Review Article

A Comprehensive Review of Technological Innovations in Teaching Clinical Nursing Skills: A Scoping Review

Abstract

Background: Nursing professionals require practical clinical skills to ensure patient-centered and safe care. Traditional teaching methods face challenges, such as limited student engagement and resource intensity, prompting a shift toward integrating technology into clinical nursing education. This scoping review aims to explore and categorize technological innovations used in teaching clinical nursing skills, thereby supporting nursing educators and policymakers. **Materials and Methods:** Following Arksey and O'Malley's five-stage scoping review methodology and PRISMA-ScR guidelines, we conducted a systematic literature search across MEDLINE, EMBASE, Scopus, WoS, CINAHL, ERIC, and PsycINFO databases. Inclusion criteria encompassed studies from 1995 to 2023 focusing on technology used to teach clinical nursing skills to students or nurses. The data from 58 studies were charted and synthesized through template analysis to identify key technological features. **Results:** The review identified seven primary categories of technological features: Content, accessibility, learning environment, usability, pedagogical approach, security, and ethical issues. Mobile applications, virtual simulations, and educational videos were the most frequently employed technologies. Findings highlight how these tools enhance skills acquisition, accessibility, and user engagement while raising ethical considerations, particularly around privacy and data security. **Conclusions:** Integrating educational technologies into nursing curricula has demonstrated significant potential to enhance clinical skill development. However, successful adoption necessitates addressing ethical issues and balancing technology with traditional teaching methods. Future research should examine the long-term impact of these innovations on clinical competence and explore strategies to mitigate ethical concerns.

Keywords: *Clinical competence, educational technology, nursing education, simulation training*

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Introduction

Nurses play a vital role in maintaining and promoting healthcare across diverse settings.[1] Their clinical competence directly influences patient safety and outcomes, underscoring the importance of rigorous training.[2] Clinical practice serves as a cornerstone of nursing education, providing students with hands-on experience to refine their skills and prepare for real-world challenges.[2] However, recent years have exposed critical gaps in the quality and accessibility of clinical training environments, raising concerns about the preparedness of nursing graduates.[1]

Traditional educational methods, heavily reliant on passive, lecture-based instruction, face significant limitations. These approaches demand substantial resources, often require students to leave work environments, and restrict practical exposure.[1] More critically, their passive nature limits meaningful engagement and active learning.[3] Studies highlight widespread student dissatisfaction, citing insufficient clinical supervision and missed learning opportunities during placements.[4,5] Such gaps reveal a systemic shortfall: Conventional methods fail to deliver adequate hands-on practice, leaving graduates underprepared for clinical demands. Compounding this issue, students frequently lack opportunities to observe or participate in clinical procedures, further widening the readiness gap.[6] As skill-building opportunities diminish, educators must adopt more effective, learner-centered strategies that prioritize active participation, critical thinking, and real-world application.[1,7]

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Educational technology has emerged as a transformative solution to these challenges. Digital tools—such as virtual reality, telehealth platforms, and e-learning systems—offer flexible, interactive, and scalable alternatives to traditional training.[8] Universities globally are integrating these technologies to enhance engagement, personalize learning, and bridge clinical training gaps.[1] Simulations, mobile devices, and podcasts not only reduce logistical barriers but also foster innovative clinical decision-making.[9,10] Despite these advances, technology adoption in nursing education remains inconsistent and underexplored.[11-13] This scoping review systematically examines technological innovations in clinical nursing education, aiming to equip educators, policymakers, and practitioners with evidence-based strategies to enhance training and, ultimately, patient care outcomes.

Materials and Methods

This scoping review systematically examined the literature on educational technologies in nursing clinical education from 1995 to January 2024, following Arksey and O'Malley's established five-stage methodological framework for scoping reviews.[14] The study adhered to PRISMA-ScR reporting guidelines[15] and JBI methodology,[16] forming part of a broader investigation into technology-enhanced nursing education. The five-stage process began with identifying key research questions about current educational technologies and their features in nursing clinical skills training. This guided the subsequent comprehensive search strategy across eight major databases (MEDLINE, EMBASE, Scopus, etc.) and manual journal searches, developed with librarian expertise using controlled vocabulary and Boolean operators. The search specifically targeted studies at the intersection of clinical competence, nursing education, and instructional technologies, with the full strategy detailed in Table 1.

