

# Exploring the Evolution of Nursing Procedurals Skills, Mastery, and Competence Through Online Learning Among Students: A Qualitative Study

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## Abstract

**Introduction:** Online learning has changed the educational environment and may influence the development of nursing skills, mastery, and competence in students.

**Objective:** The study aimed to investigate how nursing students acquire procedural skills, achieve mastery, and build competence through online learning, considering the growing use of technology in healthcare education.

**Methods:** This study utilized a qualitative descriptive research approach to investigate the experiences of 32 nursing students from the Nursing Department who had undergone online procedural learning. Semistructured interviews were conducted to collect in-depth insights. Purposive sampling was used to gather data with a profound understanding of the phenomenon. The data analysis encompassed a methodical content analysis coding procedure. Independent researchers reviewed the results to validate the findings.

**Results:** Content analysis of the data identified three key themes: achieving nursing procedural knowledge through online learning, achieving nursing procedural skills with the power of online learning, and gaining procedural competence through online social and collaborative learning.

**Conclusions:** Online learning played a significant role in shaping and enhancing nursing procedural knowledge, skills, and competence, emphasizing the importance of integrating technology training modules and staying updated with emerging technologies.

## Keywords

procedural knowledge, skills, competence, online learning, nursing students, qualitative study

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## Introduction

Acquiring procedural skills is essential to nursing education and practice (Campbell et al., 2015). Procedural skills are a significant component of clinical practice, and the health disciplines are trained to carry out a range of simple to complex skills (Campbell et al., 2015). Nursing students gain the most advantage from receiving guidance from educators during practical, hands-on training and constructive feedback (Mehdipour-Rabori et al., 2021). However, constraints, particularly those arising from the COVID-19 pandemic, have significantly reduced opportunities for students to acquire new skills directly from experienced educators (Blevins, 2021) and in wartime. Some technologies can assist in overcoming these limitations (Balante et al., 2023).

Integrating technology in nursing education, especially procedural knowledge, is crucial for preparing future nurses in a technology-driven healthcare setting (Altmiller & Pepe, 2020). Despite the growing popularity of online learning, challenges persist, particularly in transitioning from traditional campus-based learning to online platforms (Alasagheirin et al., 2023; Kumar et al., 2021).

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Online learning has gained traction among nursing students, accelerated by the COVID-19 pandemic, due to challenges in traditional classroom-based training caused by social distancing measures (Chang et al., 2022; Kanagaraj et al., 2022; Mousavizadeh, 2022). Previous studies have shown that nursing students are generally satisfied with online learning. However, there are still barriers to overcome, such as low voice and language clarity, physical health barriers such as eye strain, and reliability and connectivity problems (Kumar et al., 2021). Additionally, nursing students have reported challenges with e-learning, particularly with practical components of nursing, such as demonstrating clinical competencies (Nuuyoma et al., 2019). This research may contribute by shedding light on those challenges.

A study has highlighted the benefits of social and collaborative learning usage while integrating technologies learning to develop cognitive and skill mastery among nursing students (Männistö et al., 2020). Social presence increases a sense of authenticity among participants, increasing engagement (Livesay et al., 2023). Another study highlighted the effectiveness of interactive multimedia web-based learning in enhancing nursing students' knowledge and clinical competencies (Padilha et al., 2019). However, mixed perceptions exist, with some students expressing reservations about the lack of face-to-face interaction and the need for self-motivation in online learning (Kaddoura, 2011). These varied studies contribute to understanding nursing students' evolving attitudes toward online learning, forming the basis for further investigation in this study.

Procedural knowledge is integral to nursing education, necessitating a robust foundation of knowledge and skills. Research indicates that foundational knowledge is crucial in creating a knowledge-specific frame of reference for generating new knowledge (Makhene, 2022). Procedural knowledge is the ability to execute action sequences to solve problems (Rittle-Johnson et al., 2015). Integrating traditional and e-learning methods, such as educational websites and interactive online tools for fundamental nursing instruction, can effectively supplement nursing students' clinical procedural skills (Sheikhaboumasoudi et al., 2018).

