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Educational needs for practicing neonatal intensive care among Korean nursing students

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Purpose: This study was conducted to investigate the educational needs for practicing neonatal intensive care among Korean nursing students. **Methods:** An explorative, sequential, mixed-methods design was used. Qualitative content analysis was conducted of in-depth interviews of six nursing students, five clinical practice faculty members, and five nurses in the neonatal intensive care unit. The results of a survey of 174 nursing students were analyzed quantitatively. **Results:** Nursing students, clinical practice faculty members, and nurses wanted opportunities for direct nursing practice and education in school during neonatal intensive care practice. In terms of specific educational content, nursing students expressed the highest observation-related educational needs for communication with medical team members, and they expressed the highest practice-related educational needs for operating medical equipment used for neonatal intensive care. The nursing students' needs with regard to the method of practice education were highest for orientation from the head nurses. **Conclusion:** Communication and operating medical equipment were found to be areas with high educational needs for practicing neonatal intensive care among Korean nursing students. Further research is needed to develop an educational framework and setting for practicing neonatal intensive care that would meet their needs.

Key words: Education; Intensive care unit, neonatal; Infant, newborn; Students, nursing

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INTRODUCTION

The neonatal period refers to the first 4 weeks after birth. It is a vulnerable period as neonates adapt to the external environment outside of the mother's body and each part of the body undergoes many physiological changes. Newborns also require attentive care considering their high mortality and morbidity rates. As newborns experience rapid physiological changes after birth, nurses must provide intensive care to promote stable breathing and body temperature and adequate nutrition while closely observing whether newborns adjust well [1]. As the risks of health and safety issues increase among neonates when neonatal intensive care is provided by nurses with low proficiency [2], neonatal intensive care should be practiced by nurses with sufficient competence.

Competent nurses skillfully perform nursing in the neonatal intensive care unit (NICU). NICU nursing involves measurements and monitoring of vital signs, physical assessments and examinations, respiratory therapy, activity management, sanitary nursing and infection control, nutrition and excretion management, administration of medications and blood transfusion, treatment and procedures, the provision of education and emotional support, and special treatments [3]. NICU nurses should be able to perform professional skills, such as providing appropriate respiratory care when supplying oxygen to newborns or applying a ventilator, administering medications and transfusions according to the guidelines, feeding and gavage feeding, accurately observing and recording patients' conditions using a monitor, and providing necessary information to parents [4]. A study of NICU nurses in Korea [3] reported that special treatments, feeding, and monitoring of newborns' condition (such as vital signs), required

large amounts of direct nursing time.

In order for nursing students to develop competence in neonatal nursing, they should practice assessing the physiological characteristics and physical condition of newborns, maintaining breathing and body temperature, supplying nutrition, providing skin care and infection prevention, and performing safety management. It is also necessary for them to achieve the learning objectives of child nursing, and they should develop the ability to provide care to newborns with diseases and health problems [5].

For this purpose, nursing students must receive practice-based education so that they can apply nursing knowledge to discover and solve problems associated with neonatal nursing in the field [6]. They cannot reach the educational goal of achieving competence in neonatal intensive care through theoretical education alone, and practice-based education is essential for cultivating optimal performance. In other words, nursing students should be familiarized with the process of discovering and solving nursing problems for the recovery of newborns' health, along with developing nursing skills for assessing and improving newborns' health through clinical practice training [5].

However, with Korea's total fertility rate recently dropping to 0.88 [7], the number of cases available for neonatal nursing practice has decreased, and clinical practice education has not been conducted as planned due to the spread of coronavirus disease 2019 (COVID-19) [8], making it difficult for nursing students to practice neonatal nursing in a clinical setting. In a previous study [9] involving senior students from a nursing college who had completed child nursing practice education, nearly half of them had no clinical practice experience in neonatal nursing. Furthermore, even if there were opportunities for clinical practice, nursing students limited their own activities to avoid interfering with nurses working in the field [10]. They experienced only simple activities such as checking vital signs using a monitor or delivering materials.

In particular, in the environment where the importance of professional intensive care is emphasized due to the increase in high-risk newborns [11] and new infectious diseases such as COVID-19 keep occurring, nurses are required to perform neonatal intensive care proficiently, whereas nursing students are only allowed to have limited clinical practice experience in the NICU for the protection of vulnerable subjects. As a result, nursing students have insufficient learning opportunities in the field and experience a lack of confidence in their nursing skills [8], thereby becoming novices who are brought into the clinical field without any experience in the NICU. However, to facilitate the normal growth and development of newborns, as well as the recovery of health, it is necessary to improve the quality of neonatal intensive care provided by medical personnel, as well as nurses [11]. Nurses' lack of competence can lead to a decreased quality of nursing, resulting in negative health outcomes in newborns [2].

Therefore, theoretical and practical education should be improved so that nursing students can become nurses competent in neonatal nursing [12,13]. In order to improve practice-based education in child nursing, studies have described the need for neonatal nursing simulations [9], child nursing simulations [13], and skills training at school [14], but they focused on particular learning objectives and training methods without systematically investigating the needs of nursing students for neonatal nursing practice education. In order for practice-based education for neonatal intensive care to be effectively implemented among nursing students, their educational needs should be accurately identified and reflected when determining educational goals and content and developing a curriculum.

Therefore, this study aimed to provide basic data to help establish measures to improve neonatal nursing practice education for nursing students by accurately identifying their needs for practice education in neonatal intensive care. The first purpose of this study was to identify the educational needs for practicing neonatal intensive care of nursing students, clinical practice faculty members, and nurses. The second purpose of this study was to examine the needs of nursing students for neonatal intensive care practice, with a particular focus on content, methods, and guidance related to practice education for neonatal intensive care.

METHODS

Ethics statement: This study was approved by the Institutional Review Board of Daegu Catholic University (No. CUIRB-2020-0022). Informed consent was obtained from the participants.