The review process continued with rigorous study selection using explicit inclusion/exclusion criteria [Table 2], where two independent reviewers screened titles, abstracts, and full texts, resolving disagreements through discussion or third-party adjudication. The 1995 cutoff was chosen to capture the emergence of modern digital education technologies. A PRISMA flow diagram [Figure 1] documents the screening process, which identified 58 relevant studies after duplicate removal and reference mining. For data charting, the team developed and refined a JBI-compliant extraction tool through pilot testing, systematically capturing study characteristics, populations, technologies examined, and educational outcomes. Two researchers independently extracted data with verification processes to ensure reliability, while maintaining blinding to minimize bias during this critical analytical phase.

The final stage involved collating, summarizing, and reporting results through both quantitative and qualitative synthesis methods. Descriptive statistics characterized study demographics, while template analysis—involving iterative coding and theme development - explored patterns in technology implementation and effectiveness.[17] Throughout all stages, the study maintained rigorous ethical standards, obtaining institutional review board approval and adhering to Helsinki Declaration principles. The consultation phase (optional sixth stage) involved ongoing dialogue with nursing educators to contextualize findings, ensuring the review's practical relevance for educational policy and practice. This robust methodological approach enabled comprehensive mapping of the evidence landscape regarding technological innovations in nursing clinical education.

Ethical considerations

Ethical considerations were paramount throughout the study. Before data collection, ethical approval was obtained from the Ethics Committee of Shahid Beheshti University of Medical Sciences, with approval number "IR.SBMU.SME.REC.1402.021." All procedures were conducted following the Declaration of Helsinki. All sources were cited correctly, and data were synthesized in an unbiased manner to reflect a comprehensive overview of the current literature on educational technologies in nursing clinical education.

Results

The results are presented in three sections: First, an overview and descriptive summary of the included studies; second, the current educational technologies in nursing clinical education; and third, the technological features used in nursing clinical skills education.

Part 1: Descriptive summary of the included studies

A total of 58 studies were included in this review, published from 1995 to 2024. Of these, 56 were articles and two dissertations. Three studies (5.10%) were published between 2006 and 2010, 21 studies (36.20%) between 2016 and 2020, and 24 studies (41.30%) between 2021 and 2024. The countries of India,[18] Canada,[19] Italy,[20] Spain,[21] and Norway[22] each had one study. Brazil,[23,24] France,[25,26] Hong Kong,[27,28] Thailand,[29,30] and Singapore[31,32] had two studies. The United Kingdom had three studies,[33-35] Australia had four studies,[36-39] South Korea had five studies,[40-44] the United States had six studies,[45-50] Taiwan had seven studies,[51-57] Iran had eight studies,[58-64] and Turkey had ten studies.[65-73]

81% of the research included nursing students as participants, 17% featured nurses and other healthcare professionals, and 2% involved nursing educators. The entirety of the studies concentrated on undergraduate nursing students, with none encompassing cohorts from master's or doctoral nursing programs. The methodology comprised 46 quantitative studies, three qualitative studies, eight mixed-method studies, and one with

