 participants per group [17]. To account for a potential 10 % dropout rate, we recruited 50 students, dividing them evenly into two groups. Ultimately, the experimental group included 25 participants and the control group consisted of 24 participants, due to one individual's private scheduling conflict. There were no further dropouts.

2.3. Development and evaluation of peer tutoring-based simulation education on caring for children with respiratory infections among nursing students

The analysis, design, development, implementation, and evaluation (ADDIE) model [18] was utilized to develop a simulation education program for nursing students, involving peer tutoring, focused on the care of children with respiratory infections.

2.3.1. Analysis

Two CPFs, three CNIs, and six senior students participated in a questionnaire survey and a focus group interview. The participants of the open-ended questionnaire survey were prompted to detail the most critical aspects and challenging scenarios in simulations, as well as their perspectives on peer tutoring within these simulations. The focus group interview involved the same six senior students and was conducted once. This interview took place in a small conference room at a time that was suitable for the participants. They were asked to elaborate on the most vital elements, difficult situations, and their views on peer tutoring in simulations. The interview was recorded verbatim with the informed consent of the participants, and transcribed shortly thereafter.

The following elements were identified in simulation practice and peer tutoring: The most critical component of simulations is the provision of nursing care through a simulation under safe conditions. A significant challenge in simulations is the students' desire and need to practice competently, which is often accompanied by feelings of stress and fear during participation. According to participants, peer tutoring in simulations can assist students in learning how to provide nursing care for children with health issues. Furthermore, peer tutors can offer support to tutees throughout the simulation and debriefing processes.

2.3.2. Design

According to the healthcare simulation standards of best practice (as outlined by the INACSL Standards Committee [19]), an educational simulation was designed for the care of children with respiratory infections. This simulation included a pre-briefing, situation analysis, practice of nursing skills, the simulation itself, and a debriefing.

2.3.3. Development

A peer tutoring-based simulation education program for the care of children with respiratory infections was developed, drawing upon the findings of a questionnaire survey and the specific findings of the focus group interview. This simulation education involved

nursing students participating in simulations to learn about the care of children with respiratory infections through peer tutoring, as part of their pediatric nursing practicum.

Before their practicum, junior students attended a 2-h lecture on the care of children with respiratory infections. Concurrently, senior students reviewed simulations of this type of care, practiced relevant nursing skills, and learned about their roles as tutors. On the second day, the junior students reviewed and discussed the content of the lecture on respiratory infection care and practiced their nursing skills. The senior student tutors provided assistance and support to the junior students as they learned and practiced. On the third day, the junior students participated in a 2-h simulation to practice caring for children with respiratory infections. This simulation included a pre-briefing, situation analysis, and the simulation itself. The tutors assisted the junior students in preparing for the simulations and observed their practice. One of the researchers ran the simulations. During a 1-h debriefing session, the tutors provided the junior students with feedback on their simulations and offered constructive advice (Table 1).

The program's structure and content were validated by a CPF, a CNI, and two nurses. It was considered complete when all reviewers agreed that the content was either appropriate or highly suitable.

2.3.4. Implementation

Eight teams, each consisting of 6–7 nursing students, were established, with one team participating in the pediatric ward practicum on a weekly basis. To prevent the experimental effect from diffusing, the control group underwent regular simulation education without peer tutoring from September to October 2022. Conversely, the experimental group received simulation education that incorporated peer tutoring from November to December 2022. The clinical practice protocols mandated that both the experimental and control groups adhere to the same practice duration, location, content, and supervision. Prior to the practicum, the control group attended a 2-h lecture on the care of children with respiratory infections. They discussed this topic and practiced relevant nursing skills on the second day of the pediatric ward practicum. On the third day, they engaged in simulation exercises and debriefing sessions.

