

Effect of Online Learning on Nursing Students Satisfaction, Confidence and Skill Performance: A Systematic Review

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ABSTRACT

Background: The COVID-19 pandemic accelerated the transition from traditional face-to-face nursing education to online platforms, raising questions about its effect on student outcomes. **Objectives:** This systematic review examined the effect of online learning on nursing students' satisfaction, confidence, and skill performance. **Methods:** Following PRISMA 2020 guidelines, four databases (ScienceDirect, Cochrane Library, Karger and PubMed) were searched for studies published between January 2020 and December 2024. Eligible studies included quasi-experimental or randomised controlled trial designs with nursing student participants. Two reviewers independently screened studies and assessed risk of bias using JBI tools. **Results:** Nine studies met inclusion criteria (seven quasi-experimental, two randomised controlled trials). Findings on satisfaction were mixed: game-based and Moodle-based learning improved satisfaction, while traditional hands-on methods remained preferred in some contexts. Confidence was enhanced through interactive approaches such as augmented and virtual reality, although traditional training remained more effective for hands-on skills. Skill performance improved with web-based interactive methods, but traditional demonstrations were more effective for procedural skills like IV catheter placement. **Conclusions:** Online learning can improve satisfaction, confidence and knowledge, particularly when interactive technologies are integrated. However, face-to-face training remains essential for psychomotor and clinical skill development. The evidence supports hybrid models that balance digital engagement with hands-on practice. Future research should examine long-term outcomes, cost-effectiveness, and culturally adapted digital strategies in nursing education.

Keywords: Online Learning; Nursing Education; Satisfaction; Confidence; Skill Performance

INTRODUCTION

Traditional nursing education has primarily depended on in-person instructional approaches, encompassing lectures, hands-on demonstrations, lab sessions, clinical placements, and independent study (Khozaei *et al.*, 2022). The advent of online learning has revolutionised access to education, enhancing interactivity and communication through digital platforms (El-hamied *et al.*, 2025). This transformation has integrated innovative teaching strategies designed to enrich the educational experience (Shen *et al.*, 2024).

Student satisfaction reflects learners' positive perceptions of their educational experiences (Jallad, 2025). Confidence pertains to students' self-assurance in performing nursing tasks and applying theoretical knowledge in clinical settings (Saied *et al.*, 2025). Both develop through practice, constructive feedback, and successful skill application (Dolorfino *et al.*, 2025).

The COVID-19 pandemic accelerated the transition to online platforms, presenting both opportunities and challenges for nursing education worldwide (Wu *et al.*, 2025). Despite the flexibility offered by online formats, concerns persist regarding their effectiveness for developing hands-on clinical competencies (Natarajan *et al.*,

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2022). While multiple studies have explored e-learning outcomes, no systematic review has comprehensively synthesised findings specific to satisfaction, confidence and skill performance in nursing students (Alsadi *et al.*, 2023).

Although numerous studies have evaluated the outcomes of online learning in nursing education, the evidence remains fragmented and inconsistent, particularly regarding students' satisfaction, confidence, and psychomotor skill performance (Kumar *et al.*, 2021). Prior reviews often focused broadly on e-learning or simulation without isolating these three critical domains. Moreover, the rapid post-COVID expansion of digital platforms has generated diverse interventions—ranging from virtual reality to game-based modules—yet no synthesis has clarified which approaches best support nursing students. This review therefore addresses a critical gap by systematically consolidating evidence on the impact of online learning on satisfaction, confidence, and skill performance in nursing education.

Research Question

What is the effect of online learning on nursing students' satisfaction, confidence, and skill performance?

METHODOLOGY

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (Page *et al.*, 2021). A comprehensive search was performed in four electronic databases—ScienceDirect, Cochrane Library, Karger, and PubMed—to capture literature relevant to nursing education. These databases were chosen for their broad indexing of nursing, medical education, and healthcare simulation research (Nowell *et al.*, 2022).

Research Design

This study employed a systematic review design, conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines. The review process included a structured search of multiple electronic databases, independent screening by two reviewers, systematic data extraction, and methodological appraisal using Joanna Briggs Institute (JBI) critical appraisal tools (Barker *et al.*, 2024).

