Original Article

Effectiveness of Simulation-based Education for Nursing Students Using a High-performance Simulator

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Abstract
Background: Simulation-based education for healthcare professionals began in the 1960s and was introduced to Japan in the late 1980s. At University A, pediatric nursing practicum is conducted using SimJunior, a high-fidelity simulator.
Aim: This study aimed to investigate the effectiveness of a case study practical exercise using SimJunior.
Methodology: The survey was conducted using a self-administered questionnaire. This study involved 129 second-year nursing students from University A. The findings from the exercise using SimJunior, briefing 1 week before the practical exercise, and debriefing were studied and analyzed.
Results: The practical exercise conducted using SimJunior confirmed that students gained a better understanding of respiratory status through visualization. The briefing held 1 week before the practical exercise helped students review their knowledge and understand the case studies and contributed to improving their observation skills. In addition, the debriefing facilitated the exchange of ideas and the retention of knowledge and skills among students.
Conclusions: The practical exercises in the case studies using SimJunior were very effective. The simulator allowed the students to refresh their skills and knowledge .The briefing held 1 week before the practical exercise provided prior learning to students in assessing the condition of the pediatric patient and reviewing their knowledge. The exchange of opinions among students during the briefing led to the retention of knowledge and skills.

Keywords: Simulation-based education, high-fidelity simulator, SimJunior, nursing student, pediatric nursing practical exercise.

Introduction

The use of simulators in the education of healthcare professionals began in the 1960s and has since evolved at an unprecedented pace (Hall & Tori, 2017). Simulation-based education aims to integrate knowledge, skills, and attitudes by having learners experience and reflect on medical practices and care in situations that more closely resemble those in clinical practice, as education-based teaching and learning strengthen practical abilities by integrating learners' knowledge and skills (Abe 2013). Simulation-based education in

Japan has a shorter history than that in Europe and the United States. In the late 1980s, the use of simulated patients began to advance; although it initially focused on the education of medical students, simulated patients are now widely used in the education of healthcare professionals(Abe 2016), and in nursing, teaching is done using a combination of simulated patients and simulators. In foreign countries, simulation-based education is interactive and experiential, and the main benefit is described as the integration of acquired skills and taught knowledge (Shapiro, Morey and Small, 2004). In addition, debriefing, which is an integration of such taught knowledge, is the most important part of simulation-based education and a successful learning process and is associated with high learning benefits (Gul & Tulay, 2021).

At present, the birthrate in Japan is declining at a faster pace, partly due to the effects of the COVID-19 pandemic, and the Ministry of Health, Labor and Welfare of Japan (https://www.mhlw.go.jp/toukei/saikin/hw/jinkou/geppo/nengai23/dl/gaikyouR5.pdf).Ojiro and Naragino (2010) stated that nursing students' interaction with children has also decreased, and some students struggle with dealing with children for the first time during their pediatric nursing practicum. Practical exercises using child simulators help nursing students, who have little daily interaction with children, understand the differences between adults and children and visualize pediatric nursing, such as the need for using language appropriate to the developmental stage of each child. In Japan, simulation-based education is considered an effective way to understand pediatric patients.

Research Question and Hypothesis

In 2014, the Department of Nursing at University A established a simulation center to provide simulation education. In pediatric nursing, Laerdal's high-fidelity simulator SimJunior™ (https://laerdal.com/jp/products/simulation-training/obstetrics-paediatrics/simjunior/) was introduced and has been used for practical exercise. The high-fidelity simulator SimJunior™ allows the reproduction of normal and abnormal breath sounds in spontaneous breathing and the monitoring of 12-lead electrocardiogram images, respiratory rate, blood pressure, and oxygen saturation. In pediatric nursing practical exercise, the high-fidelity simulator SimJunior™ was introduced in 2015 to reconfirm breath sound-listening areas and listen to normal and abnormal breathing sounds during pediatric nursing practical exercise for second- and third-year students. To develop an understanding of abnormal breathing, second-year students listen to the differences between normal breath sounds and breath sounds with wheezing, breath sound attenuation, and left–right differences in lung sounds using SimJunior™ .

