

Challenges in Adopting Digital Technology-Based Simulation : Nursing Faculty Perspectives in Korea

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Abstract

Purpose: This study explores the challenges experienced by nursing faculty in initiating digital technology-based simulation within the Korean educational context. **Method:** Data were collected through both focus group and individual interviews with eight nursing faculty members who had experience operating digital-based simulation classes within the past two years. The data were analyzed using the qualitative content analysis method proposed by Elo and Kyngäs. **Result:** The challenges experienced by nursing faculty initiating digital-based simulation were categorized into two domains: background of initiating maternity simulation and burden of course preparation. The findings revealed that digital simulation has become both a structural necessity shaped by social and institutional demands and a strategic choice grounded in faculty members' professional identity and sense of responsibility. At the same time, faculty experienced significant preparation burdens including technological unfamiliarity, complex course design, and the development of extensive educational materials. **Conclusion:** Sustaining the educational value of digital based nursing simulation depends on institutional and structural support that reduces faculty burdens and fosters innovation. This study provides foundational insights into the challenges and adaptations of faculty in digital-based simulation, offering a basis for strategies that enhance the quality and sustainability of simulation-based nursing education.

Keywords: Digital, Technology, Simulation, Faculty, Nursing, Qualitative Research,

1. Introduction

Since 2000, simulation-based classes have been applied as an educational method to improve the clinical performance of nursing students in nursing education due to the rapid development of simulation-based technology (Ahmed & Masic, 2021). The technology-enhanced simulation in nursing education is proposed as an educational strategy to provide trainees with practical learning opportunities that allow them to integrate theoretical knowledge with clinical practice before entering the actual clinical field (Pan et al., 2025).

In recent nursing education, clinical practicum has been compelled to undergo structural changes in both content and methods due to patient safety reinforcement policies, recurring infectious disease outbreaks, and the growing emphasis on patient privacy protection (Risling & Low, 2019; Kuesakul et al., 2024; Park & Jeon, 2024). Previously, even if students were restricted from direct nursing performance during clinical training, they were at least able to learn through observation. However, as patient safety and rights have emerged as paramount priorities, there has been a notable increase in cases where observation itself is restricted, particularly in high-risk situations or rare cases (Jung, 2025; Kim & Che, 2025).

In addition, one of the most notable recent changes in Korean nursing education is the expansion of nursing school enrollment quotas (Ministry of Health and Welfare, 2024). This has emerged as a new challenge in clinical practicum education. Such complex socio-cultural changes serve as a critical backdrop for the expansion of simulation-based nursing education. In contemporary Korean society, the rapid advancement of digital technologies has been transforming educational paradigms at an unprecedented pace, bringing a critical turning point to nursing education as well (Nho, 2025). In particular,

the COVID-19 pandemic accelerated the digitalization of both education and healthcare (Seo, 2024), which in turn led to the widespread adoption of technologically advanced simulations in medical education (WHO, 2024). Within this context, digital-based instruction has also been rapidly introduced into nursing simulation education, either as a substitute for or a complement to clinical practicum (Yeung et al., 2023; Liu et al., 2023).

Digital technology-based nursing simulation education refers to an instructional method that employs advanced digital technologies—such as virtual reality (VR), augmented reality (AR), mixed reality (MR), artificial intelligence (AI), wearable sensors, high-fidelity manikins, and metaverse platforms—to recreate clinical scenarios that closely approximate real-world practice (Pan et al., 2025). This approach enables learners to repeatedly practice nursing skills and clinical decision-making within a safe and controlled environment (Nguyen et al., 2023). In other words, by digitally reproducing situations that are difficult to conduct with actual patients, this educational strategy facilitates the comprehensive acquisition of the knowledge, skills, and professional attitudes required for clinical practice (Fealy et al., 2023). Therefore, within the context of recent transformations in Korean nursing education, this approach is increasingly regarded as a vital educational alternative.

From the perspective of instructors operating nursing simulations, traditional approaches to simulation-based practicum have been most critically limited by temporal and spatial constraints, low levels of immersion and learning effectiveness, restricted learning opportunities, and unequal learning experiences (Guillen-Aguinaga et al., 2025). In contrast, digital technology-based simulation has been proposed as an effective alternative that addresses these shortcomings by enhancing both accessibility and educational efficiency (Buchanan et al., 2021). Numerous studies have confirmed that digital technology-based simulation classes contribute to the improvement of knowledge acquisition, critical thinking, clinical competence, and digital literacy, while also enhancing learning retention and student engagement (Buchanan et al., 2021; Fealy et al., 2023; Liu et al., 2023; Pan et al., 2025). Furthermore, digitally native Generation Z learners have been shown to adapt naturally to such digital technology-based learning modalities and express a preference for digital environments, providing additional support for the expansion of digital-based simulation education within nursing curricula (Vizcaya-Moreno & Pérez-Cañaveras, 2020; Gonzalez-Garcia et al., 2024).

In Korea, a wide range of digital health interventions utilizing information and communication technologies have been implemented within the healthcare sector and are rapidly expanding into nursing practice and education (Seo & Seo, 2025; Seo, 2024; Kim et al., 2025). Alongside this trend, the development of digital health management competencies has increasingly been emphasized as a core professional skill for nurses, given the nature of clinical nursing practice (Navarro Martínez & Leyva-Moral, 2024; Nho, 2025). Consequently, nursing faculty are expected to actively expose undergraduate nursing students—the future nursing workforce—to digital learning environments in order to strengthen their digital competence. Moreover, as faculty members' accessibility to digital technologies is increasingly recognized as a critical determinant of innovation in nursing education, calls have been made to promote digital inclusion as a means of reducing educational inequalities (Sieck et al., 2021) and to develop teaching–learning strategies that can foster students' critical thinking and clinical judgment (Park & Kim, 2025).

However, there are many challenges associated with this transition, including academics' home office infrastructure and digital teaching competence (Shon et al., 2024). Above all, the professional competence of instructors—particularly their ability to design and implement innovative teaching–learning strategies that align with the characteristics of digital-native learners—emerges as a critical factor (Choi, 2019; Kim & Choi, 2022). Thus, there is a heightened emphasis on enhancing nursing faculties' pedagogical digital competence (PDC) to effectively teach students (Shon et al., 2023).