Table 1: Databases, search strategy, and number of retrieved studies

	1. Pubmed	
1	Clinical Competence OR clinical skill OR procedural skill OR clinical competency OR clinical practice	347,372
2	Nurse OR Nursing student	525,120
3	Education, Nursing OR education OR learning OR training OR teaching OR instruction	1,519,619
4	(mobile OR apps OR technology OR game OR gamification OR software)	833,526
5	1 AND 2 AND 3 AND 4	1227
6	Filters: from 1995 to 2024	1190
	2. Embase	
1	exp clinical competence/OR (clinical skill OR procedural skill OR clinical practice OR clinical competence).ab,ti.	429,447
2	Nurse*.ab,ti	571,203
3	exp nursing education/OR (education OR learning OR training OR teaching OR instruction).ab,ti.	1,876,116
4	(mobile OR app? OR technology OR game? OR gamification? OR software?).ab,ti.	1,150,668
5	1 and 2 and 3 and 4	1250
6	limit 5 to yr=”1995 -Current.”	1213
7	6 not Conference Abstract.pt.	991
	3. APA PsycINFO	
1	(Clinical skill? OR procedural skill? OR clinical practice OR clinical competency*).ab,ti.	56,169
2	Nurse*.ab,ti.	112,500
3	exp Nursing Education/OR (education OR learning OR training OR teaching OR instruction).ab,ti.	995,151
4	(Mobile or app? OR technology or game? OR gamification? OR software?).ab,ti.	188,847
5	1 and 2 and 3 and 4	178
6	limit 5 to yr=”1995 -Current”	178
	4. CINAHL	
1	(MH “Clinical Competence+”) OR TI ((clinical skill? OR procedural skill? OR clinical practice OR clinical competency*)) OR AB ((clinical skill? OR procedural skill? OR clinical practice OR clinical competency*))	168,196
2	TI nurse* OR AB nurse*	624,127
3	(MH “Education, Nursing+”) OR TI ((education OR learning OR training OR teaching OR instruction)) OR AB ((education OR learning OR training OR teaching OR instruction))	728,386
4	TI (mobile OR app? OR technology OR game? OR gamification? OR software?)) OR AB (mobile OR app? OR technology OR game? OR gamification? OR software?))	242,367
5	S1 AND S2 AND S3 AND S4	1272
6	Limiters - Published Date: 19950101-20231231	1246
	5. Scopus	
1	TITLE-ABS-KEY (“clinical skill?” OR “procedural skill?” OR “clinical practice” OR “clinical competency*”)	610,505
2	TITLE-ABS-KEY (nurse*)	965,035
3	TITLE-ABS-KEY (education OR learning OR training OR teaching OR instruction)	5,523,901
4	TITLE-ABS-KEY (mobile OR app? OR technology OR game? OR gamification? OR software?)	4,933,497
5	AND 2 AND 3 AND 4	1856
6	5 AND PUBYEAR AFT 1994	1787
	6. Web of Science Core Collection	
1	TS=(“clinical skill?” OR “procedural skill?” OR “clinical practice” OR “clinical competency*”)	266,294
2	TS= nurse*	418,588
3	TS= (education OR learning OR training OR teaching OR instruction)	3,287,080
4	TS=(mobile OR app? OR technology OR game? OR gamification? OR software?)	2,137,210
5	1 AND 2 AND 3 AND 4	649
6	5 AND PY=1995-2024	648
	Proquest	
	(“nursing student” AND” clinical skills” AND “education” AND “technology “)	181
	Medical and nursing Journal articles	42
	Google scholar	
	All intitle: “nurse” OR” nursing student” AND” clinical skills” OR “procedural skill” AND “education” OR “training” AND “technology “OR “APP” OR “software”	218

an unspecified methodology. In the included studies, data collection methods included questionnaires in 38, open-ended queries in 7, checklists in 13, multiple-choice questions in 15, Objective Structured Clinical Examination