1. Study Design

This study used an explorative, sequential, mixed-methods design [15], in which in-depth interviews were first conducted and analyzed through qualitative content analysis [16], and a subsequent quantitative survey was conducted and analyzed.

2. Participants

For the in-depth interviews, five clinical practice faculty members, five NICU nurses, and six nursing students were enrolled through convenience sampling based on a previous study [17] that collected data by interviewing 5-10 participants to analyze educational needs with a qualitative

approach.

The participants of the quantitative part of this study were 174 juniors and seniors who were enrolled in two nursing colleges located in a metropolitan city, had experience in NICU practice education, and agreed in written form to participate voluntarily in the study. A survey was conducted among 200 students, considering a 20% dropout rate with a sample size of 159 needed for analysis of variance (ANOVA) with a medium effect size of .25, a power of 80%, and a significance level of .05 using the G*Power 3.1.2 program [18]. Of the collected survey data, 174 copies were used for the final analysis, excluding cases where responses were incomplete.

3. Data Collection

1) Qualitative study: In-depth interviews

In-depth interviews were conducted from September 15, 2020 to November 20, 2020. Five clinical practice faculty members, five nurses in NICUs, and six nursing students who agreed to participate in the study, were individually interviewed using open-ended questions. The open-ended questions were structured to elicit needs for neonatal intensive care practice education based on the learning objectives of pediatric nursing [5], the nursing performance of NICU nurses in Korea [3,4], and the researchers' experience of neonatal nursing practice education. Specific questions included "Tell me about important points in neonatal nursing practice education", "Tell me about the good and difficult aspects of neonatal nursing practice education", and "Tell me what you would like to see improved in neonatal nursing practice education". The interviews were conducted at a convenient time and place for the participants and lasted approximately 1 hour. The interviews were voice-recorded, observations were written, and after the interview, the recordings were transcribed and analyzed along with the field notes.

2) Quantitative study: Descriptive survey

The survey was conducted from December 9, 2020 to December 11, 2020, and the tool was developed through the following process.

(1) First round of item construction

The first-round preliminary questions were prepared based on the main concepts and attributes of the needs for neonatal nursing practice education derived from the learning objectives of pediatric nursing [5], the nursing performance of NICU nurses in Korea [3,4], and the analysis of the in-depth interviews. The preliminary questions consisted of a total of 89 items including 13 categories (74 items) on the content of neonatal nursing practice education, 10 items on its methods, and five items on guidance. Participants reported that it is necessary for nursing students to perform basic techniques for neonatal care, but nursing students are only allowed to observe complicated skills. Each item had two categories: one for educational needs for observation and the other for educational needs for practice. The respondents provided answers for both categories (educational needs for observation and educational needs for practice) in the same item.

(2) Content validity verification and second round of item construction

In order to examine whether the first-round preliminary questions represented the characteristics to be measured, an expert group consisting of five clinical practice faculty members and five neonatal intensive care unit nurses was constituted to test content validity. Questions with a content validity index (CVI) of .80 or higher were selected, and second-round preliminary questions were prepared based on expert opinions. The second-round preliminary questions extracted as a result of the content validity test consisted of a total of 85 questions, including 13 categories (70 items) about the content of neonatal nursing practice education, 10 items on methods, and 5 items on guidance. A 4-point Likert scale was used to rate the responses, ranging from 1 point for "absolutely unnecessary" to 4 points for "very necessary." A higher score indicates a higher demand for neonatal nursing practice education.

(3) Final round of item construction based on pilot surveys

In order to investigate the problems of the tool when it was actually used, a preliminary survey was conducted using the second-round preliminary questions among 40 seniors majoring in nursing. The time to complete the questionnaire was approximately 20 minutes, and 95% to 100% of the participants responded that the comprehension level, length, font size and style, and the use of a 4-point scale were appropriate. There were no revisions made to the second-round preliminary questions, and an 85-question tool was established, including 13 categories (70 items) on the content of neonatal nursing practice education, 10 items on methods, and 5 items on guidance. Each item had two categories: one for educational needs for observation and the other for educational needs for practice. Cronbach's α in this study was .99 for the observation category and .99 for the practice category.

4. Data Analysis

1) In-depth interviews

In-depth interview data were analyzed through the stages of preparation, organizing, and reporting according to the in-

ductive content analysis method [19]. The interview data recorded in the preparation stage were transcribed and read repeatedly to grasp the overall data and select an analysis unit. In the organizing stage, meaningful statements were derived and categorized among the analysis units. In the reporting stage, categories were presented.

2) Survey

Survey data were analyzed using SPSS Statistics version 25.0 (IBM Corp., Armonk, NY, USA). Participants' general characteristics and neonatal nursing practice education needs were analyzed with descriptive statistics such as frequency, percentage, mean, and standard deviation. The difference in practice education needs according to participants' general characteristics was analyzed by the t-test and ANOVA, followed by the Dunnett post-hoc test.

5. Ethical Considerations

For the ethical protection of the participants, the study was conducted after obtaining approval (CUIRB-2020-0022) from the institutional review board (IRB) of Daegu Catholic University. The purpose and methods of the study, anonymity and confidentiality of the collected data, the right to withdraw from the study, and disposal of the collected data if they withdrew from the study were explained to the prospective participants. The participants were informed that the collected data would not be used for any purpose other than the research and that the researchers would not use any data that the participants did not want to be disclosed. In-depth interviewees were also informed that all data would be anonymized to ensure confidentiality, the interviews would be conducted individually, the interviews would be voice-recorded, and that all the data would be discarded after the study. The participants read the research description thoroughly, decided to participate in the research voluntarily, and submitted written consent. The participants were given a small gift. Data collection and analysis were conducted in accordance with research ethics, and no participants requested to withdraw from the study.