Looking back on the previous practical exercise using SimJunior™, we contemplated that rather than focusing on the limited observation of normal and abnormal breathing and differences in breath sounds, adding a situation setting that is closer to patients' condition on admission would help in gaining a more complete picture of pediatric patients and better understand the patients. As a new exercise method, we created a case example of a 5-year-old child exhibiting signs of pneumonia. An exercise program that included a briefing 1 week before the practical exercise, practical exercise per se, and debriefing after the practical exercise was created, and its effectiveness was examined based on the students' free descriptions.

Methodology

Research Design: This study adopted a qualitative research design based on a self-administered questionnaire survey.

Research Participants: This study involved 129 second-year students from the Department of Nursing, Faculty of Human Care at University A. The five absentees on the day of the practical exercise were excluded. The remaining 129 second-year

students were divided into two classes, with approximately 65 students per class, for the 90-min practical exercise. In addition, two practical exercise items were performed on the day, and the simulator practical exercise took 45 min with about approximately 35 participants each.

Survey Method: Participants' responses to a self-administered questionnaire after the simulator practical exercise using SimJunior™ were analyzed. The survey covered the period for the briefing 1 week before the day that the pediatric nursing practice II practical exercise was conducted, during the practical exercise, and debriefing on the day of the practical exercise.

Survey Timing: The survey was conducted from December 14 to December 21 in the second semester of the second year.

Analysis Method: From the self-administered questionnaire response form, which consisted of three questions on the (1) introduction of SimJunior, (2) briefing, and (3) debriefing, record units related to the effectiveness of simulation-based education and insights, as perceived by the students from the practical exercise that was in line with the purpose of this study, were extracted. The data obtained were analyzed using Berelson's (1952) method of content analysis and classified based on the similarity of the semantic content.

Operational Definition of Terms: Simulation-based education: This refers to the use of a simulator to practice medical procedures and care that closely resemble those in clinical practice and reflect on the experience, aiming to solidify knowledge, skills, and attitudes.

practical Exercise Method: It is to conduct briefings, practical exercises, and debriefings.

Briefing 1 week before the exercise: Materials on the case example were distributed during the lecture 1 week before the practical exercise, and a 30-min oral explanation of the case example was given. The patient was a 5-year-old boy. Since December 18, 2022, he had been coughing, and breathing had become more frequent. He was admitted because of difficulty breathing at night and inadequate sleep. On admission, his vital signs were a temperature of 38.6°C, respiratory rate of 30 breaths per minute, heart rate of 118 beats per minute, and blood pressure of 112/72 mmHg. Admission blood data showed a white blood cell count of 13,000/μL and a C-reactive protein level of 1.2 mg/dL. His oxygen saturation on admission was 93%, so an oxygen flow of 2 L was initiated. After the oxygen therapy, his oxygen saturation had been maintained at 96%. An explanation was also provided using the child's chest X-ray image that showed signs of right-sided pneumonia. Continuous infusion was started at 50 mL/h. The fluid balance was 300 mL of oral fluid intake before admission. After admission, the patient had taken very little fluid and food by mouth. As for dietary instructions, infant whole porridge was served; however, the patient was required to eat only as much as he could. The infusion route was explained using a diagram of a child with an infusion pump attached. The explanation also emphasized the need to confirm normal vital sign values, normal oxygen saturation level, and blood data values relevant to the age of the pediatric patient and compare and assess the condition of the pediatric patient. To understand his nutritional status, identifying anticipated problems regarding changes in systemic condition caused by low oxygen saturation levels and confirming daily calorie and fluid intake requirements for the 5-year-old child were also clarified. Since the participants were second-year students who may not have sufficient knowledge for conducting assessments, the debriefing contents were also explained during the briefing.

Day of practical Exercise

SimJunior settings on the day of practical exercise: (1) An oxygen mask was worn, and the oxygen flow rate was set at 2 L. (2) The sensor of the oxygen saturation monitor was attached to the left thumb. (3) For breath sounds, wheezing was set, with a volume of 5 for right lung sounds and 10 for left lung sounds. The volume was lowered for the right lung because of signs of pneumonia. (4) The electrocardiogram and transcutaneous oxygen monitor were set to the same values as in the case example, and the patient wore the electrocardiogram and transcutaneous oxygen monitor 24 h a day. (5) In the model undergoing intravenous drip insertion, the insertion site was immobilized with a

bandage. (6) The infusion pump was set to a flow rate of 50 mL/h and a daily infusion volume of 1200 mL.

practical **Exercise:** All students observed the patient's breath sounds and the monitor according to the case example. The predicted nursing care for the pediatric patient with compromised respiratory status and the activities of daily living of the pediatric patient receiving continuous infusion while connected to an oxygen saturation monitor in bed were confirmed. Observations were conducted in groups of five or six students for no more than 20 min. In addition, since only one SimJunior™ was set up, all groups had simultaneous observations instead of taking turns.

