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Effectiveness of Simulation-Based Learning in Nursing Education: SDG 4

Mohammed Abed Hussein Altaee[1], Nualyai pitsachart[2], Dr. Sanket Dadarao Hiware[3], Vikas Sharma[4]

[1]Faculty of Business, Ajloun National University, Jordan
mohammed.abed.altaee@gmail.com
https://orcid.org/0000-0001-6331-5788
[2]Assistant Professor Faculty of Nursing Shinawatra University, Thailand
nualyai.p@siu.ac.th
0009-0003-5882-8660
[3]Assistant Professor, Anatomy, Graphic Era Institute of Medical Sciences, Dehradun, India.
drsankethiware@gmail.com
0000-0003-4593-3325
[4]Department of Computer Applications, SRM Institute of Science and Technology, INDIA
vicky.c610@gmail.com
0000-0001-8173-4548

ABSTRACT

Simulation-based learning (SBL) has become an integral component of modern nursing education, offering a dynamic, experiential platform for students to develop clinical competencies, critical thinking, and communication skills in a controlled and safe environment. This paper presents a secondary qualitative analysis of literature published between 2018 and 2025 to examine the effectiveness of simulation across various learning domains—cognitive, psychomotor, and affective. Findings reveal that high-fidelity simulation, virtual reality modules, standardized patient interactions, and game-based learning approaches significantly enhance student preparedness, confidence, and knowledge retention. Simulation is shown to support the development of both technical proficiency and interpersonal attributes such as empathy and decision-making under pressure. The results also highlight the critical role of structured debriefing and faculty facilitation in reinforcing learning outcomes. While challenges such as high implementation costs, faculty training needs, and infrastructure disparities persist—especially in resource-limited settings—the overall evidence positions simulation-based education as a transformative and effective strategy in preparing nurses for increasingly complex healthcare systems. This study underscores the importance of integrating simulation into nursing curricula with pedagogical alignment, institutional support, and equitable access.

KEYWORDS: Simulation-based learning, nursing education, high-fidelity simulation, clinical competence, virtual simulation, experiential learning, nursing curriculum, confidence, critical thinking, debriefing, SDG 4.

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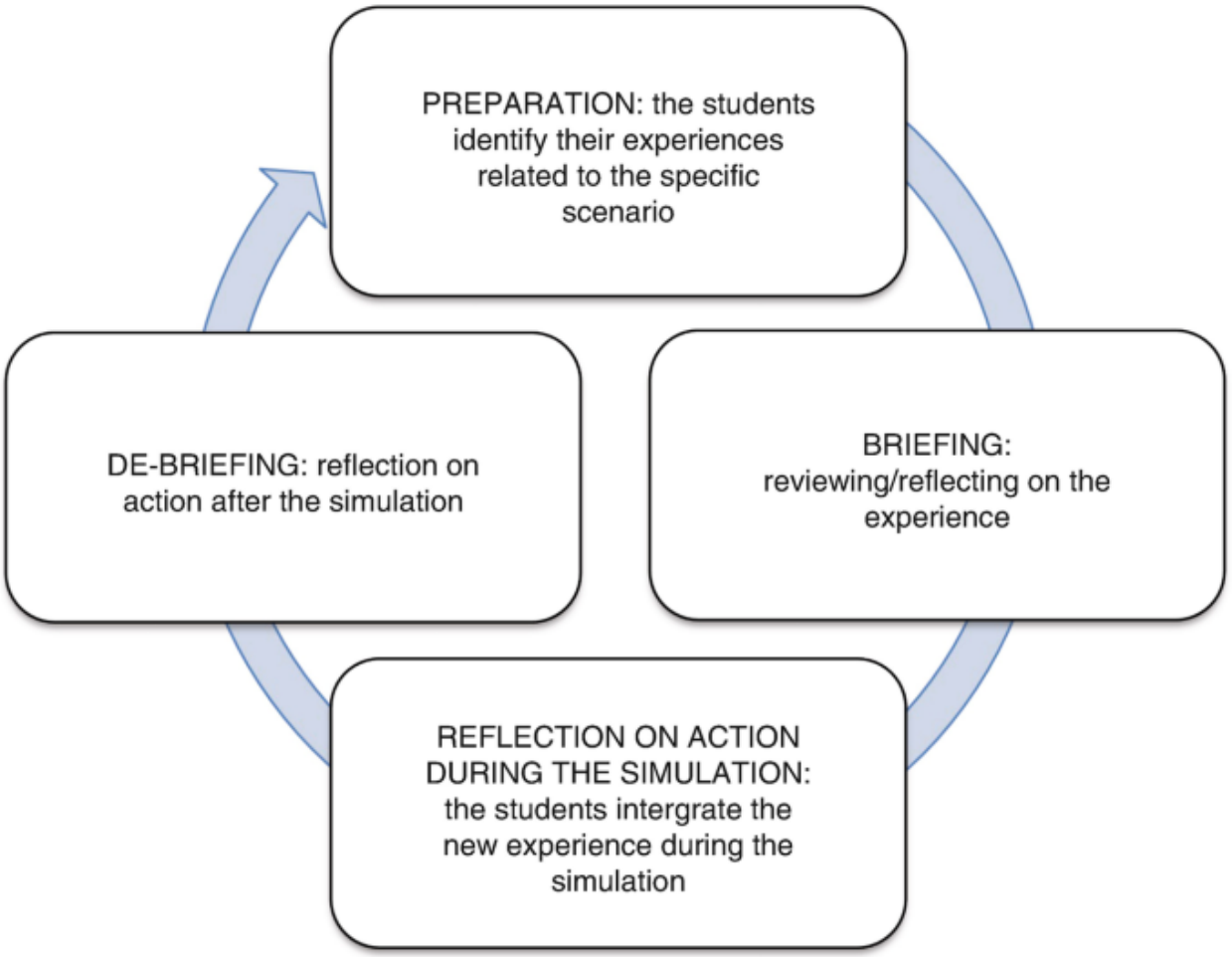
INTRODUCTION

