Participation Experience in Simulation Training Using Holographic Standardized Patients

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Abstract

To develop simulation practice education content and improve the quality of practice education by identifying nursing students' perception types regarding simulation practice education experiences using Holographic Standardized Patients (HSP) and analyzing and describing the characteristics of each type of nursing students' perception. This study is a qualitative study that applied phenomenological methods to explore the essential meaning of nursing students' perceptions of nursing students' simulation training using HSP. It was conducted after obtaining approval from the institutional ethics committee, and the data collection period was from October 24, 2022 to September 31, 2023. The interview was conducted as an in-depth interview. The participants were third-year nursing students at a university who received training implemented through simulation using HSP. Among the 14 students who voluntarily agreed to participate in the study after receiving an explanation of the contents of the study, they were the dropouts. The subjects were 10 people excluding. As a result of this study, 81 meaning compositions, 20 topic collections, and 4 categories were derived: 'interesting classes', 'expectations that overcome obstacles', 'models for future classes', and 'strengthening practical skills'. Korean nursing students have already become accustomed to digital culture for a long time, and it has been confirmed that this form of converged technology-based simulation education no longer poses a technical problem to students. If various simulation-based education is developed in the future, it is believed that it will lead to integrated development of nursing education and simulation education beyond the limited clinical practice environment.

Keyword: simulation training, patient simulation, virtual reality, nursing students, qualitative research

1. Necessity of Research

Nursing education is a practice-oriented discipline that applies nursing knowledge to the field (Sunsin 2016), which values the practicum, and clinical training is conducted to perform nursing tasks in hospital settings for this purpose. However, the increase in the number of nursing schools and nursing students has led to a shortage of wards or clinics to conduct clinical training, and nursing students are performing clinical training with a focus on observations due to the emphasis on patient rights and ethical considerations. This is why simulation training is applied as a supplementary measure by creating a virtual clinical environment for learning (Jeon 2019). Simulation training allows nursing students to actually provide nursing care to virtual patients, but it has limitations such as high costs for expensive equipment and trained technicians and instructors to create a training environment (Sherwood & Francis 2018; Kim at al., 2019). Thus, to increase economic utility and educational effectiveness in nursing education, it is necessary, at this point, to adopt simulation training using VR technology without physical constraints.

Recently, due to the Fourth Industrial Revolution, various technologies such as Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) have recently been developed, and research has been conducted on ways to apply these technologies to real life as well as to various fields. Among them, Extended Reality (XR) is an umbrella term that encompasses VR, AR, and MR (Bak et al., 2022), and it provides experiences similar to those of the real world through interaction using the five senses such as sight and hearing, by applying immersive technology to digital content (Kim 2022).

XR technology has grown through the commercialization of ultra-fast 5G networks, the emergence of digital twin technology that enables prediction and optimized operation of the real world, and the advancement and diffusion of head-mounted display (HMD) devices (Lee 2020). By fully reproducing the physical system in a virtual digital world in convergence with digital twin technology, XR technology effectively manages a system's operational risks and stability and provides benefits in terms of high efficiency and low costs (Nam 2020). Moreover, XR technology maximizes immersion, eliminates real space constraints, and connects and combines virtuality and reality by using HMD devices for virtuality and reality to coexist and interact (Bak et al., 2022; Shim & Lee 2022; Pimentel 2022). Accordingly, XR technology is used in industry for multilateral remote collaboration, for field workers to perform process work fit for real-life situations, and for maintenance and training (Lee 2020). Many studies are also being conducted concerning educational and media content development (Park et al., 2022).

Cases of educational content development using XR technology include collaborative learning that attaches importance to interaction (Suh et al., 2022), learning for training to deal with unexpected incidents in industrial settings (Lee et al., 2022), learning for military and aviation training (Bak et al., 2023), learning for practical safety training (Choi & Kwon 2022), and learning for virtual simulations, virtual human anatomy, and surgical training in medical education (Arch Virtual 2019). XR technology shows high applicability in collaborative learning and practice-based learning, in which the benefits of immersion and interaction are important.