2.3.5. Evaluation

The general characteristics, self-efficacy, disposition towards critical thinking, problem-solving ability, and satisfaction with practice were evaluated in both the experimental and control groups. These assessments were conducted 1–2 days prior to the commencement of practice, as well as on the final day of the pediatric ward practicum. Each participant was given a questionnaire with a unique number, which they were required to remember while completing the pretest questionnaire. They were then asked to use this same unique number when filling out the posttest questionnaire. The practice team's leader provided the questionnaires to participants, who were asked to respond with self-reported answers. As such, the researchers did not personally administer the surveys and were kept blind to the process. There were no incomplete questionnaires, as the team leader ensured that participants who remembered their individual numbers responded to all associated questions. The survey took roughly 20 min to complete.

On the final day of the pediatric ward practicum, the experimental group completed a posttest questionnaire. They also filled out an open-ended questionnaire that requested them to identify the positive and negative aspects of their peer-tutoring experience, as well as how it differed from traditional simulation education.

2.4. Instruments

All the instruments utilized were self-reported surveys, employed solely with permission from the original authors.

2.4.1. Self-efficacy

The General Self-Efficacy Scale for adults, developed by Song [20], was employed to measure self-efficacy. This scale consists of ten items, each rated on a six-point Likert scale, with 1 indicating strong disagreement and 6 indicating strong agreement. A higher score on this scale signifies a higher level of self-efficacy. In Song's [20] original study, the Cronbach's alpha was 0.87. In the pretest of the present study, it was 0.93, and in the posttest, it was 0.89.

2.4.2. Disposition towards critical thinking

The Critical Thinking Disposition Scale, developed by Yoon [21], was employed to measure disposition towards critical thinking. This scale consists of 27 items, each rated on a 5-point Likert scale, where 1 signifies strong disagreement and 5 indicates strong

Table 1
Peer-tutoring-based simulation education on caring for children with respiratory infections.

Phase	Content	Time (duration)
Preparation	Preparation for tutees: lecture on caring for children with respiratory infections for 2 h	Before the practicum (2 h)
	Preparation for tutors: review of the simulation of caring for children with respiratory infections, practice of nursing skills, learning of tutor roles	
Pre-simulation	Discussion of caring for children with respiratory infections	2nd day (2 h)
	Practice of nursing skills	
	Peer-tutoring: tutors help and support tutees learn how to care for children with respiratory infections	
Simulation practice	Pre-briefing → situation analysis → simulation	3rd day (2 h)
	Peer-tutoring: tutors help tutees prepare simulations and observe tutees' simulation practice	
Debriefing	Peer-tutoring: tutors give tutees feedback on simulations and constructive advice	3rd day (1 h)

agreement. After reverse-coding and summing the scores of negative items, a higher total score suggests a greater degree of critical thinking. In Yoon's [21] original study, the Cronbach's alpha was 0.84, while in the pretest and posttest of this study, it was 0.85 and 0.86 respectively.

2.4.3. Problem-solving ability

The Problem-Solving Ability Scale, developed by Lee, Park, and Choi [22], was employed to measure problem-solving aptitude. This scale consists of 30 items, each rated on a 5-point Likert scale, with 1 signifying "very rarely" and 5 denoting "very frequently." A higher score on this scale is indicative of superior problem-solving ability. In the study conducted by Lee et al. [22], the Cronbach's alpha was 0.93, while in the pretest and posttest of the current study, it was 0.95.

2.4.4. Satisfaction with practice

We utilized the scale developed by Yoo [23] and later revised by Chang and Park [24] to measure satisfaction with practice. This scale comprises 17 items, each rated on a 5-point Likert scale where 1 signifies strong disagreement and 5 denotes strong agreement. A higher score on this scale corresponds to a higher level of satisfaction with practice. In Chang and Park's [24] study, the Cronbach's alpha was 0.86. In the pretest of our study, it was 0.92, and in the posttest, it was 0.93.

2.5. Data analysis

The quantitative data were processed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). We assessed the baseline homogeneity between the experimental and control groups using the chi-square test and the unpaired t-test. The impact of the intervention on outcome variables was evaluated through repeated-measures ANOVA.