Information Sources and Search Strategy

A comprehensive search was conducted in four databases—ScienceDirect, Cochrane Library, Karger, and PubMed—to capture studies relevant to nursing education. These databases were chosen for their broad coverage of nursing, medical education, and healthcare simulation research. The search was limited to articles published between January 2020 and December 2024 to reflect the most recent post-COVID educational landscape (Busolo *et al.*, 2025).

Inclusion Criteria

Studies were eligible for inclusion if they involved undergraduate or diploma nursing students enrolled in accredited nursing programmes. Interventions of interest included online, web-based, or technology-enhanced learning approaches such as virtual simulation, game-based modules, augmented reality, or Moodle-based platforms. Comparators comprised traditional face-to-face instruction, blended learning, or, in some cases, the absence of a control group. To qualify, studies were required to report at least one of the following outcomes: student satisfaction, confidence or self-efficacy, and skill performance. Eligible designs were quasi-experimental studies and randomised controlled trials, published between January 2020 and December 2024. Only English-language, peer-reviewed and full-text articles were included.

Exclusion Criteria

Exclusion criteria were applied to studies involving non-nursing participants or mixed samples without separate nursing data. Purely descriptive, qualitative, or review articles were excluded, as were studies that did not assess satisfaction, confidence, or skill performance. Additional exclusions included non-English publications and grey literature such as these or other non-peer-reviewed sources.

Screening Process

The study selection process was conducted in two stages. First, two reviewers independently screened the titles and abstracts of all retrieved records to identify potentially relevant studies. Articles that were clearly irrelevant, did not involve nursing students, or fell outside the specified publication period were excluded at this stage. In the second stage, full-text articles were reviewed against the eligibility criteria. Reasons for exclusion at the full-text stage included outcomes unrelated to satisfaction, confidence, or skill performance; non-nursing populations; and inappropriate study designs (Trifu *et al.*, 2022). Any disagreements between reviewers were resolved through discussion until consensus was reached. The overall selection process is presented in the PRISMA 2020 flow diagram (Figure 1).

Data Extraction

Data from the included studies were systematically extracted using a structured template. Extracted items included author(s), year of publication, country, study design, sample size and characteristics, intervention details, comparator, and outcomes measured. The primary outcomes of interest were satisfaction, confidence or self-efficacy, and skill performance. Where reported, key findings and statistical results were recorded to allow comparisons across studies.

Quality Appraisal

The methodological quality of the included studies was assessed using the Joanna Briggs Institute (JBI) critical appraisal tools for quasi-experimental studies and randomised controlled trials. Two reviewers independently evaluated each study across domains such as participant selection and allocation, control of confounding factors, administration of the intervention, outcome measurement, and participant retention (Munn *et al.*, 2023). Each study was categorised as having a low, moderate, or high risk of bias. Any discrepancies were discussed and resolved by consensus. The results of the quality appraisal are summarised in Tables 1 and 2.

Reporting Bias and Certainty of Evidence

Publication bias was not formally assessed because the included studies were too heterogeneous to permit meta-analysis or quantitative synthesis. Similarly, the certainty of evidence was not appraised using the GRADE approach, as the outcomes were narratively synthesised and varied widely across interventions and study designs. Instead, emphasis was placed on transparent reporting of inclusion/exclusion decisions and structured appraisal of methodological quality using the JBI critical appraisal tools.