By adopting VR technology in simulation training, various virtual clinical environments can be provided without time and space constraints, and learners can feel the sense of presence and immersion of actually existing in the virtual space as they interact within the program and easily engage in repetition learning through real-time feedback (Jenson & Forsyth 2012; Kilmon 2010). Currently, VR technology has been used in developing programs in nursing education related to fundamental nursing skills such as administration of medicine, catheterization, intravenous injection and management, and postoperative or post-procedure nursing (Dubovi et al., 2017; Park 2020; Vidal 2013; Farra 2013), as well as in developing disaster nursing and poverty experience programs (Menzel et al., 2014; Chu & Hwang 2017) or mobile applications for fundamental nursing skills (Seo & Kang 2020). An example of creation of an XR learning environment is the "MUVE (Multi-User Virtual Environments) simulation"—a training program based on a U.S. company's VR platform "Second Life" and the video game development engine "Unity" (Kyunghee University). XR-based education software developed by other companies for nursing education is also being applied (Kim et al., 2019; Ahn & Lee 2021); in particular, HoloPatient is a program using MR-based holographic standardized patients (HSP) in which nursing educators or learners can put on Microsoft HoloLens to overlay digitally created HSP onto the real-life environment. A digital patient is utilized through a virtual HSP, so that students can actually observe the patient's state and communicate with them using visible visual clues and data, which can increase immersion and learning effects (Hamilton-Basich 2020).

In previous studies on the effect of educational programs using XR technology, learners showed positive responses to immersion, social presence, satisfaction with activity, and help with learning (Nam 2020; Pimentel 2022; Lee & Kang), and in a perception survey about applying XR technology to education, pre-service teachers showed positive responses to the usefulness and ease of use of XR as well as interest in learning (Choi et al., 2022). Research on nursing education programs includes studies on the effects of education using VR technology (Kim et al., 2019) and the instructors' interest in and opinions on applying XR technology to fundamental nursing skills education (Hwang et al., 2023). Nevertheless, quantitative research on the learning effects of using XR technology that creates virtual patients in simulation training or research on learner experience is insufficient. Therefore, this study applies a phenomenological research method to nursing students participating in simulation training using HSP and identifies their perceptions toward education. On this basis, it identifies the essence of their experiences to provide basic data for developing and conducting effective simulation training programs based on XR technology.

2. Research Objective

This study aims to examine the perceptions of nursing students toward simulation training experience using HSP, and the specific goals are as follows.

First, this study identifies the types of perceptions nursing students have toward simulation training using HSP.

Second, this study analyzes and describes the characteristics of each type of perception that nursing students have toward simulation training using HSP.

3. Research Method

3.1 Research Design

This qualitative study applied a phenomenological method to explore the fundamental meaning of perceptions of nursing students toward simulation training using HSP. The research question is "How is the experience of nursing students' simulation training using HSP?"

3.2 Data Collection and Ethical Considerations

This study was conducted after being approved by the Institutional Review Board (IRB) (1041493-A-2022-011), and data were collected from October 24, 2022 to September 31, 2023. In-depth interviews were conducted with participants who voluntarily agreed to participate in the study after the researcher's explanation of the research. The data collected from the participants during the research will be permanently deleted after the research is completed, and personal information will be encrypted and processed during the research. The interviews were conducted in empty lecture halls or seminar rooms at the school, and participants received a token of appreciation after the interview. Additionally, participants were informed in advance that they could be asked additional questions about the interview content, and the results of the analysis of the interview content were also confirmed with the participants to ensure clarity. All interview data was analyzed immediately after the interview and confirmed through discussions among the researchers.

3.3 Research Participants

The participants were nursing majors in the third year of a university in D city, who received simulation training using HSP. Convenience sampling was used to select 10 out of 14 students who voluntarily agreed to participate in the study after listening to the explanation about the research, excluding the ones who dropped out (Table 1). Snowball sampling was used to extract participants. The interviews took approximately 1.5–2 hours. It was explained to the participants that all information obtained through this study would be encrypted and saved on a computer and then completely deleted after the study.