The qualitative data were examined utilizing the inductive content analysis approach proposed by Elo and Kyngäs [25]. In the preparation phase, the data were thoroughly reviewed multiple times. During the categorization phase, open coding was employed to identify sentences that reflected the participants' experiences. These sentences, serving as the analytic unit, were then repeatedly read to extract pertinent statements. Similar elements were arranged in groups to create subcategories, which were subsequently abstracted to generate categories. These categories were then presented during the reporting phase.

2.6. Ethical consideration

This study was carried out in line with the Declaration of Helsinki, and the Institutional Review Board of Daegu Catholic University (CUIRB-2022-0028) approved the ethical protection of subjects. Potential participants were fully informed about the study's objectives, methods, and procedures, and they were assured that their participation and survey responses would not influence their academic grade or evaluation. They were notified that the data would be erased after the study, ensuring their privacy and confidentiality. They were also informed that they might withdraw at any point and that not participating would not disadvantage them. All participants in the study provided written informed consent to the principal researcher. Participants were only accepted into the study following their provision of written agreement to participate voluntarily in the investigation. Students were given coffee gift cards for taking part in the study.

Table 2
Homogeneity testing for both groups' general characteristics and outcome variables ($N = 49$).

Variables or categories	Total ($N = 49$)	Exp. (n = 25)	Cont. (n = 24)	X^2/t	p
	n (%) or M±SD	n (%) or M±SD	n (%) or M±SD		
Age (year)	21.51 ± 1.04	21.52 ± 0.87	21.50 ± 1.22	0.066	0.947
Gender					
Male	8 (16.3)	2 (8.0)	6 (25.0)	–	.138[a]
Female	41 (83.7)	23 (92.0)	18 (75.0)		
Academic performance (percentile)					
≤30	15 (30.6)	9 (36.0)	6 (25.0)	0.698	0.404
>30	34 (69.4)	16 (64.0)	18 (75.0)		
Health status					
Healthy	32 (65.3)	15 (60.0)	17 (70.8)	0.634	0.426
Unhealthy	17 (34.7)	10 (40.0)	7 (29.2)		
Satisfaction with the lectures on childcare					
Satisfied	44 (89.8)	22 (88.0)	22 (91.7)	–	>0.999[a]
Unsatisfied	5 (10.2)	3 (12.0)	2 (8.3)		
Preparedness for nursing simulations					
Ready	20 (40.8)	12 (48.0)	8 (33.3)	1.900	0.296
Not ready	29 (59.2)	13 (52.0)	16 (66.7)		
Self-efficacy	45.55 ± 8.06	44.76 ± 7.44	46.38 ± 8.74	0.698	0.489
Disposition towards critical thinking	104.43 ± 10.19	103.88 ± 10.89	105.00 ± 9.60	0.381	0.705
Problem-solving ability	117.33 ± 14.85	116.68 ± 15.83	118.00 ± 14.07	0.308	0.759
Satisfaction with practice	70.78 ± 9.62	68.72 ± 8.84	72.92 ± 10.11	1.549	0.128

[a] Fisher's exact test; Cont. = control group; Exp. = experimental group.

3. Results

3.1. Homogeneity testing for participants' general characteristics

Participants' general characteristics, such as age, gender, academic performance, health status, satisfaction with lectures on childcare, and preparedness for nursing simulations, were homogeneous (i.e., with no significant between-group differences) in both groups. Similarly, the outcome variables, which include self-efficacy, disposition towards critical thinking, problem-solving ability, and satisfaction with practice, also exhibited between-group homogeneity (Table 2).

3.2. The effects of peer tutoring-based simulation education on caring for children with respiratory infections among nursing students

No significant difference in self-efficacy was observed between the groups (F = 0.108, p = .744). However, we did find significant differences by time (F = 14.412, p < .001) and between the groups over time (F = 4.205, p = .046) (Table 3 and Fig. 2). Therefore, the first hypothesis was confirmed: the experimental group exhibited a greater improvement in self-efficacy than the control group.

Disposition towards critical thinking differed significantly by time (F = 11.605, p = .001), but no significant between-group difference was observed according to time (F = 0.672, p = .417), nor was there a difference by group alone (F = 0.018, p = .893) (Table 3 and Fig. 2), This suggests that the experimental and control groups showed similar changes following the intervention, thereby refuting our second hypothesis.