However, despite the growing need for innovation, most faculty members continue to rely on traditional teaching methods. Many report feeling technologically intimidated by digital-based simulation modalities, which contributes to their reluctance to adopt such approaches (Ryan et al., 2018). Shon et al. (2023) further noted that faculty are often unwilling to assume this additional burden, as proficiency in digital education competencies has become an essential requirement. Similarly, Park & Kim (2025) highlighted that instructors operating technology-based simulations face significant challenges as they contend with new technological demands and shifting educational paradigms.

To date, a large body of research on digital based nursing simulation primarily focuses on students' outcomes, effectiveness, and experiences (Carrero-Planells et al., 2021; Gonzalez-Garcia et al., 2024; Kuesakul et al., 2024; Mäkinen et al., 2023; Park, 2021). While a limited number of studies have examined nursing faculty, these have largely been confined to traditional forms of simulation education (Almotairy et al., 2023; Alshehri et al., 2023; Lee & Kim, 2021; Park et al., 2016). In fact, there remains a notable lack of qualitative research that explores in depth the experiences of instructors who design and operate digital-based simulations (Navarro Martínez & Leyva-Moral, 2024; Shon et al., 2024). Therefore, exploring the experiences of instructors who operate advanced digital-based simulations in nursing practicum holds significant value in facilitating the adaptation of next-generation faculty who will lead simulation-based education and in

providing empirical evidence for the development of effective pedagogical strategies. Furthermore, such research is expected to contribute to enhancing the quality of nursing education and promoting the sustainability of education in the era of digital transformation.

A focus group interview is a qualitative research method in which a small group of approximately six to ten participants with shared experiences engage in open discussion and exchange of opinions to generate diverse and in-depth information (Thomas et al., 1995). This method enables the creation of new ideas through participant interaction, the elicitation of latent opinions and emotions, and the sharing of experiences on a specific topic, thereby fostering a deeper understanding of its meaning and context. Qualitative content analysis aims to explore facts or meanings that are insufficiently known or not yet clearly explained about humans or specific phenomena, and by systematically and objectively describing these phenomena, it provides understanding and knowledge of the research topic (Elo & Kyngäs, 2008). Therefore, in the context where little prior research exists on the challenges faced by instructors initiating innovative digital-based simulation modalities in nursing practicum, qualitative content analysis is considered an appropriate research method.

Accordingly, this study aims to explore and analyze in depth the challenging experiences of faculty members who are beginning to implement digital technology-based simulation practicum within the social and educational context of Korea.

The central research question of this study is as follows: “What are the challenges and adaptation experiences of faculty members in initiating digital-based nursing simulation classes?”

2. Research method

2.1. Research design

This is a qualitative research that applies qualitative content analysis in order to explore the challenges and adaptation experiences of faculty members initiating digital-based simulation practicum classes.

2.1. Research participant

The participants of this study were eight faculty members who had experience operating digital-based simulation classes within the past two years. They were recruited from among nursing faculty who attended a workshop on digital-based simulation faculty training, organized by a simulation society in Korea, and voluntarily agreed to participate in the study. The inclusion criteria were as follows:

- 1) Those with at least three years of clinical experience as a registered nurse
- 2) Those who hold a doctoral degree in nursing and are currently employed as a faculty member at a university
- 3) Those with experience in operating digital-based simulation classes within the past two years

The participants' ages ranged from their 30s to 50s: one in her 30s, five in their 40s, and two in their 50s. Among them, three were part-time instructors and five were tenure-track professors. Their areas of specialization included adult nursing ($n = 3$), pediatric nursing ($n = 2$), and maternal nursing ($n = 3$). Their clinical nursing experience ranged from 5 to 12 years, their teaching experience in universities from 3 to 14 years, and their simulation teaching experience from 1 to 6 years.

The types of digital-based simulation modalities utilized in their classes included computer-based virtual scenario simulations (vSIM), AI-assisted scenario-based simulations, hybrid simulations, 3D virtual reality (VR) environments using VR goggles or headsets, hologram-enhanced simulations, and high-fidelity Human Patient Simulators (HPS).

2.2. Data collection

Data were collected in July 2025 through focus group interviews with eight nursing faculty members who had experience operating digital-based simulation practicum classes within the past two years. The interviews were conducted via Zoom.

The development of interview questions and the facilitation of the focus group followed the method proposed by Krueger and Casey (2000). The interview questions were prepared as unstructured, open-ended questions to freely elicit the participants' experiences. In accordance with the procedures of the focus group research method, the researcher, acting as the facilitator, briefly explained the topic, purpose, and method of the interview before initiating the discussion.

The research questions were conducted in the following sequence suggested by Krueger and Casey (2000): opening questions, introductory questions, transition questions, key questions, and ending questions. The opening question, “Could you briefly introduce yourselves?”, enabled the researcher to gather information on participants' university affiliation,

educational background, simulation experience, and age, while also fostering a more comfortable and friendly atmosphere. Introductory questions included, “How did you start digital-based simulation education?” Transition questions included, “Can you describe your experiences when you first began digital-based simulation education?”

The key questions followed, such as: “What is the first thing that comes to mind when you think of digital-based simulation education?”; “What was the digital-based simulation learning environment like?”; “Do you feel the need for digital-based simulation education? Please explain why.”; “What are the challenges of digital-based simulation education?”; and “What do you think is necessary for digital-based simulation classes?” The ending question was: “Let me briefly summarize what we discussed today. If anything is missing or if you have any additional comments, please let me know.”

The researcher encouraged free responses during the discussion. The focus group interview lasted approximately three hours, allowing sufficient time for exchanging opinions. Additional probing questions were asked based on participants’ responses to explore meanings in greater depth. The discussion was redirected and concluded once it was determined that data saturation had been reached, as the same content was repeatedly expressed. This strategy was employed to compensate for the limitation of generalizability inherent in focus group interviews with small groups.

Furthermore, recognizing that participants might find it difficult to express their honest opinions due to the group atmosphere or the influence of certain individuals, the researcher contacted each participant individually by phone after the group interview to confirm and supplement any additional opinions not expressed during the discussion. The group interviews were recorded via Zoom, while the individual interviews were recorded using a mobile phone. All recordings were transcribed verbatim by the researcher.

2.4. Data analysis

Data analysis was conducted using qualitative content analysis to gain a comprehensive understanding of the phenomenon, and commenced on the evening of the interview. Following the inductive content analysis approach proposed by Elo and Kyngäs (2008), the collected data were analyzed through the sequential stages of preparation, open coding, creation of theme clusters, categorization, and abstraction of core themes.