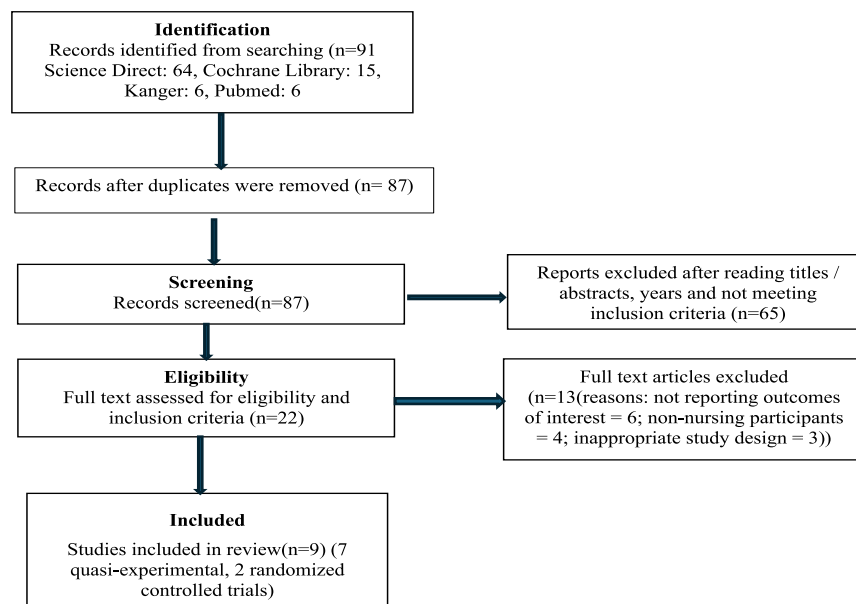


Figure 1: PRISMA 2020 Flow Diagram Showing the Process of Study Identification, Screening, Eligibility Assessment and Inclusion

RESULTS

Study Selection

A total of nine studies met the inclusion criteria. The selection process is illustrated in the PRISMA 2020 flow diagram (Figure 1).

Study Characteristics

The included studies comprised seven quasi-experimental designs and two randomised controlled trials, with sample sizes ranging from 44 to 217 nursing students. Research was conducted in Canada, Taiwan, Turkey, Indonesia, and Korea. The interventions included Moodle-based platforms, game-based and case-based modules, Kahoot-based activities, virtual simulation, virtual reality, and augmented reality. Comparators varied from traditional classroom teaching to mannequin-based training, laboratory-based practice, and video-based modules. Outcomes assessed were satisfaction, self-efficacy, knowledge acquisition, skill performance, and self-confidence.

The detailed characteristics of the included studies are presented in Table 1.

Table 1: Characteristics of Included Studies (n = 9). Study Design, Sample Size, Interventions, Comparators, and Outcomes Assessed are Presented

No	Author, Year, Country	Design	Sample (n)	Intervention	Comparator	Outcomes Assessed
1	Berga <i>et al.</i> (2021), Canada	Quasi-experimental	217	Blended online + face-to-face	Traditional classroom	Knowledge, Self-efficacy
2	Chen <i>et al.</i> (2023), Taiwan	Quasi-experimental	84	Moodle-based ELEM	Traditional	Satisfaction, Achievement
3	Hung <i>et al.</i> (2021), Taiwan	Quasi-experimental	45	Game-based online	Video-based learning	Achievement, Satisfaction, Self-efficacy
4	Öz & Ordu (2021), Turkey	Quasi-experimental	120	Kahoot-based online	Face-to-face	Knowledge, Skill performance
5	Harjanto <i>et al.</i> (2023), Indonesia	Quasi-experimental	45	Online case-based learning	None	Self-confidence
6	Hudder <i>et al.</i> (2021), Canada	Quasi-experimental	Not stated	Virtual simulation	Lab-based	Knowledge, Satisfaction, Confidence
7	Park & Yoon (2023), Korea	Quasi-experimental	44	Virtual reality training	Mannequin-based	Skill, Confidence, Satisfaction
8	Avci & Kilic (2024), Turkey	RCT	91	Augmented reality	Mannequin	Skill, Satisfaction, Confidence
9	Sarvan & Efe (2022), Turkey	RCT	99	Serious game neonatal resuscitation	Video-based training	Knowledge, Skill, Satisfaction, Confidence

Summary of Main Findings

The synthesis of findings revealed variability in the effects of online learning compared with traditional methods. Online and technology-enhanced approaches, particularly game-based learning, virtual reality, and augmented reality, were associated with greater satisfaction and confidence in several studies. Conversely, traditional or lab-based learning remained more effective for developing psychomotor skills and supporting confidence in certain contexts. Knowledge outcomes were inconsistent, with advantages seen in some simulation- or game-based learning interventions, while others showed no significant difference.

Overall, the evidence suggests that online learning can enhance satisfaction and confidence, but traditional and hybrid models remain essential for consolidating skills and ensuring competence in nursing education.