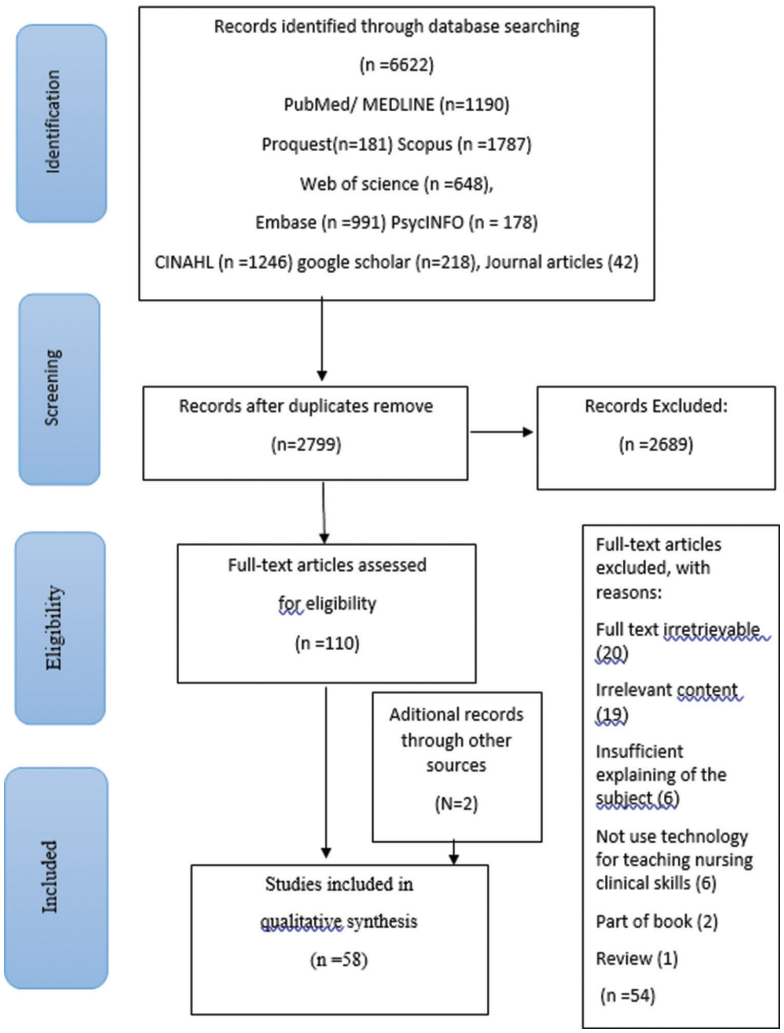

Figure 1: PRISMA-ScR flow diagram indicating the study selection process

Table 2: Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
All research designs except reviews Original research, editorials, conference papers, reports, thesis	Review studies and books
In health higher education	Using traditional and non-electronic educational methods
Using technologies to teach clinical nursing skills to nursing students or nurses	The research community should not be nursing students or nurses
From the beginning of 1995 until September 2023	Use technology to teach things other than clinical nursing skills
The full text of the article is available	

(OSCE) in five, interviews in two, and Direct Observation of Practical Skills (DOPS) in two cases.

Part 2: The current educational technologies in nursing clinical skills education

Types of technology used in nursing clinical skills education, according to included studies, are social media 5 (8.60%), Online web-based course 8 (13.70%), mobile application 13 (22.40%), educational videos 8 (13.70%), virtual reality 9 (15.50%), serious game and web-based game 7 (12%), augmented reality 1 (1.70%), e-book 1 (1.70%), phone-based 3 (5.10%), virtual patients 1 (1.70%), and e-simulation 2 (3.40%) [Table 3].

Areas of technology used in nursing clinical skills education, according to included studies, are premature infant care 1 (1.70%), stroke patient care 1 (1.70%), airway care 2 (3.40%), Preparation of craniotomy table equipment in the operating room 1 (1.70%), infection control and patient safety 3 (5.10%), Cardiopulmonary resuscitation (CPR) 3 (5.10%), childbirth and its care 2 (3.40%), care during hemodialysis 1 (1.70%), chest tube care 1 (1.70%), physical examination 3 (5.10%), chronic disease care 1 (1.70%), arrhythmia interpretation skill 1 (1.70%), Non-technical care (problem-solving, communication, teamwork, decision making, leadership) 11 (18.90%), care of the patient under mechanical ventilation 1 (1.70%), type 2 diabetes patient care 1 (1.70%), and Basic nursing skills (injections, catheterization, wound care, drug administration) 25 (43.10%).

Table 3: Types of technologies used in the included studies

Type of technology	Studies	*n* (%)
Social media (multimedia)	P. Anand 2021, Ş. Bilgiç 2021, M. M. Ghahfarokh i2022, M. Motamed-Jahrom i2022, A. K. Vicdan 2020	5 (8.60)
Online web-based course	L. Atack 2008, M. Barisone 2019, A. Erol 2020, S. Gerdprasert 2010, S. Gerdprasert 2011, D. Öztürk 2014, R. Sheikhaboumasoudi 2018, V. E. C. Sousa Freire 2018	8 (13.70)
Moblile application	C. R. A. Baccin 2020, S. B. Bayram 2019, H. Y. Chang 2021, C. J. Ho 2021, L. L. Hsu 2019, X. L. Huang 2021, S. Jonassen 2021, J. Kang 2018, H. Kim 2018, S. J. Kim 2017, Y. Kurt 2021, M. Radmard 2021, I.-Y. Yoo 2015	13 (22.40)
Educational videos	A. Bahar 2017, A. F. Cardoso 2012, J. P. C. Chau 2021, Y. H. Chuang 2018, E. G. İsmailoğlu 2020, N.-J. J. Lee 2016, Heji Mohammad Nourozi 2013, C. Catling 2014	8 (13.70)
Virtual reality	M. S. Bracq 2019, K. R. Breitkreuz 2021, H.-Y. Chan 2021, M. A. Rushton 2020, H. Singleton 2022, P. C. Smith 2015, G. Mirzayan 2023, J. Y. Wong 2022, S. Y. Yang 2022, S.J.	9 (15.50)
Serious game and web-based game	A. Calik 2022, H. M. Johnsen 2016, A. J. Q. Tan 2017, A. Blanié 2020, N. F. Cook 2012, D. Stanley 2011, Wright 2022	7 (12.00)
Augmented reality	C. Rodríguez-Abad 2022	1(1.70)
E-book	S. T. Chuang 2022	1 (1.70)
Phone based	T. N. Ghezeljeh 2021, D. Kes 2021, M. Saffari 2019	3 (5.10)
Virtual patients	M. Peddle 2019	1 (1.70)
E-simulation	F. E. Bogossian 2015, S. D. Reyes 2008	2 (3.40)
Sum		58 (100.00)