Debriefing: The contents of the debriefing were as follows. (1) What were the abnormalities in the respiratory rate, depth, and rhythm? (2) What were the abnormalities in respiratory movement patterns? (3) How would you assess oxygen administration and oxygen saturation levels? (4) The pediatric patient currently does not appear hesitant to wear the oxygen mask, but he might take it by himself. How would you explain to him the importance of keeping the oxygen mask on? (5) How did you observe the infusion volume and rate? (6) How did you assess the daily fluid balance? (7) How would you take care of his needs, such as going to the toilet, hygiene, and daily living? (8) How would you support his mother, particularly in caring for her as her son is hospitalized for the first time? The debriefing began when all group members had completed their observations of the pediatric patient's condition. Each group appointed a student to act as the moderator, and a discussion was held for approximately 30 min based on the debriefing contents.

Completion of a self-administered questionnaire response form after the practical exercise: The self-administered questionnaire response form included the following questions: (1) What do you think of the practical exercise using SimJunior? (2) Was the briefing conducted 1 week in advance of the practical exercise effective? (3) Was the debriefing effective? In addition, the participants provided free-text responses and were verbally asked to elaborate on the effectiveness of simulation-based education and share their insights.

Ethical Considerations: This study was approved by the ethics review committee of the institution to which the authors are affiliated (2023-018). On the day of the practical exercise, the participants received an explanation about the study, that is, simulation-based education. The explanation encompassed the purpose of the study and disclosure of the results to the public. The completed questionnaire was submitted within one week from the day of the training.

Results

Explanation was given in line with the purpose of the study, and consent was obtained. A total of 129 students participated in the study, and a completed self-administered questionnaires were collected. Content analysis was performed based on the responses to the three questions. As a result, the following were generated: Effectiveness of the exercise using SimJunior™ (Table 1), (2) effectiveness of the briefing 1 week before the practical exercise (Table 2), and (3) effectiveness of the debriefing (Table 3).

The results are described below according to the three items. In addition, each category is denoted by[]. The categories for the effectiveness of the practical exercise using SimJunior™ were as follows(Table 1): (1) [improvement in learning about respiratory status] with 148 codes,(2) [progress in learning using a simulator] with 36 codes, (3) [learning effects from using equipment] with 34 codes, and others.In total, 252 codes were generated on the effectiveness of the exercise using SimJunior™.

The categories for the effectiveness of the briefing 1 week before the exercise were as follows(Table 2): (1) [progress in understanding the condition of the pediatric patient] with 87 codes, (2) [effects on observation] with 61 codes, (3) [linkage to debriefing] with 11 codes, and others.In total, 165 codes were generated about the effectiveness of the briefing 1 week before the practical exercise.

The categories for the effectiveness of the debriefing were as follows(Table 3): (1) [effects of discussion] with 144 codes, (2) [effects of reflection] with 37 codes, and (3) [reflection on knowledge and skills] with 14 codes. In total, 195 codes were generated about learning from the debriefing.