After completing the data analysis, the researcher conducted repeated verification procedures to ensure that the essential meanings and components were accurately derived. For this purpose, two participants with prior experience in qualitative research reviewed the analysis to assess its universality and validity.

The collected data proceeded through the stages of preparation, coding, subcategory formation, categorization, and core themes according to the inductive content analysis method suggested by Elo and Kyngäs (2008).

In the preparation phase, the researcher repeatedly read the transcribed qualitative data several times to grasp the overall meaning. Then, in the organizing phase, open coding was performed by selecting meaningful words or sentences and giving them titles. Next, in order to generalize the data, the underlying content or meaning of the condensed codes was abstracted to form theme clusters. In the third stage, it was categorized into a language that was symbolic and could convey its meaning in detail in order to show it clearly. In the fourth stage, I derived themes that integrated the experiences of simulation practice instructors and condensed them into practical meanings.

After completing the data analysis, the universality and validity were repeatedly confirmed by two professors among the participants in this study who had experience in conducting qualitative research to ensure that the essential meaning and components were faithfully derived.

2.5 Trustworthiness of the research

To ensure the validity and trustworthiness of the study, the evaluation criteria proposed by Lincoln and Guba (as cited in Alexander, 2019) were applied.

To secure credibility, experienced professors with extensive expertise in maternal simulation practice were purposefully selected as participants. Member checking was conducted throughout data collection and analysis to ensure that participants’ perspectives and meanings were accurately represented without distortion. When meanings appeared ambiguous during the analysis, participants were contacted by telephone to confirm whether interpretations faithfully reflected their viewpoints. After the analysis was completed, the derived results (themes, categories, and essential meanings) were sent to two participants for review to determine whether the findings were consistent with their experiences. Their feedback was incorporated into the final analysis through refinement of themes and interpretations, with discrepancies resolved through dialogue between the researcher and the participants.

To ensure auditability, the analytic process followed the method of Elo and Kyngäs (2008) rigorously, and all data were described in detail.

To establish applicability, data were collected in depth until no new information emerged, and interviews were conducted for sufficient time until saturation was reached.

To ensure confirmability, the researcher set aside preconceived notions and maintained objectivity by practicing bracketing and suspending judgment throughout the entire research process.

2.6 Ethical consideration

Ethical principles were rigorously upheld throughout the entire research process. During participant recruitment, the researcher emailed a consent form that fully explained the purpose of the study, the nature and procedures of the focus group interviews, the voluntary nature of participation and the right to withdraw at any time without penalty, the guarantee of confidentiality and anonymity, the recording of the discussions, and the intended use of the data, and obtained participants' consent. During the focus group interviews, the researcher emphasized that participants were not required to respond to any topics they found uncomfortable or sensitive. Participants were also encouraged to share their experiences and perspectives openly, regardless of their professional roles, thereby fostering a safe and non-judgmental environment. In addition, participants' names were anonymized in all research outputs to ensure that personal statements and identities were not disclosed. All data were securely stored, used solely for research purposes, and destroyed upon completion of the study. These procedures were undertaken to protect participants' rights and to maintain the integrity of the research process.

3. Results

As a result of the in-depth analysis of instructors' experiences in initiating digital based simulation classes in nursing practicum, two categories, six theme clusters and seventeen themes were identified (see Table 1). The meanings of the theme clusters and themes identified for each of the two categories — 'background of initiating maternity simulation', 'burden of course preparation', are as follows.

Table 1. Categories, Theme clusters and Themes of Faculty' Experiences

Category	Theme clusters	Theme
Background of initiating digital based simulation	Societal and environmental demands	Expansion of nursing student numbers
		Higher proportion of male students
		Inevitability of simulation due to low birth rate
		Increasing emphasis on patient rights and safety
		Recurring infectious disease outbreaks
	Pressures driving the integration of digital based simulation	Need to strengthen practical competencies in clinical settings
		Curriculum requirements for nursing faculty
		Encouragement of pedagogical innovation
	Aspiration for faculty career advancement	Mandatory qualifications as a nursing professor
		Professor's pride and responsibility
Burden of course preparation	Burden of learning new teaching methods	Overwhelming amount of time and content demands required for learning
		Training to adjust to unfamiliar simulation modalities
		Vagueness in preparing for debriefing
	Complexity in class design	Efforts to give fair opportunities to students
		Arrangement considering various human-physical resources.
	Struggles in developing educational materials	Creating scenario aligned with learning objectives
		Developing simulation manual and guidelines
		Developing educational tools and simulation supplies

Participants emphasized the inevitability and alternative nature of operating simulation classes. They reported experiencing limitations in securing sufficient clinical practicum periods due to the rapid increase in student enrollment, as well as temporal and spatial constraints of on-campus practice. As a result, it became increasingly difficult to provide equal opportunities for all students using the existing simulation modalities. To overcome these challenges, they adopted digital-based simulation methods that allowed broader accessibility for a larger number of students.

“...Previously, we used only standardized patients (SPs) in class, but as the number of students increased, it became impossible to provide the session for everyone. At the same time, we couldn’t allow some students to participate in the simulation class while others did not, so we switched to a hybrid model...”

In addition, the recent sharp increase in the number of male students has further reinforced the inevitability of simulation-based education. Because male students were not allowed to participate in clinical practice in delivery rooms, obstetrics and gynecology wards, neonatal units, or pediatric wards, simulation was described as virtually the only alternative. Moreover, South Korea’s low birth rate has further limited access to clinical practice opportunities in maternal and child health, serving as a major factor that accelerates the demand for simulation-based practicum.

“...Since the year before last, male students have accounted for more than 30% of incoming nursing freshmen... but delivery rooms, obstetrics and gynecology wards, neonatal units, and pediatric wards do not accept male students for clinical practice. Yet, in order to graduate, they are required to complete practicum courses in maternal and child health nursing.... simulation is really the only answer.”

“...There are very few hospitals where students can observe childbirth due to the extremely low national birth rate. In fact, some students were unable to witness even a single delivery during their two-week hospital practicum...”

Moreover, strengthened patients’ rights have made it increasingly difficult for nursing students to perform even basic procedures, as tasks such as measuring blood pressure or checking blood glucose now require prior consent. In addition, the declining birth rate has drastically reduced the number of deliveries available for observation, leaving students with few opportunities to witness childbirth during their clinical practicum. The situation is further aggravated by recurring infectious disease outbreaks and seasonal epidemics such as COVID-19, influenza, chickenpox, and pertussis, which not only force the immediate suspension of clinical placements but also restrict even face-to-face simulation sessions conducted in confined spaces.