The main findings across outcomes are summarized in Table 2.

Table 2: Summary of Main Findings Across Outcomes, Evidence Favouring Online Learning, Traditional Learning, or Showing Mixed/no Difference is Indicate

Outcome	Evidence Favouring Online	Evidence Favouring Traditional	Mixed/No Difference
Satisfaction	Chen <i>et al.</i> (2023); Hung <i>et al.</i> (2021); Avci & Kilic (2024)	Hudder <i>et al.</i> (2021) (lab > simulation)	Sarvan & Efe (2022); Park & Yoon (2023) (both groups improved)
Confidence	Park & Yoon (2023); Avci & Kilic (2024) Harjanto <i>et al.</i> ,2023	Hudder <i>et al.</i> (2021) (lab > simulation)	Sarvan & Efe (2022) (no significant difference)
Skill Performance	Öz & Ordu (2021) (injection); Hung <i>et al.</i> (2021) (engagement & achievement)	Avci & Kilic (2024) (IV catheter, no significant improvement)	Mixed overall; most studies recommend hybrid
Knowledge	Hudder <i>et al.</i> (2021) (simulation > lab for knowledge); Sarvan & Efe (2022) (SGS > traditional)	Berga <i>et al.</i> (2021) (no difference)	Mixed, depends on intervention type

Risk of Bias

The methodological quality of included studies was assessed using the JBI appraisal tools. Overall, most studies were rated as low to moderate risk of bias. Common limitations included small sample sizes and limited reporting of randomisation or blinding procedures.

A summary of risk-of-bias ratings is provided in Table 3 and Table 4, while the full JBI appraisal checklist.

Table 3: Internal Validity Bias Related to Quasi-Experimental Study

		Internal Validity Bias Related to:									Statistical conclusion validity
		Domain	Temporal precedence	Selection and allocation	Confounding factors	Administration of intervention/ exposure	Assessment, detection, and measurement of the outcome			Participant retention	
		Question NO	1	2	3	4	5	6	7	8	9
Study ID	Outcome	Result									
Berga <i>et al.</i> (2021)	Knowledge	Time 1	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
		Time 2								Yes	Yes
	Self-efficacy	Time 1					Yes	Yes	Yes	Yes	Yes
		Time 2								Yes	Yes
Chen <i>et al.</i> (2023)	Perceived Satisfaction	Time 1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
		Time 2								Yes	Yes
	e-collaborative learning	Time 1					Yes	Yes	Yes	Yes	Yes
		Time 2								Yes	Yes
	Study achievement	Time 1					Yes	Yes	Yes	Yes	Yes
		Time 2								Yes	Yes
Hung <i>et al.</i> (2021)	Skill Performance	Time 1	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes
		Time 2								Yes	Yes
	Self-Efficacy	Time 1					No	Yes	Yes	Yes	Yes
		Time 2								Yes	Yes
	Learning Engagement	Time 1					No	Yes	Yes	Yes	Yes
		Time 2								Yes	Yes
	Learning Satisfaction	Time 1					No	Yes	Yes	Yes	Yes
		Time 2								Yes	Yes
Öz and Ordu (2021)	Knowledge	Time 1	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
		Time 2								Yes	Yes
	Skill Performance	Time 1					Yes	Yes	Yes	Yes	Yes
		Time 2								Yes	Yes
Harjanto <i>et al.</i> (2023)	Self-Confidence	Time 1	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
		Time 2								Yes	Yes
Hudder <i>et al.</i> (2021)	Knowledge	Time 1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
		Time 2								Yes	Yes
	Satisfaction	Time 1					Yes	Yes	Yes	Yes	Yes
		Time 2								Yes	Yes
	Confidence	Time 1					Yes	Yes	Yes	Yes	Yes
		Time 2								Yes	Yes
Park and Yoon (2023) Korea	Skill	Time 1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
		Time 2								Yes	Yes
	Confidence	Time 1					Yes	Yes	Yes	Yes	Yes
		Time 2								Yes	Yes
	Learning Satisfaction	Time 1					Yes	Yes	Yes	Yes	Yes
		Time 2								Yes	Yes
		Time 1								Yes	Yes
		Time 2								Yes	Yes

Table 3 summarizes the internal validity bias evaluation of the quasi-experimental studies in the review. In general, most studies had low to moderate risk of bias, reflecting acceptable methodological quality. Most studies ensured acceptable attention to issues like participant selection, control of confounding, and delivery consistency. However, some studies had shortcomings in randomisation, temporal precedence, and blinding, which may have introduced slight biases. In spite of these confines, the findings indicate that quasi-experimental evidence in favour of the impacts of online learning on nursing students' satisfaction, confidence, and skill performance is mostly valid.