RESULTS

1. Qualitative Study Results

1) Educational needs of nursing students

(1) Opportunity for nursing practice

The nursing students expected to do things that they could not experience in other departments during NICU practice, but in reality, all they did was to identify subjects through observation and electronic medical records. The reasons for not being able to provide direct care were that nurses did not allow them to touch the newborns and did not clearly tell them what care they could try to perform, there was a risk of rotavirus or COVID-19 transmission, and they were concerned about handling small and fragile newborns. The nursing students hoped to try out at least simple techniques themselves and receive clear instructions from nurses on what elements of nursing practice they could experience. The nursing students wanted to measure vital signs and weight and participate in bottle-feeding and bathing of newborns in clinical practice, and hoped they could safely operate the equipment commonly used in the NICU if it was not being used for newborns (Table 1).

> Because it was the NICU, I thought that I would be able to experience a lot of interesting and different things, but there was nothing a student can do, so I just studied. The nurses kept asking us to remain seated. (Student 1)
>
> I wish I could do a little bit more as a student. There was nothing I can do for NICU practice, so I hope they create an environment where I can do something. (Student 3)

(2) Nurses' guidance and explanation

The nursing students said that they needed an orientation so that they could quickly adapt to the field. At the start of the practice, they hoped that the head nurse would guide them on the environment and characteristics of the NICU, criteria for classifying newborns by area, major diseases, frequently used instruments and supplies, and topics to be studied. In addition, nursing students said that even if there were few activities that they could do on their own, they would learn a lot if the nurses explained what they were doing while nursing. The nursing students had difficulty understanding when they had to just observe neonatal intensive care without a nurse's explanation, and it was also difficult for them to explore and study on their own because they had no knowledge of nursing and medical equipment. The nursing students wanted explanations of the major diseases of newborns, test results, abnormal symptoms, and goals and methods of treatment and nursing (Table 1).

> I think the first orientation is important. Even if they don't have a lot of time due to their busy schedule, if they explain the environment to students who have a hard time in an unfamiliar environment, we can probably adapt quickly. (Student 5)
>
> I saw a nurse reporting on meconium of a newborn to a doctor even though it's normal for a baby to have meconium. So I wanted to hear the reason for that. It's just meconium, what made her report on it? I wish the nurse

Table 1. Educational Needs for Neonatal Intensive Care Practice in Nursing Students and Needs Recognized by Faculty and Nurses (*N*=16)

Educational needs in nursing students (n=6)		Needs recognized by faculty (n=5)		Needs recognized by nurses (n=5)	
Categories	Sub-categories	Categories	Sub-categories	Categories	Sub-categories
Opportunity for nursing practice	- Newborn care and equipment use - Prepare conditions for performance - Nurses' clear direction	Opportunity for nursing practice	- Newborn care	Opportunity for nursing practice	- Newborn care and equipment use - Trust in a student's capacity
Nurses' guidance and explanation	- Sufficient field orientation - Explanation of treatment and nursing - Explanation while nursing	Educator's attention and preparation	- Faculty as a facilitator - Head nurse as an educator - Staff nurse as a role model	Nurses' guidance and explanation	- Sufficient field orientation - Explanation of treatment and nursing - Answers to students' questions
Environment where questions can be asked	- Student-friendly nurses	Education in school	- Pre-learning: Needs for method and subject - Nursing practice in school: Situations that occur frequently in the NICU - Conference: Improving problem-solving skills through the nursing process	Mutually active attitude	- Interest in students - Active attitude toward student education - Student's active practice attitude
Education in school	- Precedence of theoretical knowledge - Pre-learning: Needs for method - Nursing practice in school: Simulation of nursing that cannot be done in the NICU	Recruitment and identification of educational practice institution	- Hospital recruitment to experience both normal newborns and high-risk newborns - Establish a system that enables faculty's field guidance	Education in school	- Pre-learning: Needs for subject - Nursing practice in school: Nursing skills performed a lot in NICU

NICU, neonatal intensive care unit.

could explain what abnormal symptoms the baby had. (Student 6)

(3) Environment where questions can be asked

The nursing students wanted an atmosphere where they could ask questions, but they said it was difficult to ask questions if the nurses seemed busy, did not give even a hasty glance to students, or responded with negative, discouraging expressions when asked. The nursing students said that it would be better if the nurses were friendly and talked to them first (Table 1).

I couldn't speak at all. Even when I asked, "Do you want me to do this?" she frowned. (Student 6)

If the nurses treated us a little more gently and kindly, I think we would be able to ask questions comfortably. (Student 4)

(4) Education in school

The nursing students wanted to learn theoretical knowledge before practicing neonatal intensive care, engage in pre-learning immediately before practice training, and have supplementary simulation training for aspects of clinical practice that they could not experience in the field. The pre-learning methods they gave as examples included talking about what they studied with professors, previewing the environment and equipment in the university training rooms, and handling newborn models. The nursing students wanted to have simulations for newborn assessments, postnatal nursing, respiratory nursing, and medication nursing, which they could not do directly in the field, as they would be able to practice making judgments and determining interventions in a realistic clinical setting during simulations. They also pointed out the importance of the evaluator's feedback and debriefing and hoped that the number of evaluation points during

their in-school practice would be increased (Table 1).

> However, if I know a little more before going to the field, I can think about why nurses are doing this and what effects it will have. If I gain knowledge beforehand and actually do what I practiced during in-school practice, I will realize "Oh, this is what I studied". (Student 5)
>
> I think simulations educate you to be able to deal with real situations. As we don't get to learn what we can do in such a situation there (the actual NICU field), it was nice to be able to learn about such situations using that baby (simulator). (Student 4)

2) Educational needs recognized by clinical practice faculty

(1) Opportunity for nursing practice

Clinical practice faculty members responded that nursing students need to have direct nursing opportunities during neonatal nursing practice. Clinical practice faculty members reported that it was necessary for nursing students to perform basic techniques for newborn care by themselves, such as vital sign measurements, status monitoring, feeding, and diaper changes (Table 1).