“...Nowadays, Patients’ rights have become so strong that some even refuse when students try to check their blood sugar. Even for measuring blood pressure, students now need to obtain consent. So it is almost unimaginable for them to actually perform any procedures during clinical practicum. Yet once they graduate, they are expected to do these tasks immediately. The gap between school and clinical practice is just too wide....”

“...When the news reported a pertussis outbreak, the neonatal unit where our students were practicing immediately notified us not to send my students from the next day... We anticipated that such situations would occur more frequently in the future. We could not simply leave the students without practice opportunities, so we replaced the neonatal practicum with virtual simulation”.

Within these societal and environmental constraints, participants emphasized that adopting digital technology-based simulation education has become the only viable alternative to safeguard students’ learning opportunities and to ensure the acquisition of essential clinical competencies.

The theme cluster of ‘pressures driving the integration of digital technology based simulation’ includes the following themes: ‘curriculum requirements for nursing faculty’ ‘clinical demands for strengthening practical competencies, and ‘encouragement of pedagogical innovation’. This reflects the external and internal pressures experienced by faculty members that have driven the adoption and integration of digital technology -based education in nursing simulation. First, maternal nursing and medical-surgical nursing were widely recognized as the top-priority subject for implementing simulation courses,

and the responsibility for managing them was often naturally shifted onto younger, newly appointed faculty members. Participants emphasized that the growing importance of practical competencies over theoretical knowledge exerted additional pressure on nursing education. With the anticipated introduction of simulator-based assessments into the national nursing licensing exam, educators felt the need to train students in essential clinical competencies, particularly clinical judgment and decision-making.

“...As soon as I got a job at school, this simulation class was already incorporated into the curriculum. As long as I majored in maternal nursing, I can't help it... No choice! Everyone recognizes maternal nursing as the top priority subject for running simulations. Since I was the youngest and newest faculty member, the responsibility for running these courses naturally fell on me. I had to learn it somehow and take charge...Unconditionally...”

“...These days, practical competencies are more important than theoretical knowledge. Doctors also use simulators to evaluate practical competencies in license tests... This will be introduced soon in nurse's license tests too...Therefore, it is essential to train students in clinical judgment and decision-making skills by any means”

The digital transformation of healthcare environments created expectations that students graduate with adequate digital health competencies. Hospitals were increasingly characterized by AI wards, digital wards, and digital health interventions, leaving little space outside of digital-based practice. Participants pointed to the limitations of traditional teaching methods in preparing students for rare or high-risk situations. They acknowledged that AI-enabled simulation could instantly generate such scenarios and facilitate real-time responses, thereby fulfilling the original purpose of simulation education.

“ Hospitals are all about AI wards, digital wards, and digital health interventions ... everything is ‘digital, digital’. There is nothing that is not digital-based... So the expectation is that students should also graduate with competencies in digital health management..”

“Honestly, with the traditional method, it was impossible to design scenarios that could implement real-time responses... The real purpose of simulation is to show students what they cannot see, touch, or experience in clinical practice. They need exposure to high-risk and rare cases, but AI generates those scenarios instantly and allows immediate responses, which truly aligns with the original purpose of simulation.”

policy-level influences and institutional pressures played a major role in driving digital simulation forward. The Ministry of Education urged continuous innovation in teaching methods, while the Korean Accreditation Board of Nursing Education actively supported the expansion of simulation classes. Participants also highlighted that funding opportunities were often contingent upon including keywords such as AI, VR, and simulation.

“There was direct or indirect pressure from the Ministry of Education to continue to strengthen digital based innovative education methods...The Korean Accreditation Board Of Nursing Education continues to implement a support policy to expand simulation classes. It is easy to receive funding only when words such as AI, VR, and simulation are used, so schools continue to ask us to secure simulation-related projects and invest in facilities and equipment.”

These experiences reveal that simulation-based education is often driven by systemic priorities related to funding, accreditation, and institutional development rather than by faculty- initiated instructional decisions.

The theme cluster of ‘aspiration for faculty career advancement’ includes the following themes: ‘mandatory qualifications as a nursing professor’ and ‘professor’s pride and responsibility’. The participants revealed that they began instructing simulation classes for academic career development to become nursing professors and that they are maintaining it to enhance their professional competence.

“...Nowadays, the ability to operate simulation courses has become an essential requirement for applying to tenure-track faculty positions in nursing. In particular, candidates who can run digital technology-based

simulation classes are given preferential consideration, making this ability virtually a mandatory qualification—almost like a license...”

Participants recognized that, in the context of rapidly digitalizing hospitals, actively adopting new educational approaches was not only a matter of maintaining their minimum professional pride as nursing faculty but also a moral responsibility to guide students in alignment with clinical trends as members of universities preparing future nurses. This sense of identity and responsibility led them to the decision to implement new simulation classes.

“These days, even in the training of newly hired clinical nurses, nearly half of the training is conducted through simulation-based methods. Hospitals are also transforming into ‘smart wards’ and ‘digital hospitals’ and so on... Since the environments where students will eventually work are changing in this way..., can universities cling to the old methods? We cannot afford to be left behind...Of course, if I just stay as I am (without developing new classes), it would be easier for me. But as a professor, it became an issue of my minimum educational conscience and pride. I felt ashamed to insist on not learning and not teaching it.”

3.2. Burden of course preparation

This category was confirmed to include the theme clusters of ‘burden of learning new teaching methods’, ‘complexity in class design’, and ‘struggles in developing educational materials’.

The theme cluster of ‘burden of learning new teaching methods’ includes themes such as ‘overwhelming amount of time and content demands required for learning’, ‘training to adjust to unfamiliar simulation modalities’, and ‘vagueness in preparing for debriefing’.

This illustrates the significant educational burden faced by instructors when preparing for digital-based simulation classes. Because every step of simulation instruction—from scenario development to equipment operation and debriefing—was unfamiliar to many, instructors had to invest substantial time and cognitive effort to acquire the necessary competencies.

“This is the same situation as I'm entering a new study. I have to learn from beginner to advanced courses. It's a huge amount to learn from the basics...Everything was new to me. Writing simulation scenarios, learning how to use the equipment, conducting debriefing sessions... I had to learn it all from scratch.”