1. Effectiveness of learning using SimJunior Numbers represent the number of record units (total = 252)

Category	Subcategory	Code	Number of record units
1. Improvement in learning about respiratory status, 148	1. Progress in understanding breath sounds in pneumonia, 70	Weakening of breath sounds in the right lung and wheezing in the right lung	33
		Adventitious sounds could be heard	33
		The use of a simulator allowed us to listen to breath sounds that closely resemble the actual disease symptoms	4
	2. Visualization of the child's respiratory status, 27	The rib cage moved in sync with breathing, making it easy to observe	23
		I was able to visualize the child's respiratory status and listen to breath sounds	4
	3. Identification of the areas to listen to breath sounds, 22	I could identify the correct areas for listening to children's breath sounds	22
	4. Experience listening to a child's breath sounds, 20	I could listen to breath sounds using a pediatric stethoscope	14
		Given the lack of opportunity to listen to children's breath sounds, using SimJunior helped me understand them	6
	5. Progress in understanding normal and abnormal respiratory status, 9	Listening to breath sounds through auscultation facilitates the visualization of both normal and abnormal lung sounds	6
		I could tell when the respiratory rate was abnormal by listening to breath sounds	2
		I learned about respiratory distress by comparing normal and abnormal breath sounds	1
2. Progress in learning using a simulator, 36	1. Comparison with adults, 19	I have learned that children's respiratory rates are faster than those of adults	10
		I am now aware of the differences in body shapes between children and adults	6
		Thoracic movements in children are more pronounced than those in adults	2
		Respiratory rates are faster than those of adults, and determining respiratory status by listening to a single breath	1

		sound is challenging, so multiple checks are necessary	
	2. Visualization of the actual scene, 10	I was able to visualize the practicum and make whole-body observation of the child	9
		It felt like the child was physically present	1
	3. Classes and exercises are aligned, 3	During the case example briefing, I could assess why the respiratory rate was high by listening to breath sounds	2
		My understanding improved through classroom learning by learning in class and actually listening to breath sounds	1
	4. Recognize the need for accurate understanding of children, 2	The actual use of a simulator allowed me to verify my knowledge and clarify uncertainties	1
		I thought that a more accurate understanding of the condition was necessary because of the small size of children's bodies	1
	5. Comparison with healthy children, 1	I learned that his breath sounds, rhythm, and respiratory rate were different from those of healthy children	1
	6. Experience comprehensive assessment, 1	In addition to breath sounds, we learned about thoracic movements and vital signs, enabling us to conduct a comprehensive assessment	1
3. Learning effects from using equipment, 34	1. Learning effects from using monitors, 20	The monitor's layout was realistic and user friendly	7
		The monitor displayed pulse, SpO2, and respiratory rate, and I understood the need for comprehensive data collection and assessment	6
		The values displayed on the monitor fluctuated, and I was able to associate it with actual experience	5
		By directly monitoring SpO2, respiratory rate, and ECG on the display, I was able to compare them with patient's admission data, facilitating easier assessment	1
		I believed that the values displayed on the monitor would help parents betterunderstand the condition of their children	1
	2. Learning from using infusion pumps, 13	The IV pump settings were easy to understand based on the case example	11
		I now have a clear understanding of how to adjust the IV flow rate	2
	3. Learning from using equipment, 1	Knowledge on the use of pediatric equipment and the nature of assistance	1

		allowed me to to offer necessary support	
4. Expansion of focus, 27	1. Consider ways to interact with children to encourage cooperation, 9	The child must understand that removing the oxygen mask will cause respiratory distress	8
		Because the oxygen mask might be removed, the patient can be distracted by securing it with a cartoon sticker	1
	2. Identification of areas to listen to breath sounds according to age, 5	There is the need to refresh on areas to auscultate according to the child's age	5
	3. Consider ways to listen to breath sounds based on children's condition, 5	I understood the difficulty of auscultating according to breathing	3
		I realized that children cry and move around a lot, making it necessary to listen to their breath sounds while anticipating these	2
	4. Predict decline in oxygen saturation level, 2	Removing the oxygen mask could decrease the oxygen saturation level	1
		Currently, 2 L of oxygen is used, and the oxygen saturation is 98%, which falls within the normal range; however, it could fluctuatewith child's body movements	1
	5. Understand the need to report abnormal breathing, 1	Adventitious sounds heard in the lower lobe of the right lung should be reported	1
	6. Expansion of observation items, 1	Other symptoms such as changes in skin color and pain should also be observed when assessing breath sounds	1
	7. Need to understand lung anatomy, 1	Knowledge of the anatomy of the lungs is important	1
	8. Understand that childreen need delicate nursing care, 1	Given their small size, children require delicate nursing care	1
	9. Consider care that makes children comfortable, 1	We need to ensure that the child's hospital stay is as comfortable as possible	1
	10. Understand children's challenges in physical movement, 1	I realized that maneuvering with various tubes attached would be challenging	1
5. Expectations for simulation-based education, 5	1. Expectations for simulation-based education, 3	I was able to listen for breath sounds and check the heartbeat, which was a valuable learning opportunity	2
		I am eager to keep practicing with SimJunior	1
	2. Expectations learned from experience, 1	Exercises using SimJunior are useful for learning because it allows auscultation of not only normal breath sounds but also adventitious sounds	1