> Clinical practice definitely increases students' interest (in newborn care) as they can see in real clinical settings what they learned through textbooks in school. But they can only observe, and they don't have the opportunity to practice by themselves. As such, it's difficult to expect substantial educational effects. (Faculty 3)

(2) Educator's attention and preparation

Clinical practice faculty members said that in neonatal nursing practice, an interest toward nursing students and a positive and active attitude as educators are needed. They said that the role of the faculty members in charge of facilitating practice education for nursing students was important. Furthermore, they suggested that head nurses should lead clinical practice as educators based on their understating of the goals and purposes of clinical practice and that nurses should serve as role models with the mindset of instructors (Table 1).

> Faculty members should participate in training for up-to-date clinical nursing during breaks between instructional periods because they can develop an appropriate curriculum and play the role of facilitators when they have an understanding of the field. I think that head nurses and nurses should focus on students with the utmost attention. In particular, I hope that head nurses will understand the goals of education and be fully aware of the evaluation criteria. (Faculty 1)

(3) Education in school

Clinical practice faculty members said that pre-learning and nursing practice in school were necessary. They said that as part of pre-learning, it was necessary to review the content studied with the students and utilize newborn models. Clinical practice faculty members said that newborns' characteristics and major diseases were appropriate subjects for pre-learning. In addition, they said that it is important to directly take care of newborns that students can be practice. Regarding in-school practice education, practicing nursing care for problems that occur frequently in clinical practice was considered necessary by the clinical practice faculty members. In conferences, the clinical practice faculty members said that it was important to improve students' problem-solving ability through the nursing process and that it was effective to use problem-based learning (PBL) (Table 1).

> I think that students should be able to improve their problem-solving ability for real clinical cases through conferences. A good method can be talking and giving feedback to other students on their own case studies. PBL was effective for analyzing patient data and diagnosing problems. (Faculty 2)

(4) Recruitment and identification of educational practice institution

The category of the necessity of securing educational practice settings was derived only from the clinical practice faculty members. The clinical practice faculty members said that it was an important part of neonatal nursing practice education to secure medical settings where nursing students can experience nursing for high-risk newborns as training sites (Table 1).

> In fact, finding an institution for educational practice is the most difficult task, especially the NICU. I would like to show (students) everything… but it all depends on whether we can find an institution where students can practice neonatal nursing. (Faculty 3)

3) Educational needs recognized by nurses

(1) Opportunity for nursing practice

Nurses pointed out the need for direct nursing experience, but limited opportunities were allowed to nursing students. In addition, nurses responded that opportunities to conduct direct nursing can be provided when they are able to trust the competency of nursing students. Nurses said that it is necessary for nursing students to carry out nursing tasks that are commonly performed in neonatal care and that they should

use equipment and devices by themselves (Table 1).

> There are many things that we don't let students do as we don't trust them. It seems that touching newborns is the most important thing, so I think it's okay to allow students to practice bathing, feeding, and changing diapers according to a routine. (Nurse 4)

(2) Nurses' guidance and explanation

Nurses reported that although they were aware of the need to provide nursing students with guidance in the field and explanations, they chose to explain only when asked because they did not know what to explain to nursing students (Table 1).

> When I ask students if they have any questions, they say they don't think so. As they do not clearly express themselves, it is difficult for us to know exactly what to teach. If they ask, "what is this?" then I could explain it in detail. (Nurse 1)

(3) Mutually active attitude

Nurses said that in neonatal nursing practice, an interest toward nursing students and a positive and active attitude as educators are needed. In addition, the nurses underscored the importance of active participation of nursing students (Table 1).

> I try to help industrious students. But, to be honest, I don't feel like taking time out of my busy schedule to help students who show no interest. If students express their interest, nurses will go out of our way to help them. I think it depends on the style of the student. (Nurse 2)

(4) Education in school

Nurses said that pre-learning and nursing practice in school were necessary. Nurses said that newborns' characteristics and major diseases were appropriate subjects for pre-learning. In addition, nurses said monitoring the status of newborns and measuring vital signs, which are mostly performed in clinical practice, are important. Regarding in-school practice education, practicing nursing techniques such as bottle-feeding, bathing, and monitoring were considered necessary by the nurses (Table 1).

> This monitor here is for measuring patient's vital signs. So if students could catch values out of the normal range, it would be really useful. As it is a basic component of nursing (vital signs), I guess it would be helpful for them to learn at least how to read the monitor and the normal ranges. (Nurse 5)

2. Quantitative Study Results

1) Educational needs by general characteristics

The mean age of nursing students was 23.2 years (SD=4.8), 79.3% (n=138) were female, and 69.5% (n=121) were juniors. Students whose academic performance was in the 30-70th percentile were 64.7% (n=112) of the sample, 69.5% (n=121) answered they were healthy, and 61.5% (n=107) answered they were satisfied with their school life. Students who answered that they were satisfied with the lecture on neonatal nursing comprised 73.6% (n=128) of the sample, and 50.6% (n=88) of the students answered that they were satisfied with their practice of neonatal intensive care.

The nursing students' needs for observation with regard to the content of neonatal intensive care practice differed according to their health status and school life satisfaction; the reported need was higher among students who answered that they were healthy than among those who answered that their health was moderate ($F=5.84$, $p=.004$), and among students who answered that they were satisfied with their school life than among those who answered that they had moderate satisfaction ($F=4.60$, $p=.011$). In addition, there were significant differences in needs for practice with regard to the content of neonatal intensive care practice among nursing students according to gender and perception of health status: it was higher in male students than in female students ($t=3.86$, $p<.001$) and in students who answered that they were healthy than in those who answered that they had a moderate health status ($F=3.60$, $p=.029$) (Table 2).