Table 1. General Characteristics

Participant Number	Age	Gender	School Year	Practic Period	Religion	Number of Times
1	20	F	3	0	Buddhism	2 or more
2	20	F	3	0	Christianity	5
3	20	F	3	0	No religion	3
4	21	F	3	0	No religion	0
5	20	F	3	0	Catholicism	2
6	20	F	3	0	No religion	4
7	24	M	3	0	No religion	About 5
8	21	F	3	0	No religion	8
9	37	F	3	0	No religion	2
10	27	M	3	0	Christianity	2

3.4 Researchers' Qualifications

The researchers in this study have been making continuous efforts to improve academic exchange and research capacity by attending academic conferences related to qualitative research and have secured proficiency and skills in qualitative research based on several experiences in conducting qualitative research.

3.5 Simulation Practical Training Program Utilizing Holographic Standardized Patient (HSP)

The simulation practical training program using the Hologram Standardized Patient (HSP) applied in this study was planned and operated as an extracurricular program with self-developed educational content. The students who participated in the program were those who had completed simulation practical courses at least once as part of their nursing undergraduate program and applied to participate.

The simulation topic was 'Burn Patient Case (HoloPatient - Burn patient Nursing Assessment)'. The content included anatomy, health assessment, emergency nursing, and adult nursing areas. The program was developed for third-year nursing students, and the learning objectives were to comprehensively assess the patient's condition and approach nursing diagnosis for burn patients. Participants were taught various nursing assessment methods to review the

history and conduct a nursing examination for burns. The program was designed to help participants understand the importance of primary assessment and history-taking in secondary assessment through a Key Word Chart, and to grasp and discuss the nursing assessment methods they thought of and missed, and why they are important.

The simulation using the Hologram Standardized Patient (HSP) was conducted over a total of 8 hours, including self-study, and participants were required to write a report after performing the simulation. Interviews were conducted after the completion of all programs. The simulation practical training program proceeded in three stages: introduction, development, and conclusion. During the introduction stage, a 50-minute orientation and group pre-learning about the program, including the learning objectives and topics, were conducted. In the development stage, a 100-minute session was dedicated to presenting cases and allowing participants to experience the Holographic Standardized Patient (HSP) Simulation Module. The conclusion stage involved a 50-minute debriefing and Q&A session (Figure 1). The simulation practical training program was organized into groups of 3-4 participants each. For pre-learning, participants were provided with the necessary topics related to the scenario theme and guided to engage in group learning from start to finish, allowing for self-directed learning.

3.6 Data Analysis

Data were analyzed according to the phenomenological analysis procedures (Kim et al., 1999) by Colaizzi (1978), which began on the night of the interviews. Data were collected and analyzed until saturated, which was the point at which no additional content was identified.

The analysis was conducted by repeatedly reading the interviews and examining the overall context, after which important details or repeated expressions were identified. Then, the participants' general statements were derived, and the meanings were classified into theme clusters. Finally, related theme clusters were formed and integrated. The data analysis was conducted sequentially according to the phenomenological analysis procedure of Colaizzi (1978) as outlined by Kim et al. (1999), and was confirmed through discussions among the researchers.

Stage	Item	Contents
Intruduction (50 minutes)	Intro	Ateendance check, Pre survey etc.
	Orientation	Program introduction, presentation of learning objectives, and guidance on learning content.
	Pre-learning	Key word 1: Write and explain individual kewards Key word 2: Find and explain team-specific keywords
Development (100 minutes)	Presenting case	Holopatient with Burn <name: Susan Ferguson>
	Simulation running	Experience the HSP module with MR application.
	Group learning after practice	Key word 3: Find additional keywords learned after completing the module Assessment sheet: Confirm the final learning objectives keywords
Conculusion (50 minutes)	Debriefing	Feedback & Make up Writing a refelction journal
	Summary	Q & A, Providing advanced learning materials