Table 4 appraises the bias of internal validity for the randomised controlled trials (RCTs). Both RCTs had adequate methodological quality, with adherence to participant retention and intervention administration procedures being consistent. However, uncertainty still existed about allocation concealment, blinding, and outcome assessment procedures, which raised the risk of bias slightly. In spite of these slight limitations of methodology, the evidence from the RCTs is valid and persuasive that online and technology-enabled learning methods have a positive effect on nursing students' learning outcomes.

Table 4: Internal Validity Bias Related to Randomised Control Trial Study

		Internal Validity Bias Related to:											Statistical conclusion validity		
		Domain	Selection and allocation			Administration of intervention/ exposure			Assessment, detection and measurement of the outcome			Participant retention			
		Question No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Study ID	Outcome	Result													
Avcı & Kilic (2024)	Satisfaction	Time 1	Yes	Unclear	Yes	Unclear	Unclear	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
		Time 2							No	Yes	Yes	Yes	Yes	Yes	Yes
	Self-Confidence	Time 1										Yes	Yes	Yes	Yes
		Time 2										Yes	Yes	Yes	Yes
Sarvan & Efe (2022)	Knowledge	Time 1	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
		Time 2							No	Yes	Yes	Yes	Yes	Yes	Yes
	Skill	Time 1										Yes	Yes	Yes	Yes
		Time 2										Yes	Yes	Yes	Yes
	Satisfaction	Time 1							No	Yes	Yes	Yes	Yes	Yes	Yes
		Time 2							No	Yes	Yes	Yes	Yes	Yes	Yes
		Time 1										Yes	Yes	Yes	Yes
		Time 2										Yes	Yes	Yes	Yes

DISCUSSION

This review highlights both the potential and the limitations of online learning in nursing education. While many studies demonstrated that online methods, especially those incorporating interactive tools such as Moodle, game-based modules, and augmented or virtual reality, enhanced satisfaction and confidence, traditional methods remained superior for specific psychomotor skills.

Satisfaction

The findings on satisfaction were inconsistent, reflecting how different delivery modes meet different student needs. Studies incorporating interactive tools such as Moodle and game-based platforms consistently reported higher satisfaction with online formats (Chen *et al.*, 2023; Hung *et al.*, 2021), suggesting that digital interactivity enhances engagement and motivation (Gause *et al.*, 2022). In contrast, Hudder *et al.* (2021) found higher satisfaction with traditional lab-based learning compared to virtual simulation, highlighting that online tools may be less effective when practical, hands-on skills are central. This contradiction indicates that satisfaction is strongly influenced by alignment between teaching methods and learning outcomes (Saied *et al.*, 2025).

Confidence

Confidence outcomes showed a similar divide. Virtual and augmented reality were effective in improving confidence, particularly for technical tasks performed in simulated environments (Avcı & Kilic, 2024; Park & Yoon, 2023). However, studies such as Hudder *et al.* (2021) emphasised that confidence in psychomotor skills

was higher in lab-based, face-to-face training. These findings suggest that while digital tools can foster technical readiness and reduce anxiety in controlled settings, real-world practice under supervision is essential for building authentic clinical confidence (Abdelaliem *et al.*, 2025).

Skill Performance

Evidence for skill performance showed partial improvements through online learning, especially when interactive tools such as Kahoot were used to reinforce theoretical and procedural knowledge (Öz & Ordu, 2021). However, traditional methods were consistently superior for procedural skill mastery, such as IV catheter insertion (Avci & Kilic, 2024). This underscores that while online tools can improve cognitive rehearsal and familiarity, they cannot fully substitute for hands-on practice (Uslu-Sahan *et al.*, 2025).