2) Educational needs according to educational content

The average score for the need for observation with regard to the content of neonatal intensive care practice was 3.43 points. The category with the highest score was "communication between healthcare professionals" (3.51 points), followed by "management of medical devices and equipment" (3.50 points) and "others" (3.49 points). The item with the highest score was "hand-off communication" (3.56 points), followed by "uses of incubator," "assessments using monitors," "reporting to a physician," and "preparing and administering intravenous (IV) medications." The categories with the lowest needs for observation were "newborn diagnostic tests" (3.33 points), "developmentally supportive care" (3.34 points), and "care for urine and bowel movements" (3.36 points) (Table 3).

The average score for nursing students' needs for practice with regard to neonatal intensive care practice was 3.02 points. The category with the highest score was "management of medical devices and equipment" with 3.26 points, followed by "newborn assessments" with 3.24 points and "newborn skin care" with 3.09 points. The item with the highest score was

Table 2. Educational Needs According to the General Characteristics of the Participants (*N*=174)

Characteristics	Categories	n (%)	Educational needs for observation		Educational needs for practice	
			M±SD	t or F (*p*)	M±SD	t or F (*p*)
Gender	Male	36 (20.7)	3.48±0.41	0.82	3.26±0.39	3.86
	Female	138 (79.3)	3.42±0.41	(.413)	2.96±0.51	(<.001)
Grade	Junior (3rd)	121 (69.5)	3.43±0.42	0.31	3.03±0.50	0.37
	Senior (4th)	53 (30.5)	3.45±0.39	(.758)	3.00±0.50	(.710)
Academic performance* (n=173)	Within the top 30th percentile	52 (30.1)	3.51±0.49	1.33	3.09±0.43	0.90
	30-70th percentile	112 (64.7)	3.40±0.42	(.268)	2.99±0.51	(.408)
	Within the bottom 30th percentile	9 (5.2)	3.40±0.39		2.91±0.73	
Health status	Healthy[a]	121 (69.5)	3.50±0.41	5.84	3.09±0.48	3.60
	Moderate[b]	41 (23.6)	3.27±0.37	(.004)	2.88±0.44	(.029)
	Unhealthy[c]	12 (6.9)	3.31±0.41	a>b†	2.85±0.71	a>b†
Satisfaction with school life	Satisfied[a]	107 (61.5)	3.51±0.40	4.60	3.06±0.48	0.94
	Moderate[b]	62 (35.6)	3.31±0.40	(.011)	2.95±0.52	(.392)
	Unsatisfied[c]	5 (2.9)	3.34±0.47	a>b†	3.07±0.74	
Satisfaction with lectures on neonatal nursing	Satisfied	128 (73.6)	3.47±0.40	1.77	3.05±0.47	1.06
	Moderate	37 (21.3)	3.34±0.41	(.174)	2.92±0.56	(.348)
	Unsatisfied	9 (5.1)	3.29±0.48		2.95±0.57	
Satisfaction with practice of neonatal intensive care	Satisfied	88 (50.6)	3.44±0.41	0.61	3.05±0.47	0.23
	Moderate	77 (44.3)	3.44±0.41	(.542)	3.00±0.54	(.795)
	Unsatisfied	9 (5.1)	3.28±0.38		2.97±0.43	

*Missing data were not included; † Post hoc test (Dunnett), $p < .050$.

"vital signs" with a score of 3.52 points, followed by "assessments using monitors," "bottle feeding and burping," "uses of incubator," and "monitor alarm settings." The categories with the lowest practice needs were "newborn diagnostic tests" with 2.78 points, "catheter and insertion site management" with 2.84 points, and "care for urine and bowel movements" with 2.94 points (Table 3).

3) Educational needs according to educational method

As for the needs of nursing students with regard to the method of neonatal intensive care practice, "orientation from the head nurse" had the highest score of 3.60, followed by "field training in the NICU" with 3.51 points and "guidance from nurses" with 3.48 points. The item with the lowest educational need was "homework assignments" with 2.99 points, followed by "conferences" with 3.19 points and "pre-learning" with 3.30 points. Among the methods of nursing practice in school, the largest number of students preferred simulations (41.6%, n=72) and the least preferred method was virtual simulations (4.7%, n=8) (Table 4).

4) Educational needs according to educational guidance

The largest number of students answered that nurses are the leaders who play the most important role in neonatal intensive care practice (61.5%, n=104), followed by clinical practice faculty members (21.9%, n=37), head nurses (16.0%, n=27), and the expert panel (0.6%, n=1). Regarding the role of the clinical practice faculty members, the need was highest for "guidance for pre-learning", followed by "guidance on the practice education schedule" and "guidance for conferences". Regarding the role of the head nurses, the need was the highest for "guidance on learning topics during clinical practice", followed by "education in the NICU" and "guidance on the clinical practice schedule and environment". The highest need related to the role of nurses was found for "directing and supervising nursing performed by students", followed by "professional nursing", and "briefing on the baby". Regarding the role of the expert panel, the highest need was reported for "feedback after evaluation", followed by "education on nursing practice" (Table 5).

DISCUSSION

As a result of the in-depth interviews in this study, nursing students wanted opportunities for direct nursing practice, guidance and explanations from nurses, an environment where questions can be asked, and education in school during the neonatal intensive care practice. The needs perceived by

Table 3. Educational Needs of the Participants According to Educational Content (*N*=174)