Figure 1. Simulation program Process

3.7 Ensuring Validity

To ensure the validity of the study results, rigor was secured according to the evaluation criteria of Lincoln and Guba (Kim, 2015). A cyclical review was conducted by interpreting and repeatedly reading the analyzed data and raw data to ensure credibility, avoiding any researcher bias. To ensure transferability, the participants were asked specific questions for in-depth interviews until data saturation. To ensure dependability, data were analyzed and interpreted faithfully according to the phenomenological analysis method by Colaizzi (1978). To ensure confirmability, efforts were made to eliminate the researchers' prior experience through "suspension of judgment."

4. Study Results

As a result, 79 meanings were formed, and 20 theme clusters in four categories such as "interesting course," "expectations beyond barriers," "future learning model," and "reinforcing practical skills" were derived (Table 2).

4.1 Category 1: Interesting Course

The relevant theme clusters are "satisfactory course," "engaging course," "the instructor's efficient intervention is important," "strengthening learning motivation," "increasing curiosity through direct observation," "strengthening knowledge," and "vivid and realistic experience." Having already experienced various simulation courses 2–8 times, the participants expressed that simulation training using HSP was more interesting than they expected as the patients seemed realistic, and they could observe their clear changes of state. The realistic expression of patients' symptoms promoted the participants' understanding of diseases, and training was more engaging and satisfactory. In the case of holographic standardized patients, we confirmed that the graphic representation of the patient's expression allowed for a detailed portrayal of the disease, including facial expressions and gestures, making it easier for the participating students to identify the disease.

"After studying the theory of a certain disease, I could immediately meet with a virtual patient with that particular disease for nursing assessment, which allowed me to actively apply the theory I'd learned before I'd forget. The program was even better than I thought in terms of both quality and quantity. (…) It was especially good to be able to see all the symptoms that occur in patients when their condition worsened in each stage." (Participant 1)

"The use of MR and VR simulations was more helpful in understanding a patient's condition than practice with written descriptions of patient cases or virtual scenarios. When providing nursing care to standardized patients, we often have to rely on theoretical knowledge, as we cannot directly assess the patient's pain or the severity of their illness. Therefore, I believe that more mistakes will inevitably occur during practical training. However, I believe that attending lectures to acquire theoretical knowledge and participating in MR and VR simulation classes is better in every respect than regular simulation classes." (Participant 8)

4.2 Category 2: Expectations Beyond Barriers

The relevant theme clusters are "inconvenience in using equipment," "demand for new content," and "disappointment in course management." The participants complained that it took too long to load the HSP, and it was inconvenient having to load them again when the system was disconnected in the middle of the class. They were anticipating more diverse patient cases because the currently developed content is limited. The content used in this study was developed overseas, it is entirely in English, and has some issues that do not fit the Korean situation, such as interruptions owing to disconnection from the Internet. This requires further improvement.

"We're not used to the device, and even the TAs get flustered because the virtual patient's position keeps changing or the patient just disappears. And the application operates well on some of the tablet PCs distributed but not on others." (Participant 3)

"In the simulation using MR, there weren't many major issues, but I remember that quite a few students experienced motion sickness due to the use of 3D technology during the class where we used the devices. Students who felt dizzy and uncomfortable couldn't sustain the simulation class as long as those who didn't experience these symptoms and had to take breaks, which was regrettable. I think that to address these issues, nursing students should have more opportunities to experience simulation classes and become familiar with the devices, which would help solve these problems." (Participant 8)

4.3 Category 3: Future Learning Model

The relevant theme clusters are "convenience in being free from time and space constraints," "growth through self-reflection," "alternatives to clinical training," and "knowledge that is complete." The participants were satisfied with the fact that simulation training, which had been possible only in the lab, could now be done without time and space constraints because they could load HSP anywhere. They admitted that this could replace clinical training and expressed that training experience using HSP reduced their anxiety over insufficient clinical training.