Problem-solving ability differed significantly by time (F = 27.006, p < .001), but no significant between-group difference was noted according to time (F = 1.113, p = .297), nor was there a difference by group alone (F = 0.019, p = .892) (Table 3 and Fig. 2). Thus, both groups showed similar post-intervention changes, refuting our third hypothesis.

Satisfaction with practice did not differ significantly by group (F = 0.537, p = .467). However, we observed significant differences according to time alone (F = 27.442, p < .001) and between the groups according to time (F = 4.344, p = .043) (Table 3 and Fig. 2). Therefore, our fourth hypothesis was confirmed, as the experimental group demonstrated a greater improvement in satisfaction with practice compared to the control group.

3.3. The experiences of peer tutoring-based simulation education on caring for children with respiratory infections among nursing students

The qualitative analysis of the narrative data yielded three categories and seven subcategories (Table 4). Despite the challenging and demanding nature of the simulation, participants were able to receive ample feedback from tutors through peer tutoring. This allowed them to address their weaknesses and engage in learning that was customized to their level. Moreover, participants found themselves in a psychologically secure environment, where they felt comfortable asking questions in a relaxed and engaging atmosphere. Peer tutoring also offered participants the chance to interact with more senior individuals. Participants expressed satisfaction with this novel experience and anticipated a variety of future learning experiences.

3.3.1. Category 1. enhancement of learning

3.3.1.1. Subcategory 1. sufficient feedback.
The participants found it challenging to apply their knowledge in the simulation and felt flustered due to not being able to respond immediately to the situations. Nevertheless, they noted that the comprehensive feedback provided by the tutor facilitated effective learning.

Table 3

Self-efficacy, disposition towards critical thinking, problem-solving ability, and satisfaction with practice in both groups (N = 49).

Variables or categories	Pretest	Posttest	Source	t or F	p
	M±SD	M±SD			
Self-efficacy					
Exp.	44.76 ± 7.44	51.04 ± 6.17	G	0.108	0.744
Cont.	46.38 ± 8.74	48.25 ± 6.60	T	14.412	<0.001
			G × T	4.205	0.046
Disposition towards critical thinking					
Exp.	103.88 ± 10.89	107.76 ± 9.82	G	0.018	0.893
Cont.	105.00 ± 9.60	107.38 ± 9.79	T	11.605	0.001
			G × T	0.672	0.417
Problem-solving ability					
Exp.	116.68 ± 15.83	127.56 ± 15.27	G	0.019	0.892
Cont.	118.00 ± 14.07	125.21 ± 12.57	T	27.006	<0.001
			G × T	1.113	0.297
Satisfaction with practice					
Exp.	68.72 ± 8.84	78.20 ± 7.48	G	0.537	0.467
Cont.	72.92 ± 10.11	77.00 ± 7.15	T	27.442	<0.001
			G × T	4.344	0.043