Categories/ items	Observation		Practice	
	M±SD	Order	M±SD	Order
Newborn assessments	3.48±0.43	4	3.24±0.46	2
1. Vital signs	3.46±0.60	31	3.52±0.54	1
2. APGAR score	3.49±0.54	15	3.17±0.64	15
3. New Ballard scale	3.44±0.51	37	3.11±0.62	25
4. Primitive reflexes	3.48±0.52	20	3.22±0.61	13
5. Physical assessment	3.50±0.52	12	3.24±0.59	9
6. Assessments using monitors (ECG, ABP, SpO_2, $ETCO_2$, etc.)	3.55±0.51	3	3.36±0.58	2
7. Pain assessment	3.44±0.52	35	3.11±0.62	24
8. Neonatal behavioral assessment	3.45±0.51	33	3.16±0.60	20
Newborn diagnostic tests	3.33±0.46	13	2.78±0.63	13
9. Neonatal screening test	3.39±0.55	53	2.93±0.67	48
10. Blood tests (CBC, BC, etc.)	3.38±0.52	56	2.78±0.75	63
11. Arterial blood gas analysis	3.41±0.52	49	2.75±0.78	66
12. Bacterial culture test (blood, urine, stool, sputum, etc.)	3.33±0.53	64	2.72±0.72	68
13. General radiography (chest, abdomen, etc.)	3.27±0.56	68	2.75±0.72	67
14. Echocardiography	3.30±0.56	65	2.76±0.70	65
15. Sonography (brain, abdominal)	3.22±0.58	70	2.70±0.70	70
16. Newborn hearing screening	3.29±0.55	66	2.86±0.69	55
17. Screening for retinopathy of prematurity	3.35±0.54	60	2.81±0.72	59
Management of respiratory distress in newborn	3.46±0.45	5	3.00±0.61	7
18. Non-invasive airway management	3.48±0.53	18	3.11±0.67	27
19. Advanced airway management	3.49±0.50	14	2.76±0.77	64
20. Bag valve mask ventilation	3.43±0.54	40	2.96±0.74	41
21. Oropharyngeal and nasopharyngeal suctioning	3.47±0.55	29	2.95±0.75	45
22. Tracheal suctioning	3.48±0.52	21	2.94±0.75	47
23. Chest percussion and vibration	3.44±0.53	38	3.13±0.63	23
24. Postural drainage	3.43±0.53	46	3.11±0.66	26
Care for urine and bowel movements	3.36±0.49	11	2.94±0.59	11
25. Exchange diapers	3.26±0.55	69	3.02±0.64	35
26. Nelaton catheter placement and care	3.41±0.54	47	2.89±0.74	52
27. Foley catheter placement and care	3.43±0.55	45	2.97±0.72	40
28. Enema	3.36±0.57	58	2.87±0.74	54
Medication administration	3.44±0.49	6	2.97±0.64	9
29. Preparing and administering oral medications	3.34±0.58	62	3.03±0.68	34
30. Preparing and administering IV medications	3.53±0.52	5	2.99±0.82	38
31. Preparing and administering IM medications	3.51±0.54	10	2.95±0.81	44
32. Preparing and administering inhaled medications	3.47±0.53	23	3.08±0.71	29
33. Preparing and administering rectal medications	3.39±0.60	55	2.80±0.75	60
34. Preparing and administering endotracheal medications	3.43±0.54	42	2.85±0.77	56
35. Preparing and administering topical medications (eye, ear, skin, etc.)	3.47±0.55	24	3.10±0.71	28
Management of nutrition	3.43±0.48	8	3.08±0.56	4
36. Bottle feeding and burping	3.44±0.57	36	3.33±0.63	3
37. Gavage feeding	3.47±0.53	22	3.07±0.71	30
38. Parenteral nutrition	3.45±0.53	34	2.92±0.70	50
39. Preparation and storage of breast milk or infant formula	3.34±0.57	61	3.00±0.68	37

ABP, arterial blood pressure; BC, blood chemistry; CBC, complete blood count; ECG, electrocardiogram; $ETCO_2$, end-tidal carbon dioxide; IM, intramuscular; IV, intravenous; NPPV, noninvasive positive pressure ventilation; PCVC, percutaneous central venous catheters; PPV, positive pressure ventilation; SpO_2, pulse oxygen saturation.

Table 3. Educational Needs of the Participants According to Educational Content (Continued) (*N*=174)

Categories/ items	Observation		Practice	
	M±SD	Order	M±SD	Order
Newborn skin care	3.42±0.50	9	3.09±0.64	3
40. Bathing	3.33±0.59	63	3.01±0.73	36
41. Umbilical cord care	3.47±0.52	26	3.14±0.69	22
42. Care for diaper rash	3.43±0.56	44	3.17±0.71	17
43. Dressing	3.45±0.52	32	3.05±0.72	32
Catheter and insertion site management	3.43±0.51	7	2.84±0.68	12
44. Management of umbilical catheters	3.43±0.53	41	2.83±0.75	58
45. Management of central catheters	3.43±0.55	39	2.80±0.74	62
46. Management of PCVC	3.43±0.54	43	2.80±0.73	61
47. Changing infusion sets	3.47±0.52	28	3.07±0.72	31
48. Management of ventriculoperitoneal shunt	3.39±0.58	52	2.71±0.81	69
Developmentally supportive care	3.34±0.55	12	3.07±0.59	5
49. Kangaroo care	3.28±0.65	67	2.88±0.75	53
50. Developmentally supportive positioning	3.36±0.58	59	3.17±0.62	19
51. Developmentally supportive environment	3.36±0.55	57	3.17±0.62	18
Parents education	3.40±0.57	10	2.95±0.72	10
52. Education for admission	3.40±0.60	51	2.98±0.76	39
53. Education for discharge	3.39±0.60	54	2.92±0.76	49
54. Education for breastfeeding	3.41±0.59	48	2.95±0.74	43
The others	3.49±0.48	3	3.05±0.64	6
55. Immediate care of the newborn	3.52±0.51	9	3.03±0.75	33
56. Care of newborn jaundice (phototherapy)	3.53±0.51	6	3.16±0.73	21
57. Vaccination	3.48±0.55	19	2.96±0.75	42
58. Blood transfusion	3.47±0.53	30	2.92±0.79	51
59. Intake and output monitoring	3.47±0.55	27	3.17±0.68	16
Management of medical devices and equipment	3.50±0.47	2	3.26±0.59	1
60. Monitor alarm settings	3.48±0.52	17	3.29±0.66	5
61. Uses of incubator	3.55±0.52	2	3.32±0.68	4
62. Uses of radiant warmer	3.52±0.50	8	3.29±0.68	6
63. Uses of infusion pump and syringe pump	3.52±0.53	7	3.26±0.69	7
64. Uses of infusion warmer	3.47±0.52	25	3.22±0.69	11
65. Uses of emergency cart	3.48±0.56	16	3.24±0.67	10
66. Uses of PPV equipment	3.50±0.54	13	3.25±0.66	8
67. Uses of NPPV equipment	3.51±0.52	11	3.22±0.68	12
Communication between healthcare professionals	3.51±0.52	1	2.99±0.72	8
68. Hand-off communication	3.56±0.51	1	3.19±0.74	14
69. Reporting to a physician	3.55±0.54	4	2.95±0.82	46
70. Treatment consultations	3.41±0.64	50	2.84±0.79	57
Total	3.43±0.41		3.02±0.50	