"I could bring the patient anywhere, such as the bed or desk in front of me, and observe them anytime, which was interesting and fun. The best part was that I could experience patients with the most realistic response right in front of me when I couldn't actually go to clinical training." (Participant 5)

"I was worried about getting a job because I had never had any clinical practice experience, but I thought that my practical experience using virtual reality-based simulations would be something I could incorporate into interviews and self-introductions when I got a job at a hospital. Although I encountered the patient virtually, I think it was also helpful to understand the patient's pain, even if not completely, and to take time to think about how to provide optimal nursing care. I had been practicing by playing the role of a patient with my classmates, but I was disappointed that I could not actually meet the patients. I think it was good, because I was able to acquire theoretical

knowledge and practical experience through this simulation program." (Participant 9)

4.4 Category 4: Reinforcing Practical Skills

The relevant theme clusters are "improving communication skills," "training required in advance," "expanding thinking," "building intimacy through interaction," "providing opportunities to empathize," and "efficient health assessment." Various symptoms can be expressed for each disease through training experience using HSP; thus, the participants could perceive that their thinking skills improved, and they could form intimacy with the patient, while also improving empathy and communication skills. They were especially satisfied with their improvement in the ability to assess the patient's health.

"After participating in the VR-based simulation, I realized that I should observe patients more closely. I learned that patients can show various symptoms, and the sounds they make are not the same, so I should distinguish whether their breath is short or interrupted. Now I have learned that I should examine their symptoms more closely." (Participant 8)

"I was reminded of the image of the virtual patient. Based on this, I was able to think more richly about the topic. For example, the topic of this simulation was the nursing assessment of burn patients, but because we had previously only learned about burns through text and pictures, there were limitations to the nursing assessment. However, during the simulation, I was able to assess not only the patient's damaged area but also the patient's expression and situation, so I think it was more impactful and memorable." (Participant 4)

Table 2. Theme Cluster

Meaning formation	Theme cluster	Category
Course I want to take again next time	Satisfactory course	Interesting course
Greater satisfaction than general simulation training		
An experience I would recommend to other students		
Hopeful that education methods are developing for the better		
Realistic symptom expression increases immersion in training	Engaging course	
More nervous and realistic than SimMan, making me focus more		
Fresh and immersive		
Instructor's active intervention	The instructor's efficient intervention is important	
Instructor's waiting and encouragement		
Horizontal class between students and instructors		
From passive to active experience	Strengthening learning motivation	
Resolve to study more		
Realize the importance of knowledge about the major		
Realize the importance of direct observation	Increasing curiosity through direct observation	
Participate more actively than in lecture-style classes		
Intriguing and interesting experience that makes me want to know more		
Better understanding of disease and longer memory	Strengthening knowledge	
Feel that my theoretical knowledge was strengthened by learning from realistic patients		
Detailed patient observation is possible	Vivid and realistic experience	
Observation of clear state changes is possible		
HSP like a real patient		
High-quality VR beyond expectations		
Detailed and specific changes in the patient's facial expression make it feel like a real patient		
Patient expressions similar to clinical situations		
Can better understand the patient based on a detailed assessment		
Vivid patient expression		