Knowledge

The evidence for knowledge outcomes was mixed. Simulation- and game-based strategies demonstrated improvements in knowledge acquisition, as seen in Hudder *et al.* (2021) and Sarvan & Efe (2022). However, Berga *et al.* (2021) reported no significant difference between blended online methods and traditional classroom instruction, suggesting that online delivery alone may not guarantee better knowledge outcomes (Steenkamp & Chipps, 2024). For curriculum design, this implies that faculty must invest in pedagogical innovation, not just digitisation to ensure knowledge outcomes are optimised.

Contradictory Findings and Curriculum Implications

Taken together, these findings show that the effectiveness of learning modes depends on the nature of the outcome. Online platforms appear particularly effective for cognitive and affective outcomes such as satisfaction and knowledge engagement, whereas traditional learning remains crucial for psychomotor and confidence-building tasks that require real-world interaction (Foronda *et al.*, 2020).

For curriculum design, the implication is that online learning should not be viewed as a replacement but as a complement to traditional clinical teaching (Khozaei *et al.*, 2022). Hybrid or blended approaches are best positioned to maximise learning outcomes. For example, a flipped classroom model could leverage Moodle or game-based platforms for theory and engagement, followed by lab-based sessions for practising invasive procedures (O'Doherty *et al.*, 2018; Munn *et al.*, 2023).

Curricula should also align delivery modes with intended outcomes: online for knowledge and engagement and face-to-face for psychomotor skills (Du *et al.*, 2022). Institutions must further consider resource allocation—while Virtual Reality (VR) and Augmented Reality (AR) offer promise, their high costs may not be sustainable in many settings (Tang *et al.*, 2019; Wang & Raman, 2025). Low-cost digital tools such as Kahoot and online case-based modules may provide more accessible solutions.

Integration with Broader Educational Goals

These findings resonate with global trends in nursing education, which emphasize student-centred, flexible, and technology-enhanced learning while maintaining the profession's emphasis on clinical readiness (Swift *et al.*, 2022). The challenge for educators and policymakers is not whether to integrate online learning, but how best to combine it with experiential practice so that graduates are both digitally literate and clinically competent (Shen *et al.*, 2024).

Limitations

This review has several limitations that should be considered when interpreting the findings. Most included studies were quasi-experimental with relatively small sample sizes, which limits the generalisability of results. The interventions varied widely from Moodle-based platforms to virtual reality and game-based modules, making direct comparison challenging. Some studies also lacked detailed reporting on randomisation, blinding, or follow-up, contributing to a moderate risk of bias.

Only English-language, peer-reviewed publications were included, which may have introduced language and publication bias. The exclusion of grey literature and non-peer-reviewed sources may also have omitted potentially relevant evidence. Finally, the review primarily synthesised short-term outcomes such as satisfaction, knowledge, and confidence but did not capture long-term effects such as skill retention, clinical

competence, or patient-related outcomes.

CONCLUSION

This systematic review demonstrates that online and technology-enhanced learning can significantly improve satisfaction, confidence, and knowledge among nursing students, particularly when interactive elements are integrated. However, traditional face-to-face methods remain critical for mastering psychomotor skills and building authentic clinical confidence. The overall implication is that hybrid or blended learning models offer the most balanced and effective approach, combining the flexibility and engagement of online platforms with the irreplaceable value of hands-on practice.

Future studies should address several key gaps. Larger, multicentre randomised controlled trials are needed to strengthen the evidence base and enhance generalisability. Standardised outcome measures across studies would improve comparability and allow for meta-analysis. Research should also move beyond short-term outcomes to examine the long-term effects of online and hybrid learning on skill retention, clinical competence, and patient care outcomes. Additionally, studies evaluating the cost-effectiveness and scalability of advanced technologies such as VR and AR are necessary, particularly in resource-limited contexts. Finally, future research should focus on developing culturally relevant and context-specific online learning strategies, ensuring innovations are inclusive and adaptable across diverse nursing education settings.

Conflict of Interest

The authors declare that they have no competing interests.

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