Part 3: Analytical summary of the included studies

The technological features used in nursing clinical skills education

The final template consists of various technological features in nursing clinical skills education. The features were categorized according to their content, accessibility, environment, usability, pedagogical approach, security, and ethical issues [Table 4].

Content

The scoping review identified a range of features focusing on the content of technological tools used in nursing clinical skills education. These features grouped into three main categories: This combination of features allows nursing programs to deliver comprehensive and engaging clinical skills education.[23,29,56,64,66-67]

Accessibility

The review identified a variety of platforms that enhance the accessibility of technology-based nursing education. This diverse range of platforms allows nursing programs to cater to different learning styles and preferences, ensuring greater accessibility for all students.[52,58,66,68]

Learning environment

The technological features identified in the review contribute to a positive and effective learning environment for nursing students. These elements contribute to a more effective and enriching learning experience for nursing students.[23,26,52,58,70]

Usability

The scoping review identified features that enhance the usability of technology-based nursing education. This combination of features ensures that technology-based learning is not only accessible but also user-friendly and promotes a practical learning experience for students.[22,45]

Pedagogical approach

The review identified various features that support different pedagogical approaches in nursing clinical skills education. By supporting these diverse pedagogical approaches, technology-based learning caters to different learning styles and fosters a deeper understanding of clinical skills in nursing students.[68,73]

Security

The scoping review highlighted the importance of security and privacy in technology-based nursing education. Nursing programs can ensure students' safe and trustworthy learning environment by implementing these security and privacy measures.[18,25,27,48,66]

Ethical issues

The review identified several ethical issues to address when utilizing technology-based nursing education. Nursing programs must consider these ethical issues carefully and develop clear policies regarding online consent, data protection, and student privacy. By doing so, they can ensure that technology is used ethically and responsibly to enhance student learning.[26,53,58]

All features are divided into categories and sub-categories [Table 5].

Discussion

This review aims to identify and extract the technological features employed in teaching clinical nursing skills, provide a summary of research findings, and highlight

Table 4: Categorization of technological features used in nursing clinical skills education[5,12-14,17-19,21,23,26,27,31-73]

Content	Accessibility	Environment	Usability	Pedagogical approach	Security	Ethical issues
Multimedia	Smartphone based	Learner Satisfaction	Easily accessible	Collaborative learning	Anonymity	Online Consent
Update	Web-based	Immersive learning	Cost-effective	Active learning	Encryption	Legal obligation
Organized	Mobile- Based	Interactive learning	User-friendly	Cooperative learning	Protected content	Justice
Interactive scenarios	Computer-based	Realistic learning	Supplemental	Debriefing	Confidential	Autonomy
Realistic scenarios	Social media platform	Personalized education	Self-paced	Problem-based learning	Privacy	Beneficence
Theoretical and practical parts		Engagement Learning	Safe practice	Case base learning	Data protection	non-maleficence
Inquiry-based		Supportive learning	Flexible			
Valid			Effective access			
High quality			Collaborative			
Attractive						
Standardized						

existing knowledge gaps. Fifty-eight articles and theses published between 1995 and 2024 were identified. Technology is transforming nursing education in Iran by making it easier for students to access learning materials, revisit content whenever needed, and strengthen their clinical skills and understanding more effectively. Technology serves an essential role in improving the learning of clinical nursing skills, providing easy access and content repetition, and helping to consolidate knowledge and skills better. The extracted features of technological tools used in teaching clinical nursing skills include seven general categories: Content richness, accessibility, environment, usability, pedagogical approaches, security, and ethical considerations.