Cont. = control group; Exp. = experimental group; G = group; T = time.
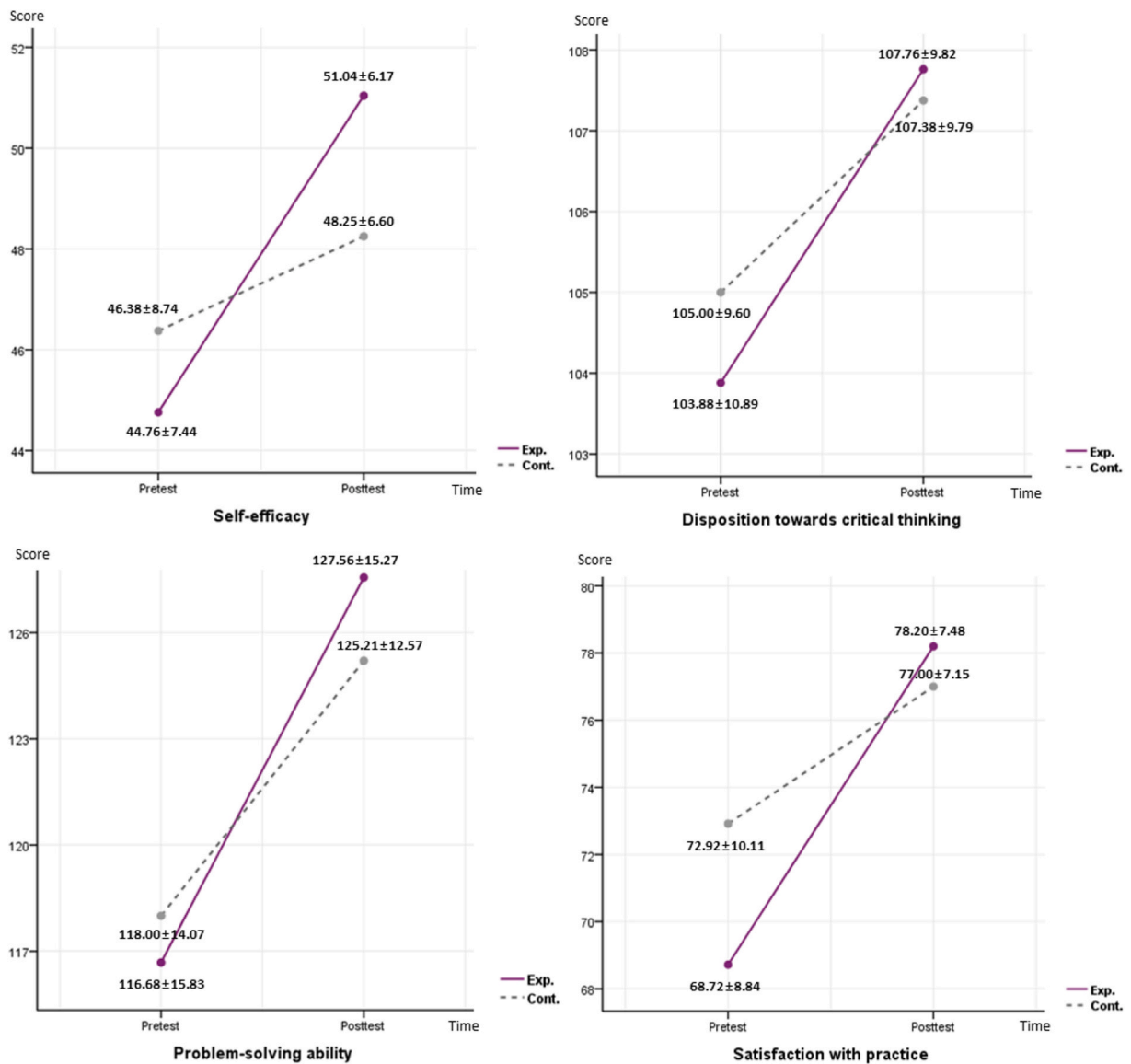
Fig. 2. Self-efficacy, disposition towards critical thinking, problem-solving ability, and satisfaction with practice between the groups. Cont. = control group; Exp. = experimental group.

Table 4
Experiences of peer tutoring-based simulation education on caring for children with respiratory infections among nursing students: categories and subcategories.

Categories	Subcategories
Enhancement of learning	Sufficient feedback
	Complementing deficient skills
	Keeping it at our level
Psychologically secure environment	Laid-back and interesting atmosphere
	An environment conducive to asking questions
Novel experience	Interaction with senior students
	Expectations for various learning methods

"It was difficult to accurately apply my knowledge in the simulation situation. However, the tutor gave me immediate feedback after the simulation, pointing out both strengths and areas for improvement. This was helpful, and I think it will stay with me for a long time." (participant 9)

3.3.1.2. Subcategory 2. complementing deficient skills. The participants better understood what they had previously studied while discussing it with tutors. They expressed that the tutors were instrumental in their learning process, specifically by addressing their areas of weakness. These included strategies for coping in different situations, considerations related to nursing, and potential oversights during procedures.