ABP, arterial blood pressure; BC, blood chemistry; CBC, complete blood count; ECG, electrocardiogram; ETCO2, end-tidal carbon dioxide; IM, intramuscular; IV, intravenous; NPPV, noninvasive positive pressure ventilation; PCVC, percutaneous central venous catheters; PPV, positive pressure ventilation; SpO2, pulse oxygen saturation.

clinical practice faculty members and nurses in neonatal intensive care practice fell into similar categories. However, while nursing students wanted the nurses to give them explanations first, nurses preferred to answer questions when asked by nursing students. The nursing students had a passive attitude, hoping that the nurses would give them explanations first because it was difficult for the students to ask questions to busy nurses, and the nurses were also passive by

Table 4. Educational Needs of the Participants According to Educational Methods (*N*=174)

Categories/items	M±SD or n (%)
Orientation from faculty	3.40±0.57
Orientation from the head nurse	3.60±0.50
Field training in the NICU	3.51±0.55
Guidance from faculty	3.47±0.57
Guidance from nurses	3.48±0.60
Pre-learning	3.30±0.58
Conferences	3.19±0.59
Homework assignments	2.99±0.70
Nursing practice in school	3.32±0.58
Methods* (n=173)	
Simulation	72 (41.6)
OSCE	48 (27.7)
CPX	45 (26.0)
Virtual simulation	8 (4.7)

*Missing data were not included; CPX, clinical performance examination; NICU, neonatal intensive care unit; OSCE, objective structured clinical examination.

answering only questions when asked by the students because they did not know what to explain.

This attitude of nursing students is similar to that reported in a previous study [10], where nursing students said that because patient nursing was a higher priority for nurses than practice guidance, they stepped back in order not to interfere with nurses' work. In addition, the passive attitude of nurses in nursing education observed in this study is consistent with that reported in a previous study [20] where most clinical nurses did not know what to do as they were asked to guide students without any experience in education. Furthermore, due to the increased nursing workload during the recent COVID-19 pandemic, it has become more difficult for nurses to make time for providing appropriate guidance and supervision to nursing students [8]. Therefore, prior instruction and continuous education and support should be given to nurses so that they can fully take on the role of guiding nursing students for clinical practice [21].

As a result of the survey in this study, the needs of nursing

Table 5. Educational Needs of the Participants According to Educational Guidance (*N*=174)

Variables	Categories	n (%)
The most important educator*	Faculty	37 (21.9)
	Head nurse	27 (16.0)
	Nurse	104 (61.5)
	Expert panel †	1 (0.6)
Role of faculty ‡	Guidance for pre-learning	92 (52.9)
	Guidance on the practice education schedule	73 (42.0)
	Guidance for conferences	71 (40.8)
	Field guidance for the NICU	59 (33.9)
	Q&A	52 (29.9)
	Guidance and evaluation for nursing practice in school	46 (26.4)
	Guidance for report	45 (25.9)
	Counseling on practice education	39 (22.4)
Role from the head nurse ‡	Guidance on learning topics during clinical practice	113 (64.9)
	Education in the NICU	108 (62.1)
	Guidance on the clinical practice schedule and environment	79 (45.4)
	Assigning students to nurses	67 (38.5)
	Professional nursing	57 (32.8)
	Guidance for report	46 (26.4)
	Q&A	44 (25.3)
	Counseling on clinical practice	19 (10.9)
Role of nurse ‡	Directing and supervising nursing performed by students	106 (60.9)
	Professional nursing	103 (59.2)
	Briefing on the baby	102 (58.6)
	Explanation of neonates	95 (54.6)
	Q&A	59 (33.9)
	Explanation of role and qualifications of neonatal nurses	35 (20.1)
	Counseling on clinical practice	11 (6.3)
Role of expert panel † ‡	Feedback after evaluation	124 (71.7)
	Education on nursing practice	95 (54.9)
	Evaluation	40 (23.1)
	Q&A	36 (20.8)

*Missing data were not included; † Expert evaluating nursing practice in school; ‡ Multiple-response item (percent of respondents); NICU, neonatal intensive care unit; Q&A, question and answer.

students with regard to the content of neonatal intensive care practice, which were rated using a 4-point Likert scale, were high: the mean scores for the need for neonatal nursing observation and practice were 3.43 points and 3.02 points, respectively. The nursing students had higher needs for observation than for practice. The categories with higher observational needs were communication between healthcare professionals and management of medical devices and equipment related to neonatal intensive care, and the items with higher needs were nurse-to-nurse hand-off, incubator use, and assessments using monitors.

Management of neonatal nursing-related devices and equipment was also high on the list of needs for practice among nursing students. In a previous study [10], nursing students were bewildered when they saw specialized medical equipment in the NICU and wanted to receive prior education on the medical equipment used for newborns. In the in-depth interviews in this study, the nursing students expressed their interest in operating medical devices that are often used in the NICU, indicating that the management of devices and equipment must be included in neonatal intensive care practice. The item that was at the top of the list of needs for observation among nursing students was hand-off between nurses, and in a previous study involving nursing students [22], most of the participants answered that hand-off education was important for the safety of children, but 60% of the participants had no experience of receiving related education. In the current study, hand-off was higher than the average on the list of needs for both observation and practice; thus, it is necessary to implement neonatal nursing hand-off education using various methods such as simulation and role-playing [13].