Can express more diverse and realistic patient symptoms		
No more frustration from ambiguous state changes		
Specific patient expressions due to disease		
The inconvenience of taking a long time to operate		
The inconvenience of HSP changing location or disappearing		
Frequent system errors		
The text spreads out, making it difficult to read on the device	Inconvenience in using equipment	
Direct nursing is not possible		
Difficult to obtain due to expensive equipment		
Difficult to use for a long time due to dizziness and discomfort		Expectations beyond barriers
The discomfort of cybersickness		
It takes a lot of time to load HSP		
It is expected that patient expressions will be added when nursing intervention fails	Demand for new content	
Nursing assessment is possible, but application of nursing intervention is limited		
Hope that HSP related to fundamental skills is developed		
Hope HSP is applied to more courses	Disappointment in course management	
Limited interaction		
Repeated learning is possible if desired	Convenience in being free from time and space constraints	
Convenience of being able to use anywhere, free from space constraints that could only allow it in the lab		
Realized my shortcomings and motivated me to work harder		
Become realistically aware of my level of knowledge	Growth through self-reflection	
Feeling the limitations of not being able to understand the patient overall		
Discovered my lack of theoretical knowledge in training		
Increased confidence through repeated learning		
HSP can replace clinical training		Future learning model
Encountering various nursing situations	Alternatives to clinical training	
High-quality experience that can replace hands-on training		
Reduced anxiety due to lack of clinical training		
Optimal for prior learning before clinical training		
Feels as if the experience is fully my own, not forgotten even after the exam		
Can fully remember due to the simulation course after studying the knowledge		
Learning from the text and then actually experiencing improve the learning effect	Knowledge that is complete	
Solidified the knowledge obtained		
Long-lasting memory		
Knowledge that remains vivid in memory		
Can communicate in English	Improving communication skills	
Realized the importance of communication		
Requires prior learning	Training required in advance	
Requires proficient training in equipment		
Important to be familiar with the device due to the difficulty in using it		
Scope of thinking expanded due to associated images	Expanding thinking	Reinforcing practical skills
Having a variety of symptom expressions for each disease strengthens thinking skills		
Feeling responsible for the patient	Building intimacy through interaction	
Building intimacy with HSP		

Can build intimacy with patients	Providing opportunities to empathize
Opportunity to understand patient pain	
Seeing the patient's symptoms more closely	
Becoming more interested in patients	
Realizing the importance of checking patient vital signs	
Easy to collect objective and subjective data from patients	Efficient health assessment
Feeling that my nursing assessment skills have improved	
Responding sensitively to the patient's constantly changing states	
Easy to assess symptoms as it is possible to see words and facial expressions	

5. Discussions

To identify the meaning of simulation experience using HSP, this study implemented a simulation training program applying HSP, and interviews were conducted with nursing students who participated in the program. As a result, four important and meaningful categories—"interesting course," "expectations beyond barriers," "future learning model," and "reinforcing practical skills" were derived, and various experiences of nursing students could be examined.

The fact that students perceive the HSP-based simulation training experience as an "interesting course" can be due to the fact that the scenarios implemented in the simulation are similar to actual clinical settings, which increases students' interest. This was similarly recognized by students as an interesting class in a study conducted on home visit simulation for nursing students (Baek, 2013) and as reported by a study conducted on simulation practice education in the field of obstetric nursing (Lee & Kim 2011). Additionally, what students perceive as a "future learning model" is in fact what nursing students in South Korea have long been accustomed to in digital culture, and this form of convergence-technology-based simulation training is no longer a technological problem for students. By developing various HSP-based simulators and simulation-based training, it would be possible to achieve integrated development of nursing education and simulation training beyond the constraints of the actual clinical training environment. Furthermore, simulation-based training can resolve the issues of existing nursing curricula and address health care needs (Seo & Park 2021); moreover, it can enable interactive and immersive activities by reproducing clinical experiences without putting the patients at risk (Kwon 2023). This proves the need to develop more of these future forms of learning.

Students perceived the HSP-based simulation training experience as "expectations beyond barriers" as they complained about the inconvenience or difficulty in using new equipment and the limited interaction in class management, but they also requested more new nursing content. In addition, they experienced an improvement in confidence by repeatedly participating in simulations and prior learning about the learning content. This is the same result as reported in a study that verified the effectiveness of visiting nursing simulations and the results of a case study of mixed reality-based online vocational education using XR, which showed that students experienced an increase in confidence after simulation training (Oh 2022; Kang & Kang 2022), which demonstrates that HSP-based simulation training also has the effect of general simulation training.