> "It was helpful that the tutor informed us of things that we might overlook if we didn't think carefully about them, such as detailed skills and reassuring patients' guardians." (participant 11)

3.3.1.3. Subcategory 3. keeping it at our level. The participants reported that the tutors were well-prepared and provided excellent responses to their inquiries, explaining concepts in a logical and easily comprehensible manner. They found it helpful that the tutors offered detailed guidance on the sequence of procedures and necessary precautions, tailored to the tutees' level, and also demonstrated these procedures themselves.

> "The tutors informed me of the order of nursing skills and gave tips on each one, tailored to our level, which allowed us to improve the completeness of our skills in a short time."
>
> (participant 15)

3.3.2. Category 2. psychologically secure environment

3.3.2.1. Subcategory 1. laid-back and interesting atmosphere. The participants expressed that their confidence was bolstered due to the relaxed learning environment provided by the tutors, which alleviated their fear of making mistakes. They appreciated the tutors' approach of making the learning process enjoyable. This laid-back and engaging atmosphere significantly lessened the psychological stress associated with simulation-based learning.

> "It was done in a relaxed and laid-back atmosphere, so I felt confident rather than worrying about 'what if I get it wrong?' and the pressure on the test was reduced." (participant 2)

3.3.2.2. Subcategory 2. an environment conducive to asking questions. The participants valued the presence of a tutor throughout their learning journey. This arrangement enabled them to promptly ask even minor questions and feel at ease posing queries that they might find challenging to direct toward the professor.

> "It was easier to ask questions and hear answers. For example, things that I felt embarrassed to ask the professor about." (participant 16)

3.3.3. Category 3. novel experience

3.3.3.1. Subcategory 1. interaction with senior students. The participants viewed peer tutoring as an excellent chance to engage with older students and expressed their appreciation for the tutors who assisted them. They noted their gratitude for the tutors' willingness to share their experiences in a congenial way, as well as their provision of information about school life and job opportunities.

> "I enjoyed hearing about the tutor's practical experience and appreciated the tutor providing information about job preparation and other topics during break time." (participant 4)

3.3.3.2. Subcategory 2. expectations for various learning methods. The participants expressed satisfaction with their novel experience of peer tutoring and conveyed a desire to engage in such sessions again in the future. They also looked forward to learning in various other new and different ways.

> "I think it would be fun to have peer-tutoring during the next simulation practice as well." (participant 3)

> "It was enjoyable, and I hope that in the future, simulations will be conducted in various ways to keep things interesting." (participant 22)

4. Discussion

In this study, nursing students who participated in a peer tutoring-based simulation education program for the care of children with respiratory infections, demonstrated greater growth in self-efficacy compared to those who did not participate. The students were able to build confidence in their ability to provide nursing care by practicing their skills in a safe, supervised environment through simulation training [6]. However, despite the positive learning outcomes associated with simulations, students often experience high levels of stress and anxiety during these exercises. This can adversely affect their self-efficacy and overall learning outcomes [26].

Peer tutoring during simulation training enhances learning effectiveness by stabilizing students' emotions [14] and reducing their

anxiety levels [27]. In the open-ended surveys of this study, participants from the experimental group reported that they had the opportunity to practice care for children with respiratory infections in an engaging, unrestricted environment, and supplement their lacking skills. They also gained confidence in the simulation by receiving constructive feedback from the tutors. In a previous study [15], tutees developed confidence as they promptly corrected their mistakes with the help of tutors and received praise for their skills during the simulation practice. Nursing students who have faith in their abilities to provide nursing care to children, or who possess strong self-efficacy, are more capable of applying the nursing process in a clinical setting.

Satisfaction with practice in this study exhibited a more substantial improvement in the experimental group than in the control group. Nursing students have previously described participation in simulations as an enjoyable experience [8]. Despite the perception of simulation as a stressful task among students in this study, those in the experimental group were able to experience a psychologically secure environment during peer tutoring. This aligns with recent findings by An & Koo [15], which suggest that the support and encouragement provided by tutors can help alleviate student pressure. The nursing students in this study observed that tutors made an effort to adapt their instruction to the tutees' level of understanding, creating an environment where tutees felt comfortable asking questions. The students appreciated the opportunity to communicate with their tutors and expressed an intention to participate in peer tutoring in the future. Peer tutors are seen as valuable mentors who not only help nursing students learn and study effectively, but also provide them with a supportive network [11]. Therefore, the active consideration of peer tutoring could be a viable strategy to enhance students' learning satisfaction in pediatric practicum.