The nursing education environment has changed dramatically over the past decades and has no longer been just on didactic lectures and clinical placements, but has now extended to include technology-enhanced teaching techniques. Of these, simulation-based learning in particular has become an effective learning platform that effectively fills the gap between theory and the practice. Simulation enables nursing students to practice, test critical thinking, and get a sense of confidence on a gradual scale without risks in an arrangement that depicts the real-life clinical situations they will eventually encounter. The challenge of growing complexity of healthcare systems and raised level of the necessity to ensure patient safety and professional competence has also contributed to the active implementation of simulation as an essential part of most nursing education curricula worldwide. The introduction of high-fidelity manikins, virtual reality (VR), standardized patients, and hybrid simulation-based models allow them to simulate learning environments that are closer to reality (Tank & Ta rooms, 2025).



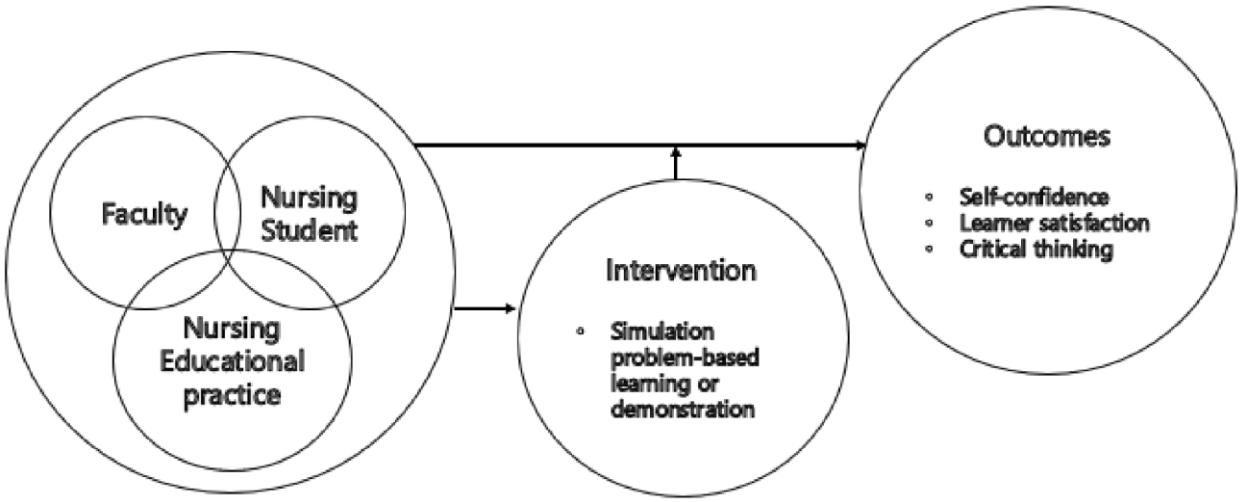
The learning theory upon which simulation-based learning is most effective is based on theories of adult learning, especially, Kolb Experiential Learning Theory and Bandura Social Learning Theory. These frameworks point to the crucial nature of active engagement, feedback, consideration, and repetitive practice, which are all elements of effective simulation programs. The evidence over repeated research studies has shown that simulation plays a significant role in the enhancement of learning in cognitive, affective, as well as psychomotor outcomes of nursing students. An example of improved performance when dealing with critical care scenarios is that simulation-trained learners achieve higher performance over holistic reasoning and longer retention of procedural knowledge when compared to traditionally trained learners (Saleh et al., 2025). Besides, simulation promotes secure education with students being able to make errors and learn through them without posing a threat to patient safety. The learning safety net can help develop an attitude of autonomous and powerful feeling that is usually hard to maintain in actual clinical experiences.