Students experienced growth in reinforcing practical skills while participating in HSP-based simulations. The participants claimed that their range of thinking was expanded through associated images, and forming a sense of responsibility and intimacy with the patient helped them better understand the patient's pain and pay more attention, while also gaining the ability to observe their symptoms more closely. Furthermore, their problem-solving skills were improved as they could collect objective and subjective data on patients and show improved nursing assessment skills. They could also gain integrated thinking skills, which made them feel as if they were actual nurses. These results were also found in other simulation-based studies. Studies on simulation training also showed that nursing students could improve problem-solving skills, therapeutic communication self-efficacy, and confidence in clinical performance through simulation, which also affected clinical practice (Seo & Park 2021; Kwon 2023; Oh 2022; Lopez 2021; Barng 2018). This is a significant result proving that simulation training has a positive impact on clinical practice. However, some challenges in simulation courses are still to be solved. The students who participated in this study were flustered by the unfamiliar format of the course and equipment and felt pressured by the problem situations provided as scenarios without correct answers. They were surprised by the HSP that looked so much like real patients and were feeling an excessive learning burden, thinking that they needed substantial knowledge to deal with the situations at hand. They were also feeling disappointed by the lack of adequate

educational content compared to the infrastructure developed.

The results of this study proved that the participants were generally satisfied with HSP-based simulation training. Students could immerse themselves in the simulation as the HSP looked realistic like real patients, which had the positive effect of improving their empathic skills. The participants stated, "After experiencing the simulation, I felt as if I had transformed from just a student into a real nurse." They stated that through the simulation, they experienced a sense of responsibility for patients and work ethics, which they could not feel in observation-oriented clinical training. In a study by Kim et al. (2021), an HSP program provided nursing students with the opportunity to develop skills in observing and noticing physical signs, thereby adapting to changes in the health of patients and other health professionals on the healthcare team. The finding that the interaction can be improved is consistent with the results of this study, which suggests various aspects of simulation education in which MR technology that integrates multisensory channels and environmental sensors is applied to simulation education (Kang & Lee 2023). By providing HSP-based simulation training based on these results, it will be possible to help reinforce the students' practical skills, such as patient assessment, interaction, and empathic skills as nurses in clinical settings.

Since many nursing schools are currently adopting and using various simulators in class, this study has significance as it identified the essence of the experiences of nursing students through HSP-based simulation training. More HSP-based simulation training programs extended to various courses will hopefully be developed in the future based on the results of this study, as well as efficient educational content to apply to these programs. It is hoped that these programs will be used as useful learning tools for nursing students.

6. Conclusions and Suggestions

This study aimed to provide foundational data for the development and utilization of an efficient simulation practical education program using XR technology based on participants' experiences explored by applying phenomenological research methods to simulated practical education for nursing students that used HSPs. As a result, 79 meaning formations, 20 theme clusters, and 4 categories such as "interesting course," "expectations beyond barriers," "future learning model," and "reinforcing practical skills" were derived. It is hoped that various HSP-based simulation training programs will be developed in the future based on the results. In nursing education, the use of HSPs for simulation training can enhance student engagement and improve practical skills. However, if domestic products suitable for Korean clinical situations are developed and used in the future, they can contribute to overcoming obstacles in classroom practice.

The limitations of this study are as follows. First, this study targeted only one year of study at one university. Therefore, future research should include a more diverse population. Second, this study collected qualitative data on experiences using HSPs, and we suggest that quantitative research be conducted based on the findings of this study. Third, this study collected data on the experiences in implementing a single program. Since various patient cases using HSPs have been introduced and can be utilized in various teaching methods, research should be conducted on the utilization of HSP simulation education based on the findings of this study.

The results of this study suggest several measures. First, based on the qualitative research results, quantitative research is necessary to confirm the effectiveness of simulation education using HSPs. Second, continuous research is necessary to develop various clinical scenarios and apply them in classes. Third, we hope that a long-term longitudinal study will be conducted to evaluate the effectiveness of a simulation education program using HSPs, developed and applied not only to nursing students but also to nurses.

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