In this study, the experimental group's changes in disposition towards critical thinking and problem-solving ability did not significantly differ from those of the control group. However, there was a significant difference over time in both these areas; that is, the disposition towards critical thinking and problem-solving ability of nursing students in both the experimental and control groups improved following their pediatric practicum. Both groups used the same practice site, practice time, practice guidelines, and simulation topic. The simulation involved a scenario about a child with a respiratory infection, which emphasized critical thinking and problem-solving skills. Therefore, the simulation training on caring for a child with a respiratory infection effectively enhanced the disposition towards critical thinking and problem-solving abilities of the nursing students. This finding aligns with a previous study, which found that nursing students who participated in simulations improved their problem-solving abilities [7].

In this study, peer tutoring failed to significantly improve the disposition towards critical thinking and problem-solving ability of nursing students. Critical thinking and problem-solving involve identifying a problem, exploring potential solutions, choosing the most effective one, implementing it, and then evaluating the outcome [22]. Students require sufficient time to engage in critical thinking and independently solve problems. While peer tutoring facilitated learning by providing a more approachable communication channel than with a professor, the tutees recognized the ineffectiveness of relying solely on their tutors for solutions, rather than finding them independently [15]. Unprepared participation in peer tutoring may lead to increased dependency on tutors. Tutees admitted that they often sought easy answers from their tutors instead of thinking independently or collaborating with their peers [15]. To promote active and effective learning, tutees should prepare for simulation practice using suitable pre-simulation tasks [28]. Future research should focus on using peer tutoring to analyze simulation scenarios and find solutions to problems. Tutors should be properly educated to present appropriate questions that encourage tutees to find the answers themselves, rather than providing the answers directly.

In summary, the peer tutoring-based simulation education on caring for children with respiratory infections significantly increased self-efficacy and satisfaction with practice among nursing students, and it will be used to further improve nursing students' learning in the care of children with respiratory infections. It is noteworthy that the use of peer tutoring in simulations can contribute to increasing learners' self-efficacy and satisfaction with practice by providing a comfortable environment. While simulations provide a psychological safe and controlled environment for learners, ensuring their psychological safety during simulation-based education can be quite challenging [19,26]. Peer tutoring in simulations can be employed as a strategy to address this issue.

This study has several limitations. First, data were collected using a convenience sample from nursing students at a single university in South Korea, and due to the limited number of participants, the generalizability of the findings is limited and caution is needed in interpreting the results. Second, participants were allocated to groups based on their practice period, rather than randomly, to prevent the diffusion of the experimental effect. Future studies should consider implementing a randomized controlled design. Third, only one post-intervention test was administered in this study, with no subsequent tests to verify the long-term impact of the intervention. Future research should include follow-up studies to validate the long-term efficacy of the intervention.

5. Conclusions

This study of focused on the development and evaluation a simulation education program for nursing students, specifically targeting the care of children with respiratory infections, using a peer-tutoring approach. The results indicated that the experimental group experienced a greater increase in self-efficacy and satisfaction with practice than the control group. The use of peer tutoring in simulation education fostered a supportive and engaging learning environment, thereby enhancing the nursing students' learning experience. The findings suggest that simulation education, facilitated through peer tutoring, can be an effective tool for improving the competency of nursing students in caring for children with respiratory infections.

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Data availability statement

The datasets are available from the corresponding author on reasonable request.

CRediT authorship contribution statement

Hyun Young Koo: Writing – review & editing, Writing – original draft, Supervision, Funding acquisition, Conceptualization. **Bo Ryeong Lee:** Writing – review & editing, Writing – original draft, Visualization, Investigation, Formal analysis.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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