The content feature includes multimedia educational content, up-to-date evidence, organized materials, interactive and real-life scenarios, and theoretical and practical sections based on inquiry, quality, and standards. Educational technologies should provide engaging content, including videos, images, and text, to address diverse learning styles. Content must be standard, updated, and sourced from reputable books, guidelines, or expert-approved articles. Realistic, interactive scenarios simulating clinical environments are essential for practical learning. Iranian nursing programs should incorporate locally relevant cases to align education with community healthcare needs. Online learning offers continuous access to standardized information.[4] Bassin *et al*. found that realistic scenario-based simulations enhance clinical assessment and decision-making.[5] Similarly, video-based education significantly reduced anxiety and improved satisfaction among physiotherapy students,[6] while Shayan *et al*. highlighted its positive impact on performance and attitudes in learning clinical procedures.[7]

The accessibility feature, includes mobile-based, computer-based, and web-based education and education via social media. Mobile device usage has expanded significantly, with 95% of the global population covered by mobile networks and most adults owning multiple devices. The primary users, aged 18 to 29, align with university student demographics. Research shows that mobile learning effectively supports higher education.[8] A study on orthopedic trainees highlighted that electronic education accelerates motor skill acquisition and enhances cost-effectiveness, learner satisfaction, and self-directed learning efficiency. This approach is particularly beneficial for exposure to rare and complex cases, improving clinical pattern recognition.[9] Mohamed demonstrated the positive impact of web-based education on nursing competencies,[10] while another study noted that self-directed smartphone uses fosters self-discipline and enables flexible, time-efficient studying.[11]

The environment feature includes immersive, realistic, interactive, supportive, engaging, and personalized learning. Virtual simulation has been shown to enhance student satisfaction, confidence, and skills, such as in catheter insertion.[12] Bracq *et al*. found that virtual reality training in the operating room provided deep learning and complete immersion.[26] Similarly, Moher *et al*. reported that 70% of nursing students felt motivated to continue practicing sterile catheterization skills using a virtual reality game.[14] However, implementing virtual reality poses challenges due to high costs, technical complexities, and potential compatibility, reliability, and privacy issues. It can also lead to physical and mental discomfort, such as nausea, dizziness, and fatigue. Ethical concerns, such as misuse or misleading representations, may impact learning accuracy and credibility. Moreover, excessive reliance on virtual reality might reduce human interaction in education. Therefore, its integration into nursing education requires careful planning, evaluation, and complementary use with other teaching methods to maximize benefits for learners and instructors.[14,15]

The usability feature encompasses accessibility, cost-effectiveness, user-friendliness, supplemental use, self-paced learning, safe practice, and flexibility. Bertucci's

Table 5: The technological features used in nursing clinical skills education

Feature 1		
Label	**Content**	**References**
• Knowledge representation • Multimedia • Up-to-date • Organized • Valid • High quality • Learning engagement • Interactive scenarios • Realistic scenarios • Inquiry-based scenarios • Attractive • Skill development • Theoretical and practical integration • Standardized		
Feature 2		
Label	**Accessibility**	
• Delivery platforms • Smartphone-based • Web-based • Mobile-based • Computer-based • Social media integration • Social media platforms		
Feature 3		
Label	**Learning environment**	
• Immersive learning • Interactive learning • Realistic learning • Personalized learning • Engaging learning • Supportive learning		
Feature 4		
Label	**Usability**	

study highlighted cost-effectiveness, noting that students believed fewer consumables, such as sterile catheters, syringes, and other supplies, were wasted during practice. One student remarked, "As a stressed student, being able to practice multiple times before performing the task in front of faculty members truly helps me."[14] Mobile learning enhances technological skills, improves communication, fosters collaboration, and optimizes learning outcomes.[16] Smartphone-based education provides a non-judgmental space, allowing students to practice repeatedly without fear of making errors.[17]

The pedagogical approaches discussed include collaborative, cooperative, active, problem-based, and case-based learning. Communication through chats and discussions on specific topics sparks brainstorming among teachers and students, engaging them and clarifying doubts.[18] Active learning improves performance across disciplines. Blanié *et al*. found that simulation-based training for recognizing deteriorating patient conditions outperformed traditional methods.[19] As an active teaching strategy, gaming enhances knowledge retention and promotes problem-based learning, encouraging nursing students' active participation.[25]