Furthermore, a systematic review of flipped classroom methodology, incorporating online learning in undergraduate nursing education, identified positive learning outcomes among students regarding knowledge, skills, and attitudes (Youhasan et al., 2021). Another study explored the influence of different feedback on students' clinical procedural skill acquisition in a prospective randomized study, demonstrating that deliberate practice with both high- and low-frequency recurrent feedback significantly improves students' early procedural skill acquisition (Bosse et al., 2015). Other studies emphasize technology's benefits and use procedural simulations to develop knowledge and skill mastery among nursing students (Chen et al., 2020; Tan et al., 2022). However, challenges and barriers persist, including a lack of basic skills, limited access to digital

health technologies, low voice and language clarity issues, physical health barriers such as eye strain, and reliability and connectivity problems (Altmiller & Pepe, 2020; Livesay et al., 2023). The acquisition of procedural knowledge, skills, and competence is becoming more concerning in light of these challenges. A study that investigated the acquisition of procedural knowledge in clinical procedures, in the case of the insertion of a urinary catheter, recognized the importance of fostering safe and authentic learning environments where learners actively engage in hands-on experiences and assess their progress (Evi-Colombo et al., 2023).

## Review of Literature

The study is grounded in constructive learning theory, an educational framework that highlights the active role of learners in constructing their own knowledge (Jonassen, 2013). Constructivism emphasizes the importance of hands-on experiences, reflection, and collaboration in learning (David, 1991). By incorporating this theory, a study found that an online learning environment motivates nursing students to engage actively in procedural skill exercises, reflect on their experiences, and collaborate with peers to achieve a deeper understanding (Nestel et al., 2011).

However, uncertainties persist regarding the effectiveness of online training and the role of technology integration, along with social and collaborative learning, in developing procedural competency in nursing students (Campbell et al., 2015; Gause et al., 2022; Grundgeiger et al., 2023). This study introduces a pioneering exploration of constructive online (that develops and renews continuously) nursing procedural learning, focusing on developing nursing students' procedural knowledge, skills, and competence.

Aligned with constructive learning theory, the research aim is to explore the development of procedural knowledge skills through online learning among nursing students. It represents a constructive approach to understanding the development of nursing procedural knowledge, skills, and competence and investigating the role of constructive online learning technology integration in online constructive learning among nursing students.

## Methods

### Research Design

A qualitative descriptive research design (Bradshaw et al., 2017) was utilized to explore the development of nursing procedural competence in online learning while investigating the role of technology integration among students. We selected a qualitative descriptive methodology to capture detailed insights into nursing procedural knowledge, skills, and competence evolution through online learning among students, emphasizing the depth and richness of their experiences (Husserl, 2013).

## Sample

The participants were 32 nursing students from the School of Health Sciences at the university. Participants were enrolled by the PI (Principal Investigator) through social networks, such as WhatsApp. Participation in the research was voluntary, and participants signed informed consent forms. An opening email specified the study's aims and importance, encouraging the students to participate. Participants' average age was 27 (SD = 4.5). For other research background characteristics, see Table 1.

Table 1 shows that most of the participants were female (28; 87%), single (24; 75%), secular (20; 63%), and without children (26; 82%). Most considered their socioeconomic status good (28; 88%).

## Inclusion and Exclusion Criteria

The inclusion criteria were undergraduate nursing students who have experienced online learning to acquire procedural knowledge, skills, and competence as part of their nursing education. Exclusion criteria encompass individuals not pursuing a nursing degree and those without experience with online learning in nursing education.

## Procedural Online Learning in Nursing Education

The procedural online learning program incorporated various online learning methods, including comprehensive e-learning modules that offered in-depth insights into various nursing procedures like wound care management, intravenous line insertion, and basic medication administration protocols. Additionally, short educational movies and documentaries were strategically utilized to provide visual demonstrations and real-life case scenarios, facilitating a deeper

understanding of complex nursing procedures. These resources were thoughtfully supplemented with an interactive online forum query tool, fostering active engagement and continuous self-evaluation among nursing students, enhancing their comprehension, and maintaining critical procedural skills. This learning program was open and allowed the students to self-learn at any place at any time within the 4-year nursing education.