"In that year, I attended all the simulation workshop and learned... Then I again learned three times from the instructor dispatched from the simulator company... But I felt it was not enough, so I took a few more lessons after class. It felt like I was a student again, studying late into the night.”

In the theme of 'training to adjust to unfamiliar simulation modalities', instructors repeatedly practice and build up training to masterfully adapt to the simulation operation methods learned through various methods in class. These training and adaptation processes were also necessary whenever new digital technology based simulation formats were introduced.

"This is not something I can learn theoretically, but something I have to practice... No matter how much I saw and heard it with my own eyes, if I don't touch it and manipulate it step by step, I forget it right away... This is not my major... I'm not engineer... I have to deal with machines... I have to train repeatedly.”

"It took me a while to get used to HPS as well. So I didn't want to introduce a new simulation type as much as possible. But, the situation compelled me to conduct hologram-based simulation... It was very stressful. At first, it was hard to understand how the classes were run, and I didn't get used to writing in English... I practiced by simulating how the classes were run by looking at manuals, because I wasn't confident.”

The debriefing session is a key step in determining the quality of simulation-based education, and the competence of instructors becomes a very important factor. In the theme of 'vagueness in debriefing preparation', instructors are

pressured to recognize the importance of the debriefing process and prepare, but they experienced tension due to the lack of specific standards and ambiguity about preparation.

"At first, I was not sure how to prepare for debriefing. They say debriefing is the flower of simulation. It's the most important step. I was educated that the role of a professor is important... But... There's nothing specific... It's hard to find the direction of what to do in class... Preparing for many aspects was difficult, but honestly, debriefing was the part I could not prepare for and yet felt the heaviest burden in my mind..."

The theme cluster of 'complexity in class design' includes the following descriptions: 'efforts to give fair opportunities to students' and 'arrangement considering various human-physical resources'. Participants reveal that in order to ensure equitable learning experiences and maximize learning outcomes in simulation-based nursing practice, instructors must make multi-faceted efforts including balanced teaming, limited resource coordination, and integrated curriculum organization. during the course preparation phase.

The theme of 'Efforts to provide fair opportunities to students' reveals that instructors make efforts to form a team in consideration of the fair distribution of simulation-type operational opportunities, students' learning capabilities and clinical practice experience to ensure that as many students as possible reach their learning goals without gaps in experience between students.

"...All students should be able to experience HPS classes and virtual simulation classes... Students who have experienced delivery room practice have superior simulation class management skills than those who have not. So, we need to organize the teams so that at least one student in each team who has practiced in the delivery room before can be assigned... Students with high grades and low grades should be mixed and evenly distributed in one team."

The theme of 'the arrangement considering various human and physical resources' represents a complex scheduling process in which instructors comprehensively grasp the number of students, human factors such as instructors, assistants, and operators, and physical resources such as available simulation rooms, laboratories, and debriefing rooms, and then adjust, deploy, and modify them.

"I have to assign a simulation room to the schedule of four simulation instructors and one operator... and I also have to match the student's syllabus... We can't use the debriefing room when it overlaps with other simulation classes, so I have to think about that... and I have to consider other teaching schedules to assist with on-campus practical classes... I'm responsible for all this, and at the start of every semester, I get cramps in my head...."

The theme cluster of 'struggles in developing educational materials' includes the following themes: 'creating scenario aligned with learning objectives', 'developing simulation manual and guidelines', and 'developing educational tools and simulation supplies'. This study revealed that nursing instructors encounter substantial burdens during the course preparation phase, particularly in developing scenarios, manuals, and educational tools.

First, instructors should create and set up scenarios by constructing cases that are aligned with learning objects. In addition, it was necessary to develop or prepare simulation supplies necessary to run the scenario.

"Developing scenarios is the most difficult thing to do. It has to be based on my clinical experience. It's hard to set up scenarios, so I ended up getting help from an educator at the company."

"They say AI can create scenarios, but I realized that I also needed to know how to handle it. It's not that AI does everything automatically... I have to understand it in order to adjust things or ask for different outcomes... In the end, it was all something I had to learn myself."

Second, the 'developing simulation manual and guidelines' include the following things necessary for simulation practice operation: instructor simulation handbook, student simulation manual, simulation practicum guidebook, simulation operational guidelines, simulation facility and equipment use guidelines, safety protocols, preparation

protocols, role assignment guidelines(operator, coordinator, TA), evaluation and rubric guidelines, debriefing procedure guidelines, etc.

“I thought it would be over if I just made a scenario. But... I had to make a practice guidebook... and I had to make a manual for using simulation facilities... I couldn't see the end of what I had to do...”

Third, 'developing educational tools and simulation supplies' involves the following things to develop: orientation material, pre-learning assessment form, reflective diary form, assignment and evaluation tool, patient information sheet, scenario checklist, small props such as uploadable images and visual aids, etc.

“There were so many small things I had to make and prepare...Just because it is digital technology does not mean that the program alone can run the class. I still have to continuously create and provide something for the students to do. It felt endless.”

4. Discussion

This study was undertaken within the global healthcare movement that emphasizes patient safety as a foremost priority. Against this backdrop, it explored the challenges encountered by nursing faculty in Korean universities as they introduced digital technology-based simulation as an innovative educational modality. To capture these experiences, both focus group and individual interviews were conducted, providing vivid accounts of faculty perspectives. Through qualitative content analysis, the study sought to develop a deeper understanding of these perspectives and to illuminate the challenges and adaptations inherent in this educational transition.

The findings revealed that the experiences of faculty members initiating digital simulation-based nursing courses could be categorized into two overarching domains: the ‘background of initiating digital based simulation’ and the ‘burden of course preparation’.

The first category, the ‘background of initiating digital based simulation’, reflects the contextual factors that prompted faculty to adopt and implement such classes. Three subcategories emerged from participants’ accounts: socio-environmental demands, pressures to integrate simulation-based education, and aspirations for professional growth. Among these, the socio-environmental demands faced by Korean society were identified as a critical driver of adoption, commonly acknowledged by all participants. Policies emphasizing patient rights and safety, as well as the recurring outbreaks of infectious diseases, were recognized as major forces pushing for the integration of digital learning in education and simulation-based training in healthcare. These findings resonate with global trends reported in prior studies (Alshehri et al., 2023; Park & Jeon, 2024; Jung, 2025; Risling & Low, 2019).