Inquiry-based learning is another practical approach. Chau *et al*. demonstrated that an inquiry-driven, technology-based program using simulated clinical scenarios significantly improved knowledge and student satisfaction.[27] Repeated practice with feedback enhances clinical reasoning, motor skills, and precision.[17] Immediate feedback also corrects students' thought processes.[22] A systematic review of 80 studies found that 86% supported virtual simulation to enhance knowledge, skills, critical thinking, and confidence, though technical disruptions sometimes caused frustration.[23]

Cardoso . and Khedo recommended simple, visually appealing designs to optimize mobile learning, minimize effort, and create interactive interfaces for error detection and feedback.[24] Virtual simulation improves cognitive, psychomotor, and affective learning outcomes.[25] Skill demonstration videos on smartphones provide students with opportunities for repeated practice when instructors are unavailable.[26] Virtual environments foster interactions among students, content, and instructors, enhancing research, inquiry, and problem-solving skills.[27]

The preservation of privacy, security of personal data, respect for intellectual property rights, and equitable access to educational technologies are crucial technological features identified in this study. Wong *et al*. raised ethical concerns about virtual reality, particularly its addictive nature, surveillance capabilities, and potential for manipulation through brain-computer interfaces, warning of risks like "brainwashing."[28] Spiegel identified four issues: (1) mental health risks, (2) physical neglect, (3) privacy concerns regarding data manipulation, and (4) blurred boundaries between real and virtual worlds, recommending content ratings, age restrictions, and stronger data protection laws.[29]

Yoo and Lee emphasized the dangers of virtual reality's "superrealism," noting that vulnerable groups, including children, may struggle to differentiate between the virtual and physical worlds. They also highlighted the risk of body dysmorphia among healthy adults if their virtual representations appear more attractive than their real ones. They recommended content warnings, adjustable realism levels, and enhanced data protection measures to mitigate these risks to safeguard user autonomy and reduce psychological impacts.[33] The future of nursing education in Iran lies in strategically incorporating technology into teaching and learning. This approach should align with the country's unique cultural, social, and economic realities, ensuring innovations are both practical and accessible. A priority is establishing a national framework for integrating technology in nursing education, supported by

government policies, creativity-promoting initiatives, and partnerships between academic institutions and industry. Affordable, scalable solutions will meet the diverse needs of students, from urban centers to remote areas. Researching the impact of these technologies on clinical skills and patient care will provide valuable insights for ongoing improvement.

Nursing schools should develop tools tailored to Iran's context, such as culturally relevant case studies, multilingual platforms, and simulation scenarios reflecting the country's healthcare environment. These resources can bridge the gap between classroom learning and real-world practice, helping students build confidence and skills for clinical work. Collaborations with global institutions and technology leaders can further enrich Iran's nursing programs, fostering knowledge exchange, and creating opportunities for research and development. This could position Iran as a leader in innovative nursing education in the region.

For success, educators must equip themselves with the necessary tools and training to integrate technology into teaching while ensuring fair access for students from underserved areas. These steps will transform nursing education in Iran, preparing graduates to excel in local and global healthcare settings and contribute meaningfully to the nursing profession. Limitations of the study include excluding research published in languages other than Persian and English, which may have omitted valuable studies from non-English-speaking regions. Additionally, the unavailability of articles despite efforts to contact authors may have excluded pertinent studies. Another limitation of scoping reviews is the lack of mandatory quality assessment frameworks for included studies, potentially allowing studies with lower quality standards.

Conclusion

This study identified and analyzed diverse technological features for teaching clinical nursing skills, offering educators a broad overview of options to select tools aligned with their resources and teaching contexts. By reviewing multiple technologies rather than focusing on a single solution, the findings support integrating digital tools with traditional methods to enhance learning outcomes, address diverse student needs, and reduce educational barriers. While these technologies improve engagement and skill acquisition, ethical, privacy, and security concerns must be addressed to safeguard student well-being and data. Future research should prioritize longitudinal studies on mobile/social media learning impacts, solutions for virtual reality challenges (e.g. hardware limitations, physical discomfort), robust data protection protocols, and evaluations of technology-enhanced pedagogical approaches across nursing education settings to optimize strategies for Iran and beyond.

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Conflicts of interest

Nothing to declare.

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