## Research Instruments

The study employed semistructured interviews as a data-collection tool (DiCicco-Bloom & Crabtree, 2006). The interview guide was constructed for the study, containing opening, continuation, and listing questions (Kvale, 1988). Questions included in the interview guide aimed to explore participants' perceptions and experiences related to knowledge, skills, and competency mastery development within the online learning environment. The interview questions were carefully crafted to capture critical dimensions of the research topic. Before data collection, the interview guide was pilot-tested with a small sample of participants to assess its clarity, relevance, and effectiveness in eliciting in-depth responses. Based on the pilot study feedback, minor revisions were made to refine and enhance the interview questions for the primary data collection phase. The interview guide included questions like "How has online learning contributed to developing procedural knowledge, skills, and eventually competency mastery during your nursing education?" "Can you provide examples of how technology has improved your understanding and mastery of nursing procedures within the online environment?" "Describe your experiences with social and collaborative learning within the context of online learning." and "If and How did the interactions with peers contribute to your knowledge, skills, and competency mastery?"

**Table 1.** Frequency and Percentage of Background Characteristics.

Background characteristics	Nursing students (N = 32)	
	Frequency	Percent
Gender	Female	28 87
	Male	4 13
Status	Single	24 75
	Married	8 25
Religious	Secular	20 63
	Traditional	8 25
	Religious	4 12
Children	Yes	6 18
	No	26 82
Socioeconomic status	Poor	2 6
	Good	28 88
	Very good	2 6

## Data Collection

A purposive sampling approach (Polit & Beck, 2018) was used to recruit 32 students from the Nursing Department, which provided in-depth, detailed information regarding the development of procedural skills in nursing students through online learning and examined the role of technology integration. This sampling strategy is most commonly used in descriptive research, as it allows for selecting participants who have rich knowledge of the phenomenon (Husserl, 2013).

The interviews were performed online using the Zoom platform and lasted 40 minutes each. All interviews were audio and video recorded, as were the footnotes inscribed by the interviewer. The interviewers implemented several strategies to minimize potential disruptions and ensure a positive participant experience. To address technical communication barriers, including audio/video quality and delays,

the interviewers ensured a reliable technical platform and encouraged clear and concise language. Regarding privacy and confidentiality concerns, the interviewers ensured that the interview platform complied with privacy procedures and reminded participants to choose a private location for the interview. Furthermore, the interviewers enhanced engagement and collaboration by introducing a brief introduction, using active listening techniques, and incorporating elements to facilitate discussion. The interviews were conducted by an investigator with a Ph.D. in health, education, and technology and a female nurse researcher and educator with over 10 years of experience in qualitative research. The data gathered lasted until saturation was accomplished, ensuring research reliability and reducing bias (Hsieh & Shannon, 2005). No participants dropped out during the study. The study pursued the Consolidated Criteria for Reporting Qualitative Studies (COREQ) (Tong et al., 2007).

### **Ethical Considerations**

This study received approval from the Ethics Committee (Institutional Review Board—IRB) at Ariel University, with confirmation number AU-HEA-GG-20200727. The research team asked for informed consent, following a clear explanation of the research objectives to all participants and their right to withdraw from research at any time. Confidentiality of participants and data was carefully maintained, and it was assured that any published information would be presented without identifying information.

### **Data Analysis**

The data underwent continuous, systematic content analysis (Hsieh & Shannon, 2005). It involved a structured and methodical examination of the data-identified patterns, themes, and categories within the dataset. This process included several iterative steps, data familiarization, coding, categorization, theme development, and interpretation conducted rigorously and systematically to ensure the analysis' reliability and validity. Afterward, the data were organized into broader conceptual themes and later subjected to authentication and improvements. The findings were reviewed by a team of three independent researchers, who arrived at similar conclusions (DiCicco-Bloom & Crabtree, 2006; Polit & Beck, 2018) for validation—each independent coder (coded a randomly selected subsample [20%]) of the transcripts. Inter-coder percent agreement of 90% was achieved. Any coding discrepancies were discussed and agreed upon (O'Connor & Joffe, 2020).