	3. Effective for pediatric nursing practicum, 1	SimJunior provides a clear understanding of the characteristics of children, making it useful for practicum	1
6. Growing expectations for practicum, 2	1. Expectations for observation in practice, 1	I was looking forward to observing children during my practicum	1
	2. Expect to listen to breath sounds in practice, 1	I was excited to listen to breath sounds during practicum	1

2. Effectiveness of the briefing 1 week before the exercise. Numbers represent the number of record units (total = 165)

Category	Subcategory	Code	Number of record units
1. Progress in understanding the condition of the pediatric patient, 87	1. Learning from prior information, 55	The case example briefing allowed me to prepare for the exercise smoothly (vital signs, fluid levels, nutrition, lung characteristics, abnormalities, etc.)	24
		The case example briefing was useful for the exercise regarding understanding the patient's systemic condition	17
		The prior explanation enabled smooth implementation of the exercise	5
		It was useful for reviewing nursing care and assessment	4
		The explanation helped clarify issues and the exercise	2
		Individualized nursing care could be considered by taking fever, cough and lung conditions into account	2
		The explanation of oxygen flow and infusion was useful in considering ways to provide assistance	1
	2. Construct an image of the pediatric patient, 32	I was able to participate in the exercise by visualizing under what conditions treatment is provided	24
		I was able to consider the possibility and risk of self-removal and its countermeasures	4
		I could participate in the exercise while thinking about the characteristics of a 5-year-old child	2
		I now understand the importance of providing explanation to 5-year-old children	2
2. Effects on observation, 61		Prior knowledge of the patient's condition facilitated listening to breath sounds	16

	1. Learning content for observation of respiratory status, 29	The X-ray images helped us identify the inflammation site and assess breath sounds	9
		I could anticipate the breath sounds that would be heard from the case example and actually confirm it	4
	2. Learning content for observation of systemic condition, 24	From the case example, it became clear where to focus my observations	17
		I had information about the patient, which allowed me to understand and monitor his condition	6
		I was able to identify areas that require careful observation, facilitating a smooth detection of abnormalities	1
	3. Progress of observation by explanation, 8	I noted that normal values were maintained due to oxygen administration	4
		I could analyze the symptoms present and connect them with my observations	2
		During the exercise, I was able to assume and observe the condition of the pediatric patient using SimJunior	1
		I was able to verify and gain a deeper understanding of pathology by comparing it with data values	1
3. Linkage to the debriefing, 11	1. Linkage to the debriefing, 11	It was easy to reflect on the discussion because the debriefing topics has been clarified during the briefing	9
		The case example briefing was also useful for our discussion	2
4. Effects of guidance toward prior learning, 6	2. Confirmation of reference values, 5	Having prior knowledge allowed me to evaluate the patient's vital signs against reference values.	3
		I was able to check and compare data with reference values beforehand, making them very much easier to understand	2
	2. Supplementation of knowledge, 1	It was useful because I could pinpoint aareas where my knowledge was insufficient before participating in the exercise	1

3. Effectiveness of debriefing. Numbers represent the number of record units (total = 195)

Category	Subcategory	Code	Number of record units
1. Learning from discussion, 144	1. Deepening of learning, 88	I learned perspectives I was unaware of from other students	29
		I heard many different opinions and found them helpful	23
		Exchange of opinions among members improved my understanding	13