Notably, however, this study highlights uniquely contextual factors in Korea—namely, the nation’s extremely low fertility rate and the increasing enrollment of male nursing students—which further shaped the imperative to adopt digital simulation modalities.

One of the most notable recent changes in Korean nursing education is the sharp increase in nursing student enrollment—over 30% (Ministry of Health and Welfare, 2024)—together with the marked rise in the proportion of male students, reaching nearly 50% of entrants (Yu, 2022). This trend reflects a weakening of the traditional perception of nursing as a female-dominated profession and a growing recognition of its appeal as a stable and prestigious career, a phenomenon also reported globally (Raman et al., 2020).

In this study, participants emphasized that the surge in student numbers has made it increasingly difficult to secure sufficient clinical placements. Moreover, the temporal and spatial limitations of conventional simulation practices hindered their ability to provide equitable learning opportunities for all students, leading faculty to adopt digital simulation as an inevitable alternative. For male nursing students in particular, simulation became the only viable option to meet graduation requirements in maternal and child health nursing, as clinical practice in delivery rooms, obstetrics and gynecology units, neonatal intensive care units, and pediatric wards was not permitted. This finding extends prior studies reporting that Confucian cultural norms in Korea restrict male students’ access to women and child patients (Shin et al., 2017).

Similar challenges have been documented internationally. Chan et al. (2014) noted that providing quality clinical training for male nursing students remains a persistent issue in China, while Mitra et al. (2018) observed that, although female physicians encounter little resistance when treating male patients, male nursing students still face

barriers in acquiring competencies in maternal and child care. In Islamic cultural contexts, simulation has been widely adopted as a practical strategy to overcome cultural and religious constraints (Kennedy et al., 2020; Raman et al., 2020). Although the nature of socio-cultural restrictions differs across countries, these cases collectively demonstrate that simulation emerges not as an optional supplement but as an essential educational intervention.

Meanwhile, Korea's extremely low fertility rate—falling below 0.7 in 2025 (Statistics Korea, 2025)—constitutes another critical factor limiting opportunities for clinical practicum. Kim and Che (2025) reported that the declining birth rate has led to the collapse of maternal and child health services and a shortage of qualified clinical instructors, a reality that was also reflected in the experiences of participants in this study. The quality of clinical training depends heavily on securing appropriate practicum sites and the expertise of field instructors. However, Korea's demographic crisis undermines both conditions simultaneously, thereby making digital simulation an indispensable alternative. This demographic factor represents a uniquely Korean context not commonly identified in international studies, and thus serves as a distinctive driver of the growing demand for simulation-based education.

The theme cluster of 'societal and environmental demands' aligns with previous studies that emphasized the heightened value and importance of simulation-based practicum in contexts where opportunities for clinical training are limited (White & Champion, 2017; Tolarba, 2021). However, this study revealed that, beyond academic necessity, the more immediate and pressing concern for faculty was the need to substitute simulation for clinical practicum in order to meet graduation requirements. This represents a critical contextual factor overlooked in prior research and highlights a distinctive contribution to understanding the rationale for adopting digital simulation.

Ultimately, in the context of rapidly changing demographic, social, and educational environments, digital based simulation has emerged not merely as a supplementary strategy to enhance educational quality but as an unavoidable alternative to fill the gap in clinical practicum and to sustain clinical training itself. This finding supports Ahmed and Masic's (2021) argument that the role of simulation is shifting from improvement to substitution. It further suggests that digital simulation must be newly positioned as a core tool for ensuring both the continuity and quality of practicum education in Korean nursing education.

The theme cluster of 'pressures driving the integration of digital technology-based simulation' illustrates that the adoption of simulation in nursing education is driven less by instructors' educational philosophies or purely pedagogical motivations—such as responding to learners' needs or promoting student engagement—and more by institutional pressures, curricular requirements, and administrative directives. Participants emphasized that responsibility for managing simulation courses was often assigned to faculty members of specific subjects, with this burden disproportionately placed on younger, newly appointed faculty. Park et al. (2016) similarly reported that, in Korea, novice faculty must accept all responsibilities and adapt to the institutional environment in order to survive in their academic roles, a finding that resonates with the present study.

This context partially aligns with Jeffries et al. (2011), who noted that the introduction of simulation frequently stems from administrative mandates and institutional power structures rather than voluntary faculty decisions. However, it also contrasts with much of the Western literature, where simulation adoption has been more closely linked to pedagogical outcomes, such as enhancing learning achievement and bridging the gap between theory and practice (Cant & Cooper, 2017; Fealy et al., 2023).

This study also revealed that government incentives for digital adoption, together with the directions of educational administration, have intersected with the pragmatic needs of institutions, thereby intensifying the sense of obligation for faculty to implement simulation. This reflects the institutional reality in which external visibility and resource acquisition are prioritized. However, as Almotairy et al. (2023) argued, while simulation holds the potential to enhance learning outcomes and foster continuous pedagogical development, inadequate institutional structures and reliance on top-down policy directives may, in fact, undermine its effectiveness and weaken faculty motivation. The findings also resonate with Park et al. (2016), who reported that instructors operating simulations bear heavy workloads under limited support in order to meet institutional expectations and requirements. In this context, the concern raised by Lee and Kim (2021)—that when simulation is adopted primarily as a performance indicator or institutional mandate, its burdens are unfairly shifted onto faculty, leading to frustration, job fatigue, and inconsistencies in educational quality—represents a critical pedagogical implication.

Meanwhile, the findings of this study demonstrate that faculty increasingly recognized simulation as an essential means of equipping students with the competencies required in contemporary clinical settings, particularly in response to the broader digital transformation of healthcare. In other words, these clinical demands functioned as an indirect pressure compelling the adoption of digital simulation. With the rapid integration of diverse digital

health interventions—such as smartphones, mobile applications, wearable devices, personal health records, electronic medical records, and telemedicine—into clinical practice, nursing education is likewise challenged to prepare graduates capable of adapting to these changes (Kaur et al., 2021; Navarro Martínez & Leyva-Moral, 2024). Furthermore, the findings align with recent reports that simulation-based education is increasingly incorporated into the training and orientation of novice healthcare professionals, and that digital competence has emerged as a core nursing competency for effective patient care (Booth et al., 2021; Kim et al., 2025; Yeung et al., 2023).