### **Results**

The results yielded three main themes tracing the evolution of procedural knowledge, skills, and competence among nursing students through online learning. The first theme

revolves around their adaptation to the online learning environment (achieving nursing procedural knowledge with the introduction of online learning), encompassing their initial struggles, gradual familiarity, and eventual comfort with the online learning medium and achieving nursing procedural knowledge. Following this, the second theme underscores the pivotal role of technology in augmenting nursing procedural knowledge to skills (moving forward for achieving nursing procedural skills with the power of online learning), encompassing students' recognition of their technology preferences and its contribution to procedural skill abilities. Lastly, the third theme highlights the social and collaborative dimensions of their learning process (gaining nursing procedural competence via online social and collaborative learning), as students socially engage, collaborate, and eventually belong to a learning team, mirroring real-world clinical settings, which eventually lead them to master procedural competence. These themes collectively offer a comprehensive insight into the profound transformation experienced by nursing students within the dimension of procedural online learning.

### **Achieving Nursing Procedural Knowledge With the Introduction of Online Learning**

This theme primarily focused on the development of nursing students, from novices to experienced individuals, in the context of online nursing procedural learning.

#### ***Oriented to the Online Learning Environment***

The students become familiar with the technology of the online setting and undergo a learning process as they navigate these new online spaces. One student reported:

“At first, the online learning environment was a bit overwhelming. I had to figure out how to navigate the online environment and make the most of the available tools.” (GG)

Another report:

“In the beginning, I struggled; I needed to immerse myself in the digital environment of online learning; it is needed since it forms a future where knowledge exceeds physical boundaries.” (AD)

In the initial stages of their online learning experience, both students expressed their early challenges and their subsequent recognition of the expansive opportunities that the digital learning platform offered.

### ***Achieving Nursing Procedural Knowledge via Online Training***

As students become more comfortable with the online environment, they become acquainted with nursing procedural knowledge via online training. This involves their first knowledge of hands-on essential nursing abilities, such as catheter insertion and Zonda procedure skills, through realistic online scenarios.

“As I got more comfortable with the online environment, I started my initial acquaintance with nursing procedural knowledge. It was fascinating to learn via online scenarios, and it allowed me to take my first steps toward knowledge by practicing clinical procedures.” (SG)

“Through my first step in practice in the online environment, I could feel myself starting to improve my technology skills. After each phase, I initially familiarized myself with the difference in hands-on nursing procedures, such as catheter insertion and Zonda procedure skills.” (SF)

They reflected on their engagement with nursing procedural knowledge online, highlighting their growing comfort and the gradual improvement in their technological proficiency as they familiarized themselves with various hands-on nursing procedures.

### ***Preparedness to Further Expertise Nursing Procedural Knowledge via Online Learning***

Students acknowledge that online experiences of learning nursing procedural knowledge have prepared them for further, more advanced practice by providing them with the initial necessary theoretical and procedural knowledge. They now feel ready to engage in more learning.

“I felt prepared by the end of the online nursing procedural learning sessions. The experience gave me the initial theoretical and procedural knowledge, and I felt more professionally confident that online learning would continue.” (WQ)

Through numerous online learning experiences, the students developed strong foundational and practical knowledge, fostering deep confidence and readiness to explore more advanced aspects of nursing procedural education.

Other reported:

“After several online learning rounds, I recognize that this foundation has equipped me with the essentials required for more advanced practice, fostering a profound readiness to examine deeper learning.” (WQ)

Other stated:

“I went through several courses, I felt prepared, gaining nursing practical knowledge and boosting my confidence for continued online learning.” (UP)

They underscored technology’s significant role in building their proficiency and confidence in nursing procedures.