		It was an opportunity to think based on diverse opinions	5
		All members discussed and conducted the assessment	5
		Listening to many opinions led to better nursing	3
		Members came up with the idea based on the teacher's explanation	3
		I learned different perspectives by exchanging and sharing opinions	3
		I gained a deeper understanding of nursing assistance	2
		The contents of opinion exchange were recorded, which could be utilized in the practicum	1
		I was able to specify the type of help required and the assistance needed	1
	2. Opinion sharing, 27	We could share our opinions	17
		I was able to listen to the opinions of each member	10
	3. Sharing of information on knowledge and skills, 26	The exchange of opinions allowed for the sharing of knowledge	13
		I confirmed that the breath sounds I had heard were accurate	5
		As a group, we successfully identified abnormal breath sounds	3
		I could hear the opinions of the members and review correct contents	3
		We managed to validate observation items collectively among members	2
	4. Use of previous knowledge, 3	I was able to apply the knowledge I had gained up to this point	1
		I successfully applied my learnings about IV observation and breath sounds in basic nursing practice	1
		Self-study encouraged discussions	1
2. Learning from reflection, 37	1. Learning from reflection, 31	Reflection enhanced my understanding	31
	2. New discoveries, 3	I made new discoveries	3
	3. Understanding precautions, 2	Through reflection, I identified key points to focus on.	1
		I was able to review material based on the teachers' explanations and reminders	1
	4. Clarification of learning, 1	The learning from this exercise became clear	1
3. Reflection on knowledge and skills, 14	1. Identification of lack of knowledge, 9	Discussions compensated for my gaps in knowledge	4
		I realized my lack of knowledge	4

		I now understand which aspects of knowledge I was lacking	1
	2. Identification of lack of skills, 5	I acquired skills that I previously lacked through exchanging ideas	2
		Sharing information clarified that I was not accurately perceiving breath sounds	2
		I have a clear understanding of the areas where I was both proficient and lacking in skill	1

Discussion

This section focuses on the effectiveness of the practical exercise using SimJunior™, effectiveness of the briefing 1 week before the practical exercise, effectiveness of the debriefing, and significance of simulation-based education in pediatric nursing.

Effectiveness of the exercise using SimJunior™

In Category 1 [improvement in learning about respiratory status] of Theme 1, i.e., the effectiveness of the practical exercise using SimJunior™, we believe that presenting the case example using SimJunior™ made it easier to visualize the pediatric patient's condition and understand his respiratory status. In addition, the use of a life-size simulator for the practical exercise led to Subcategory 1 <comparison with adults> and Subcategory 2 <visualization of the actual scene> in Category 2 [progress in learning using a simulator], where the students recognized the differences in the body shape between children and adults and perceived the child as a pediatric patient in a hospital room.

Students learned the differences in respiratory rates and thoracic movements between children and adults and the difficulty of observing respiratory status in children because of their high respiratory rates. The use of a simulator set up based on a case example also provided a visual effect for learning about the body shape of pediatric patients.

In comparing adults and children, introducing this in the lectures for Introduction to Pediatric Nursing, which serves as the foundation of pediatric nursing and starts the second semester of the first year, would be desirable. Observing the life-size SimJunior™ provided valuable information, and introducing it early will effectively enhance students' practical skills.

In relation to Category 4 [expansion of focus], students expanded their nursing care by directly observing SimJunior™. This included recognizing the importance of giving an explanation to a 5-year-old child using suitable language, helping the child understand his or her illness, and providing explanations to facilitate acceptance of treatment, depending on the child's age. Students were able to examine the nursing care needs of a 5-year-old pediatric patient with a respiratory illness, including strategies for instances where the patient refused an oxygen mask. Students became aware of age-appropriate care, and the synergistic effect of understanding the case example during the briefing and using a life-size simulator helped them focus on growth and developmental stages, expanding their perspectives to age-appropriate nursing care.

In addition, in Subcategory 1 <learning effects from using monitors] of Category 3 [learning effects from using equipment], some students were able to check the values displayed on the monitor with other students and explain and share deviations from normal values among themselves, indicating that these monitors allowed them to deeply assess the pediatric patient's condition. Assessing the patient's condition based on the values displayed on the monitor is very important for improving practical skills, and early and repeated practice of interpreting the values

displayed on the monitor may lead to more accurate assessments.

In total, 252 record units were extracted for learning from the practical exercise using SimJunior™, which was significantly higher than those for the other two themes. In addition, the series of processes including briefing, practical exercise, and debriefing led was deemed to be a more memorable learning experience. According to Hustad, Johannesen, and Fossum (2019), nursing students tend to retain and recall learning outcomes from their experiences in simulation-based training during clinical practicum, which is also expected in this practical exercise using SimJunior.