Therefore, the findings in the theme cluster of ‘pressures driving the integration of digital technology–based simulation’ indicate that, within the Korean context, the adoption of digital simulation has been driven less by instructors’ voluntary pedagogical innovation than by external pressures and institutional demands. Unlike previous studies that primarily emphasized the effectiveness or dissemination of simulation, this study highlights the constraints and institutional burdens experienced by faculty during the adoption process, thereby offering a distinctive contribution to the literature.

The theme cluster of ‘aspiration for faculty career advancement’ illustrates that, whereas other themes in the background of adopting digital simulation reflected its largely inevitable implementation driven by social demands and external pressures, this category highlights instructors’ internal motivations. Specifically, it captures their voluntary and strategic adoption of the modality as a means of pursuing professional growth and career development.

This study demonstrates that many participants perceived competence in operating simulation courses as an essential requirement for academic career development. Nursing education has recently shifted from traditional approaches—such as preceptorship, mentoring, and clinical shadowing—to digital platforms, accompanied by growing emphasis on strengthening faculty pedagogical digital competencies (PDC) (Delva et al., 2019). In line with this trend, the present study confirmed that digital simulation competence has effectively become a *de facto* prerequisite for newly appointed nursing faculty. This finding resonates with Hou et al. (2011), who highlighted innovative teaching competencies as a critical component of faculty qualifications, and with Shon et al. (2024), who reported that digital teaching competencies are becoming institutionalized within Korean nursing faculty development programs.

Accordingly, this study reaffirms that simulation competence has been institutionalized as both a credential and a performance criterion within higher education. At the same time, it reveals that, within the Korean context, simulation is not only driven by external institutional demands but also strategically adopted by individual faculty members as a means of academic survival and career advancement in a performance-oriented and competitive academic environment. This finding extends the concern raised by Lee and Kim (2021), suggesting that when innovation is propelled more by adaptation than by creativity, outcome-driven educational environments may risk undermining faculty autonomy and intrinsic motivation.

This study further revealed that participants perceived the adoption of digital simulation not merely as a matter of career consideration, but as part of their professional identity and educational responsibility as nursing faculty. They emphasized that persisting with traditional teaching methods in the rapidly digitalizing hospital environment could risk leaving universities behind the times. Such a sense of responsibility to align education with clinical realities resonates with Liaw et al. (2015), who argued that the sustainability of simulation pedagogy is driven by faculty identity and values, as well as with Park et al. (2016), who highlighted self-reflection and integration of experiences as essential for adaptation to the faculty role.

Unlike previous studies that predominantly framed simulation adoption as a response to external demands or as an educational strategy to bridge the theory–practice gap (Cant & Cooper, 2017; Shin et al., 2015), the present findings highlight a distinctive perspective: faculty members are motivated to adopt simulation by strong internal drivers such as professional pride, a sense of responsibility, and moral obligation.

Ultimately, the category ‘background of initiating digital-based simulation’ illustrates that, within the Korean context, digital simulation in nursing education functions both as a structural necessity imposed by social and institutional demands and as a voluntary innovation strategy grounded in faculty identity and a sense of professional responsibility.

The second category, ‘burden of course preparation’, highlights the multifaceted challenges faculty face when implementing an unfamiliar teaching method such as digital simulation. These challenges were expressed in three main dimensions: the burden of learning new pedagogical approaches, the complexity of course design, and the difficulty of developing educational resources.

The theme cluster 'burden of learning new teaching methods' illustrates that faculty experienced considerable cognitive and temporal demands while learning to operate digital-based simulations. For instructors who were not part of the digital generation, handling new digital systems and equipment posed the greatest challenge. Older participants, in particular, perceived technologies such as AI, VR, 3D, and holograms as tools belonging to domains far removed from nursing education, which elicited feelings of fear and intimidation. Compared with their younger colleagues, they reported investing significantly more time and repeated training to acquire the necessary competencies.

These findings are consistent with Park et al. (2025), who reported that instructors unfamiliar with advanced simulation modalities encounter substantial emotional and cognitive burdens during the preparation process, with technological unfamiliarity emerging as a major barrier to course implementation. They also support Ryan (2018), who noted that many nursing faculty members feel intimidated by simulation-related technologies and therefore avoid their use, while little effort has been made to address these concerns.

This study further emphasizes that such burdens are not limited to the initial phase of adopting simulation but recur each time new digital formats are introduced. In other words, the continuous evolution of simulation technologies places faculty in a cycle of repeated relearning, leading to the accumulation of educational burdens over time. These findings are consistent with Guillen-Aguinaga et al. (2025), who reported that integrating digital simulation into nursing curricula intensifies both workload and emotional labor for faculty.

In contrast, the present study diverges from earlier research that viewed the development of digital teaching competence as a one-time acquisition of technical skills (Jeffries et al., 2011). It also stands in opposition to more optimistic perspective suggesting that collaborative use of digital technologies may alleviate the burden on simulation instructors (Røykenes et al., 2023).

This study revealed that, despite devoting substantial time and effort to preparing simulation courses, many faculty members began instruction without confidence in their teaching competence, with this lack of self-assurance emerging as a major source of stress. These findings support Lee et al. (2022), who noted that faculty often commence simulation teaching without adequate technical or pedagogical competence, and Foronda et al. (2020), who identified unfamiliar equipment as the greatest operational burden. They also align with Alshehri et al. (2023), who warned that adopting simulation without sufficient faculty development may undermine instructors' self-efficacy and lead to inconsistencies in educational quality.

Such realities not only diminish the effectiveness of student learning but also risk undermining the very purpose of simulation education. The results extend the arguments of Nguyen et al. (2023), who cautioned that while digital simulation expands access to learning opportunities, its complexity and usability challenges may also generate negative consequences. They further resonate with Seo (2024), who emphasized that resolving technical problems is a prerequisite for educational effectiveness in digital health services, and with Part et al. (2025), who reported that technical malfunctions were the most serious disruption to simulation outcomes. Moreover, the findings are consistent with Lee and Kim (2021), who stressed that the provision of technical support personnel can alleviate the burden on faculty lacking technological expertise, and with Ryan et al. (2018), who argued that simulation design that mitigates faculty fears and concerns about technology can promote greater adoption.

This study also highlighted the challenges faculty members encountered in preparing for debriefing. Participants reported that the absence of clear standards or guidelines made it difficult to determine the direction of preparation and often led to psychological tension. These findings support Choi (2019), who emphasized that the success of digital simulation depends not merely on technical proficiency but on instructors' readiness to conduct reflective and structured debriefing.