### ***Moving Forward for Achieving Nursing Procedural Skills With the Power of Online Learning***

After gaining nursing procedural knowledge, the students feel prepared to move forward and learn nursing procedural skills via online learning; they recognize technology’s role in enhancing their procedural skills to a level aligned with professional nursing standards.

### ***Shaping Nursing Procedural Skills by Acknowledging Students’ Online Learning Preferences***

The students develop personal preferences for online learning, allowing them to develop their nursing procedural skills.

“Knowing my personal technology preferences made my learning more engaging and interactive. I started appreciating online learning in shaping nursing procedural skills” (AB)

“Online learning completely transformed how I learned. Tailoring my learning to my personal tech preferences made it more interactive and engaging, leading to a deeper understanding of nursing procedural skills.” (ER)

Another one said:

“Totally embracing online learning; it is great for my personalization learning pace. Witnessing its great impact on my procedural skills.” (YO)

### ***Expertise in Nursing Procedural Skills by Using Online Learning Pros***

After using technology for a while to learn enhanced procedural skills, the students realize that technology has assisted them in achieving relevant procedural skills. They have used technology to record, assess, and improve their performance, ultimately achieving nursing procedures.

“I used online learning pros to record and review my procedural skills performances. It helped me pinpoint specific areas for improvement and ultimately expertize those skills.” (ET)

One student emphasized:

“I used online learning technology to assess my procedural skills repeatedly. It helped me identify areas for improvement and ultimately make me an expert in those skills.” (E, Q)

With a similar opinion, another student stated:

“I used online learning technology to reflect my procedural skills and investigative areas for improvement.” (PP)

### **Gaining Nursing Procedural Competence via Online Social and Collaborative Learning**

Students initiate online learning interactions that foster collaboration and the emergence of teams, ultimately leading to the development of these competencies.

#### *Gaining Nursing Procedural Competence Through Online Social Learning*

Students achieve procedural nursing competency by using social interactions to ask questions online. One reported:

“Nursing online learning allowed me to interact with my peers, even though we were not physically present. Online forums allowed us to ask questions regarding procedural competence.” (RT)

Another report:

“Through nursing procedural online learning, I randomly ask two peers about Zonda insertion in the online forum, and they help me.” (HK)

#### *Gaining Nursing Procedural Competence via Online Learning Collaboration*

The learning process promotes online collaboration among students, encouraging them to work together and learn collectively. By sharing knowledge and offering support, they recognize the importance of collaboration while simultaneously enhancing their nursing procedural skills.

“After the nursing procedural online training round, we collaborated to learn together. I shared insights, discussed strategies, and even collaborated and debated nursing procedural skills; it allowed me to be competent.” (WE)

Reflecting on the collaborative learning experience, another student expressed:

“Collaborative learning enriched our discussions, strategies, and debates, ultimately enhancing my procedural nursing competency.” (JL)

Another student highlighted the impact of visual learning tools on learning together, stating:

“The utilization of short educational movies and interactive e-learning modules significantly enhanced our competency. We could visualize complex techniques, fostering a deeper understanding of critical nursing practices together.” (EW)

### *Nursing Procedural Competency Through Team-Based Online Learning*

The online learning collaboration initiative created constant team-based nursing procedural learning. Students learned to perform within the frame of a constant team, which may mirror real clinical team-based nursing environments.