Effectiveness of the briefing 1 week before the practical exercise

Considering that this was the first exercise using a case example and that the study participants were second-year students raised concerns among the teaching staff regarding students' ability to retain knowledge and comprehend information from the case example, as well as their assessment skills. This concern was connected to Subcategories 1 <effects of understanding the condition of the pediatric child> and 2 <construct an image of the pediatric patient> of Theme 2, that is, learning from the briefing 1 week before the practical exercise, and the briefing clearly facilitated students' learning. Category 2 [effects on observation] included Subcategories 1 <effects on observation of respiratory status>, 2 <effects on observation of systemic condition>, and 3 <progress of observation items>. Certain codes indicated that X-ray images helped students identify the inflammation site, and knowledge of the patient's condition in advance facilitated the listening for breath sounds. The students believed that the briefing helped them expand their observation points and build an image of the practical exercise. Although the level of understanding varies depending on the ability of each student, adding more specific details to the explanation content according to the responses of the students receiving the explanation will affect student learning. Some students effectively utilized the briefing 1 week before the practical exercise in preparation for the practical exercise, emphasizing the importance of the timing of the briefing. Although they did not touch on the timing of the briefing, Kim, Ryu, and Jang (2019) noted that structured preparation and briefing before simulation can effectively improve nursing students' confidence in problem solving, clinical judgment, and clinical decision making. After the briefing, explaining the need for review, such as assessing basic knowledge according to the age of the pediatric patient, and ensuring that students have adequate time to study before the exercise, as in this study, would be beneficial. This will enable students to participate confidently in the practical exercise after refreshing their knowledge. For the study participants, who were second-year students, creating a week's leeway allowed them to refresh their knowledge and skills. Providing students time to study after the briefing may facilitate learning during the practical exercise.

Effectiveness of debriefing

Abulebda, Auerbach, and Limaiem (2023) stated that debriefing is an intentional discussion following the simulation experience that allows participants to clearly understand their actions and thinking processes to facilitate learning outcomes and improve future clinical performance. In addition, Abe (2018) stated that discussion and reflection on events during the session allowed group members to validate and share knowledge and skills that support their actions. Among them, Subcategory 1 <deepening of learning> of Category 1 [effects of discussion] showed the effects of group learning, and as Abe pointed out, confirming one's knowledge and skills and sharing information led to Subcategory 2 <opinion sharing>. The codes included "I was able to refer to various opinions" and "I will be able to refer to various opinions in the future," and the positive learning effect from the discussion experience was possibly induced by the students themselves. Effective group learning happened, just as Abe stated. In addition, reflecting on the practical exercise during the debriefing may allow students to unify vague knowledge and skills, and it was a very effective time for sharing.

In this practical exercise plan, debriefing topics were explained in advance during the briefing. The overall simple structure of the practical exercise may have been beneficial for the second-year students who participated in the practical exercise based on a case example using Sim Junior™ for the first time.

Significance of simulation-based education in pediatric nursing

In this study, simulation-based education was conducted for the first time using a high-fidelity simulator, SimJunior™. Through briefing, practical exercise, and debriefing, students were able to better visualize the pediatric patient, and the process of gaining a better understanding of the patient on their own became clear. The results indicated that participants learned proactively, which could not be observed in previous practical exercises, such as guidance toward prior learning before the exercise, group learning effect, and reconfirmation of skills and knowledge. According to Abe (2016), setting the patient's condition and situation that match the learning content, which is an advantage of simulation-based education, enhances observation skills, which will be useful in clinical practicum. However, their assessment skills were expected to be further improved through visualization of the child through SimJunior™ , drawing on knowledge acquired from the Introduction to Pediatric Nursing course in their first year, as well as through continuous practical exercises with SimJunior™ that utilized case examples from the first semester of the second year up to the first semester of the third year. In addition, planning the exercise content in stages, with case examples tailored to students' abilities, may allow the planning of exercises geared toward practical application. This may help students further solidify their knowledge and skills and improve their assessment abilities.

Conclusions: The exercise using the high-fidelity simulator SimJunior™, in conjunction with a case example of a 5-year-old child, facilitated nursing students in gaining a comprehensive understanding of the pediatric patient, which involved listening to breath sounds and checking for abnormal breath sounds, thereby enhancing their understanding of the patient's condition.

The simulator allowed the students to refresh their skills and knowledge.
The briefing held 1 week before the practical exercise provided prior learning to students in assessing the condition of the pediatric patient and reviewing their knowledge.
The exchange of opinions among students during the briefing led to the retention of knowledge and skills.

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