Unlike prior studies that primarily focused on the technical or logistical difficulties of preparation (Jeffries et al., 2011; Carrero-Planells et al., 2021), the present findings revealed that uncertainty in preparing for debriefing constituted a distinct source of psychological stress for faculty. This underscores the lack of systematic frameworks and support programs for debriefing within faculty development for digital simulation, and indicates that its importance has not been sufficiently addressed.

The theme cluster 'complexity in class design' demonstrates that faculty members experienced considerable overload when designing simulations, as they sought to maximize learning outcomes while accommodating large numbers of students and managing limited human and material resources. Cant and Cooper (2017) emphasized that inequitable access to simulation can exacerbate disparities in clinical competence, underscoring the need for structural designs that ensure fairness in learning opportunities. The present findings also support Kim (2020), who

reported that administrative and logistical burdens intensify when large-scale simulation programs are implemented, and that adequate institutional support is essential to maintain the quality of instruction.

Furthermore, while simulation centers and dedicated staff support are relatively common in Western contexts (Jeffries et al., 2015), Korean educational institutions often lack such infrastructure, leaving individual faculty members to shoulder the entire responsibility.

The theme cluster struggles in developing educational materials highlights the burden faculty face in preparing digital simulation courses, which extends beyond scenario design to include the creation of various manuals and supplementary teaching resources often overlooked in prior research. Participants described this as an “endless task,” a perception that stands in contrast to earlier optimistic claims that digital technologies would reduce faculty workload and shift their role toward monitoring students’ self-directed learning (Nguyen et al., 2023; Nho, 2025).

In this study, faculty perceived the burden of repeatedly relearning new technologies and developing associated instructional resources with each introduction of a new digital format as more significant than the challenges of scenario design itself. These findings suggest the need to develop and share standardized tools tailored to each newly emerging digital simulation modality. Such efforts would minimize duplication in resource development, alleviate the repetitive burdens on faculty through collaborative resource creation, and ultimately enhance the consistency of simulation-based education.

Ultimately, this study demonstrates that operating digital simulation courses requires far more than the use of advanced equipment. Successful implementation cannot be achieved through macro-level design alone—such as scenarios, equipment, and assessment—but depends heavily on the hidden labor at the micro level. The findings further reveal a structural gap in which digital simulation in nursing education is often introduced in response to external demands rather than internal faculty motivation, yet the overall responsibility for its operation is disproportionately placed on individual instructors. This reflects longstanding concerns that digital simulation, when promoted as an educational innovation without sufficient administrative and institutional support, results in an inequitable burden on faculty (Lee & Kim, 2021; Yeung et al., 2023; Nho, 2025). Such burdens, in turn, may undermine sustained faculty motivation and hinder the advancement of educational innovation.

In a similar vein, Kim et al. (2020) identified shortages of facilities and personnel, along with the challenges of developing clinical case-based scenarios, as major barriers to the effective operation of simulation. These findings are consistent with Jeffries et al. (2015), who argued that the absence of systematic support for faculty preparation—such as workshops and scenario templates—undermines the continuity and quality of simulation-based education. They also align with Almotairy et al. (2023), who reported that inadequate organizational readiness in terms of personnel, resources, and time makes it difficult for faculty to implement simulation in an integrated manner.

The category Burden of course preparation consistently illustrates that the challenges faced by faculty in preparing simulation-based education are multilayered, spanning temporal, technical, emotional, and institutional dimensions. Despite the rapid expansion of demand for and use of digital-based simulation in nursing education, these findings underscore that the role of faculty remains central to maximizing its educational effectiveness.

Unlike previous studies that primarily emphasized the advantages of simulation in terms of student learning outcomes, this study highlighted the substantial preparation burdens faculty face in operating simulation-based education. These findings move beyond the narrative of simulation as merely an “innovative teaching method” and shed light on the practical challenges instructors encounter in its implementation. Importantly, they underscore that course preparation and design are not solely matters of individual pedagogical competence but are closely tied to institutional and structural support. Therefore, to enable faculty to focus on enhancing educational quality and student outcomes, robust infrastructure and sufficient human resource support at the institutional level are essential.

This study reflects experiences specific to digital-based simulation and thus has limitations in generalizing the findings to all nursing simulation contexts in Korea. Although data collection was discontinued once saturation was deemed to have been reached, the use of a small purposive sample, participants drawn from a single region, and the inherent possibility of researcher bias in qualitative research limit the interpretation and transferability of the results. Moreover, variations across institutions in the use of digital simulation modalities, the level of infrastructure, and the availability of support and personnel further warrant caution in interpretation. At the same time, these limitations underscore the need for future research to broaden and deepen the evidence base.

Based on the findings of this study, several directions for future research are suggested.

First, in-depth studies are needed to further explore the lived experiences of faculty members who operate digital-based nursing simulations, with particular attention to their perceptions of effectiveness.

Second, research should investigate the learning experiences of students participating in digital simulation courses to provide a more comprehensive understanding of its educational impact.

Third, longitudinal designs are required to trace changes in the educational role of digital simulation over time, along with international comparative studies across diverse cultural and national contexts. Such efforts would contribute to the development of more comprehensive conceptual and theoretical frameworks. Together, these directions would not only verify and extend the present findings but also lay an important foundation for advancing the global development of simulation-based nursing education.

5. Conclusion

This study explored the challenges and adaptations experienced by nursing faculty in initiating digital-based simulation within the Korean educational context. The findings revealed that digital simulation has become both a structural necessity shaped by social and institutional demands and a strategic choice grounded in professional identity and responsibility. However, faculty reported significant preparation burdens—including technological unfamiliarity, complex class design, and the continuous development of educational materials—highlighting the urgent need for institutional and structural support.

Given the demographic and educational characteristics of Korea, marked by a declining birth rate and a sharp increase in nursing student enrollment, digital-based simulation emerges as a crucial alternative to ensure the quality of practicum education and students' clinical readiness. To maximize its educational value, support must extend beyond individual faculty efforts to include systematic strategies that lower barriers to simulation, alleviate faculty workload, and foster motivation for pedagogical innovation. Such strategies should encompass technical assistance, faculty development programs, administrative and personnel support, and formal recognition of faculty contributions.

In conclusion, this study provides foundational insights into the practical challenges and adaptive processes of faculty engaging with digital-based simulation. These insights offer a valuable basis for enhancing the quality and sustainability of simulation-based nursing education.

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