“Working as a team, meeting once a week, enhanced our procedural competency. We became proficient not just as individuals but also as a cohesive unit, ready for real clinical settings.” (HJ)

Other student reports:

“My learning team helped me acquire essential procedural competencies and discuss real-world clinical dynamics situations, preparing me for professional healthcare teamwork.” (LB)

One nursing student emphasized the significance of team meetings and learning, stating:

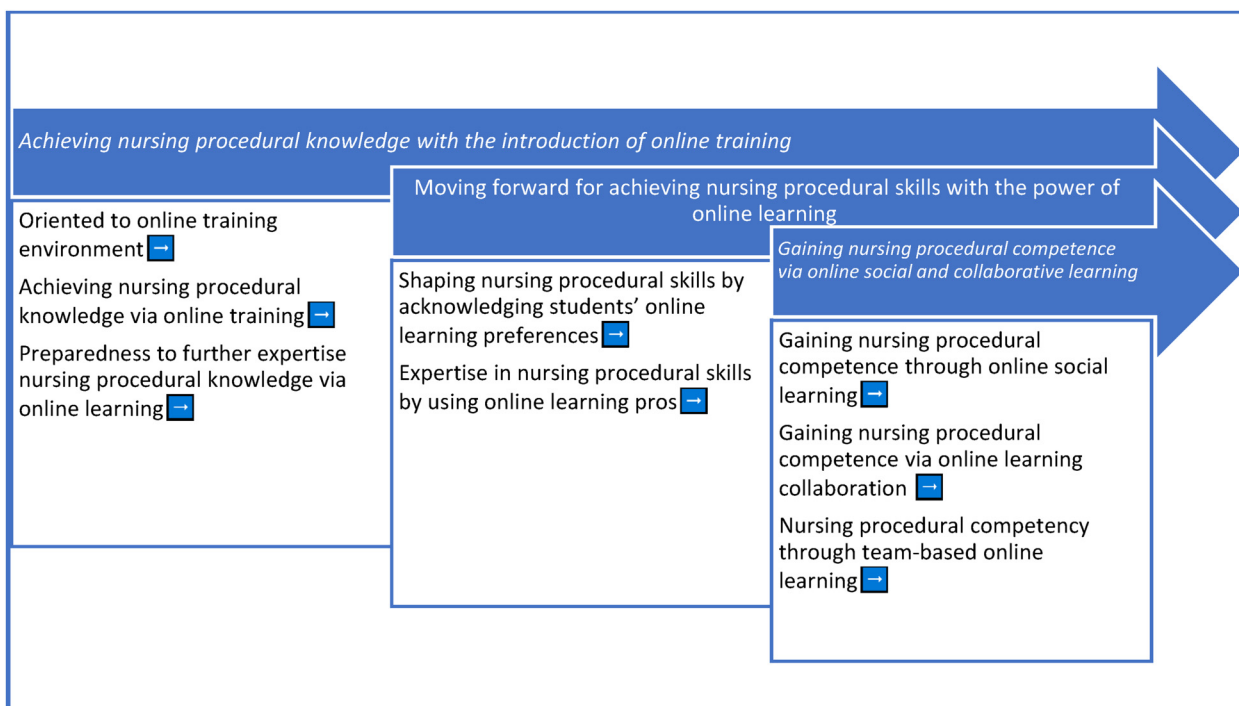
“The weekly team meetings enhanced my nursing procedural competence, effectively preparing us for the demands of real-world clinical practice.” (ER)

For themes and subtheme summarization related to research question results, see Figure 1.

Figure 1 shows that the themes represent a cohesive path, with each phase building upon the previous one. Integrating online individual and cooperation learning, aloud procedural knowledge, skills, and competence.

## **Discussion**

The study aimed to explore the development of procedural knowledge skills through online learning among nursing students. Three themes emerged. The first theme is achieving nursing procedural knowledge with the introduction of online learning, fostering preparedness for further expertise in this field via online learning. The second theme is achieving nursing procedural skills with the power of online learning, shaping and expertise these skills by acknowledging students' online learning preferences and advantages. The



**Figure 1.** Themes and Subtheme Summarization.

third theme is gaining procedural competence via online social collaborative and team-based learning.

The first theme evolved from the study, achieving nursing procedural knowledge with the introduction of online learning. It is related to students' adaptation to the online learning environment, encompassing their initial struggles, gradual familiarity, and eventual comfort with the digital medium (Biber et al., 2021; Martin et al., 2021). To support students in adapting to online learning, it is important to remove barriers and enhance their online learning resources, including internet and connectivity issues, ensuring students have access to the necessary technology (El-Sabagh, 2021; Martin et al., 2021).