In this study, the categories with high needs for neonatal nursing practice were the management of neonatal nursing-related devices and equipment and newborn assessments, and the items with high practice needs were measurement of vital signs, assessments using monitors, and bottle feeding and burping. This is similar to the result reported in a previous study [9] where senior students who completed child nursing practice reported that newborn assessments such as Apgar and physical assessment were difficult subjects and thus should be given more emphasis in training. After birth, newborns undergo dramatic physiological changes such as the transition from gas exchange through the placenta to pulmonary respiration and occlusion of the fetal circulatory system, so careful observation is necessary [1]. Nurses should be able to quickly detect health problems in newborns, and for this purpose, nursing students should learn how to assess newborns accurately through practice education in nursing college. If nursing students do not experience neonatal nursing in the clinical field during training or if they only observe and do not perform nursing themselves, they may continue to experience difficulties at work when they become nurses [9]. Therefore, it is necessary to include newborn assessments in the content of neonatal nursing practice training, for which the nursing students expressed high practice-related needs, in order to promote effective education.

The nursing students' needs for observation and practice in neonatal intensive care practice differed according to general characteristics such as gender, health status, and school life satisfaction. Educational needs were higher in nursing students who were healthy and satisfied with school life than those with average health and satisfaction. Although this finding should be confirmed by further studies, students with good health and positive perceptions of school life are expected to have high interest in and needs for education, which is their responsibility as students. Male students had higher needs for neonatal nursing practice than did female students, suggesting that male students wanted to be more actively involved in providing nursing directly. In a qualitative study using a focus group [23], male students actively tried to participate in training to create a positive environment for themselves in a clinical practice environment where most nursing students and nurses are female, which supports the results of the current study.

In this study, orientation from the head nurse was the highest among the list of nursing students' needs related to the method of neonatal intensive care practice, followed by field training in the NICU and guidance from the nurses. In addition, the nursing students said that nurses were the leaders who play the most important role in neonatal intensive care practice, and they wanted to receive guidance, directions, and supervision from the head nurses and nurses during practice. The nursing students had many expectations and hopes for head nurses and nurses, rather than clinical practice faculty members, as they are influenced by these nurses, with whom they spend a considerable amount of time. Head nurses and nurses in the field play an important role in practice education by allowing nursing students to directly experience job performance ability, interpersonal relationships, and communication [24]. As such, the role of nurses is crucial in neonatal intensive care practice; thus, it is necessary to provide specific and practical guidance and guidelines to nurses so that they can effectively teach and lead nursing students during practice.

In this study, when the nursing students' needs related to the method of practice education for neonatal intensive care practice was assessed using a 4-point Likert scale, the need for field training was high at 3.51 points, but the need for practice in school was also high at 3.32 points, and the largest number of students wanted simulations as a method for practice in school. In the in-depth interviews, they said that they wanted

to have practice in school for nursing care performed immediately after birth or respiratory support nursing, which they could not experience directly in the field. In recent years, the provision of direct nursing by nursing students has been limited due to legal and ethical issues such as work overload of nurses in clinical settings and the protection of vulnerable subjects [25], and new methods of nursing education are being introduced since the outbreak of new infectious diseases such as the COVID-19 pandemic [26].

The nursing students' needs for practice in school reflect this situation. The methods of practice in school include simulations, clinical performance examinations (CPXs), objective structured clinical examinations (OSCEs), and online training. Simulation education on jaundice and pneumonia in newborns was effective in improving class satisfaction and clinical practice performance among nursing students [27], and nurses in the NICU also preferred the simulation education method for nursing of high-risk newborns and had high needs for education on nursing interventions immediately after birth [28]. In addition, the effects of computer-based neonatal nursing simulation education [29] and mobile-based high-risk neonatal education programs [30] have also been reported. However, in the current study, only 4.7% of students preferred virtual simulations. Knowledge and skills cannot be acquired by using digital technology alone; thus, methods for learners to actively participate in learning should be considered, and appropriate clinical practice equipment should be used [29]. The nursing students in this study preferred simulation practice to CPXs or OSCEs to discover and solve nursing problems as nurses do in similar clinical situations, and they responded that evaluators' feedback was important. Therefore, in order for nursing students to achieve the goals of clinical practice education, it is necessary to construct a clinical-based neonatal intensive care scenario, conduct simulation training that reflects real-world circumstances situation, and provide appropriate feedback through debriefing.

It is advised to promote the active participation of nursing students and to achieve the learning objectives by developing practice education programs reflecting nursing students' needs for neonatal intensive care practice education in terms of the content, methods, and guidance identified in this study.

CONCLUSION

The in-depth interviews and survey on the needs for neonatal intensive care practice education among nursing students demonstrated that nursing students' education needs were high. The categories with high needs for observation in neonatal intensive care practice were communication between healthcare professionals and management of medical devices and equipment related to neonatal intensive care, and the categories with high needs for practice were management of devices and equipment related to neonatal intensive care and newborn assessments. The nursing students' needs with regard to the content of education training for neonatal intensive care differed according to general characteristics such as gender, health status, and satisfaction with school life. The nursing students' needs with regard to the method of neonatal intensive care practice education were highest for orientation from the head nurses. Nurses were considered as the leaders who play the most important role in guidance on neonatal nursing practice education, and the nursing students hoped to receive academic guidance, instructions, and supervision from head nurses and nurses during practice.

Nursing students' needs with regard to the content, methods, and guidance for neonatal nursing practice should be reflected when developing neonatal intensive care practice education programs in order to achieve the goals of neonatal nursing practice.

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Conflict of interest

No existing or potential conflict of interest relevant to this article was reported.

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Data availability

Please contact the corresponding author for data availability.

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