The second theme evolved from the study, achieving nursing procedural skills with the power of online learning. Overall, the students felt that online learning helped them to achieve procedural skills. Similar to this research, combining e-learning and hands-on exercises improves students' procedural skills acquisition during medical training (Grundgeiger et al., 2023). Online training offers an opportunity to work via observation and feedback, with repeated practice, assisting learners with skill acquisition and retention (Burgess et al., 2020). Other former research suggests that nursing students' training needs and procedural skills should be identified and addressed to improve their confidence and competence (Campbell et al., 2015), as online training suggests.

The third theme found in this study is gaining nursing procedural competence via online social and collaborative

learning. It highlights the social and collaborative dimensions of students' learning process, as students engage, collaborate, and eventually belong to procedural competency learning teams, mirroring real-world clinical settings. This study highlighted the need for further research on the effectiveness of remote online learning platforms regarding achieving the intended learning outcomes of clinical courses (Suliman et al., 2021). Dissimilar to this study's findings, another study demonstrated that digital educational technologies decreased interaction and provided less physical contact, concluding that the impact of digital education technology used in personalized nursing care is yet to be understood (Loureiro et al., 2021). These differences may evolve due to the timing, before, and after COVID-19 pandemic closures.

### Strengths and Limitations

The research strength is anchored in the insight that online learning demonstrates advantages in developing nursing students' procedural knowledge, skills, and competence through enhanced access to educational resources, preparation for advanced expertise, tailored learning experiences based on individual preferences, and facilitation of social and collaborative learning opportunities. These highlight the effectiveness of online learning in fostering comprehensive understanding and proficiency in nursing procedures among students, ultimately contributing to their professional growth and readiness for clinical practice.



There are three research limitations. The research's single-site focus within a university's School of Health Sciences may limit the qualitative findings to reduced nursing education contexts. Moreover, while the qualitative descriptive approach in the research captured rich experiential data, it may have introduced subjectivity in interpreting the findings. Also, relying solely on self-reported experiences through interviews might have introduced recall bias or underreporting challenges faced during online nursing procedural learning.

### Future Research Recommendation

There are three future research recommendations. Future qualitative research should include multisite studies across universities to further qualitative findings related to diverse nursing education contexts. Moreover, integrating mixed-method approaches in future studies will offer a more comprehensive understanding of nursing students' experiences in nursing procedural online learning. Also, future research should incorporate observational methodologies such as video recording and real-time data collection alongside self-reported experiences to ensure a more objective assessment.

### Implications for Practice

Based on the findings, several practice recommendations are proposed to optimize the utilization of online learning in cultivating nursing procedural knowledge, skills, and competence. It is important to provide comprehensive orientation programs, implement mentorship initiatives, and seek continuous feedback from students to enhance their adaptation to the online learning environments, especially regarding the increasing shift toward online learning in nursing education (Green & Shorer, 2022). Moreover, it is important to integrate technology training modules, establish performance tracking systems, and stay current with emerging technologies to enhance nursing procedural skills.

### Conclusions

This study explored the development of procedural knowledge, skills, and competence through online learning among nursing students. Three main themes emerged from the analysis. Firstly, the introduction of online learning facilitated the achievement of nursing procedural knowledge, enhancing preparedness for further expertise in this field through online platforms. Secondly, online learning played a significant role in shaping and enhancing nursing procedural skills by acknowledging students' preferences and leveraging the advantages of online education. Lastly, gaining procedural competence was facilitated through online social and collaborative learning and team-based learning approaches. These findings highlight the importance and effectiveness of online learning in developing gradual

bites of nursing procedural knowledge, skills, and competence among nursing students (Green, 2021).

Guidelines and Standards Statement: Reporting guideline was used. The study pursued the Consolidated Criteria for Reporting Qualitative Studies (COREQ) (Tong et al., 2007)


### Declaration of Conflicting Interests

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