With the COVID-19 pandemic, simulation has been increased in valuation to a new level. Social distancing regulations and limited access to clinical facilities resulted in the increased use of virtual simulation and remote scenario to maintain clinical education continuity. This change not only proved the adaptability of the simulation-based approach but also revealed inherent differences in DM simulation capacity and faculty readiness namely in low- and middle-income countries. The increasing amount of literature has offered simulation as one of the cornerstones in modern nursing education, but remains unclear as to its cost effectiveness, ability to scale its use, and long-term affects that it has on clinical performance. This paper examines the evidence of the effectiveness of simulation-based learning in nurse education using recent empirical evidence, implementation options and pedagogic benefits. It aims at determining the best practices and its constraints giving the educators and policymakers information on how simulation can be optimized to meet the quality and safety of the nursing care delivery.

RATIONALE OF THE STUDY

Increased complexity of healthcare delivery, the increased focus on patient safety, and the changing expectations of the professional nursing roles have all designated an augmented facility in nursing education that is more effective, responsive, and experiential. Conventional teaching methodology, including lectures, case studies, and clinical observations, although fundamental, does not always help to ensure that students are ready to face the requirements of the real world clinical settings (Palmes & Ching, 2025). Clinical placements present the major limitation, including overcrowding in the hospital environment, ethical dilemmas in treating patients, inconsistency in clinical exposure, and more often, lack of access during the pandemic era or institutional policies. This has given an impelling argument of educational innovations which can recreate real life scenarios without affecting safety or learning context.

SBL is so promising because it achieves three important things: overcoming these challenges by providing standardized, repeatable, and interactive learning experiences; meeting the requirements of modern pedagogical ideals; and offering a comprehensive, modular solution to a wide range of learning needs. It provides a well-structured environment through which technical skills of the students can be developed, and clinical reasoning or decision-making abilities can be refined and polished, at a low-therapeutic-insult environment but at a high simulation of the real world. Simulation does not support passive learning as per in contrast to passive forms of learning students are instructed to evaluate patient conditions, react to changing situations and cooperate as members of a clinical team. This is in line with the experiential aspect of nursing practice, as simulation is a perfect tool, to help close the theory-practice gap.



The profession is growingly in need of evidence-based education in nursing, teaching approaches in which the strategies have to have an evidence of effectiveness through retention of knowledge, and skills completed, and clinical decision making. There is an emerging literature that shows that simulation does not only compound these outcomes, it leaves to the increase in both student confidence and the decrease in anxiety during clinical practice. This contributes to it being particularly useful in training high stakes or sensitive scenarios, i.e. code blues scenarios, patient death, ethical dilemmas, which are seldom experienced in situ, and even more seldom debriefed upon.

This study has been necessitated by the rationale that the effectiveness of simulation based-learning as a pedagogical tool and a strategic response to deficiencies of conventional nursing education is an issue that requires critical evaluation. This paper helps to consolidate recent studies, locate main advantages of its implementation, and reveal the gaps in its implementation, thus offering useful information to a nurse educator, curriculum developer, and policy stakeholders. The eventual outcome will be to inform best practices in ensuring that nursing graduates are competent, confident and well prepared in the realities of healthcare settings of the present days.

LITERATURE REVIEW

3.1 Evolution and Theoretical Foundations of Simulation-Based Learning

The nature of simulation-based learning (SBL) in nursing education has also changed quite a lot over the last twenty years, as it is no longer role-play, but rather high-fidelity manikin-based, virtual, and mixed-reality simulations. It is based on the adult learning theory, the Kolb experiential learning model and the constructivist pedagogy with its focus on active engagement, feedback, reflection (Cánovas-Pallarés et al., 2025). It is based on these general principles on which the ‘learning Francesco style,’ the idea that learners will do a better job of storing and using knowledge when embedded in a real, practical context, is founded.

SBL is not merely a technological advancement but a paradigm shift in nursing education. It replaces passive, lecture-based methods with dynamic, scenario-based learning that replicates clinical decision-making in safe environments. According to Persico et al. (2025), the "Healthcare Simulation Standards of Best Practice®" ensure that simulation-based education adheres to rigorous quality benchmarks, including prebriefing, psychological safety, realism, and structured debriefing. These core elements contribute significantly to learner satisfaction and competence acquisition. The ecosystemic approach proposed by Oyekunle, et al. (2024) highlights how learning environments must be systematically aligned with the learning needs of students to maximize simulation outcomes. Simulation is thus both a pedagogical method and an environmental innovation tailored to modern healthcare challenges.

3.2 Comparative Effectiveness of Simulation vs Traditional Methods

Several studies directly compare simulation-based learning to traditional instructional strategies and clinical placements. Tank & Taşdemir (2025) conducted a comparative study between game-based simulation, high-fidelity simulation, and traditional CPR instruction among nursing students. Results revealed that simulation methods—particularly high-fidelity—led to significantly better outcomes in knowledge retention, psychomotor skill proficiency, and learner confidence.

In a quasi-experimental study, Saleh et al. (2025) evaluated advanced cardiovascular life support (ACLS) knowledge among emergency nurses taught via simulation versus video-assisted methods. Simulation-trained participants demonstrated superior knowledge application and procedural accuracy. Similarly, authors utilized escape-room style simulations for malignant hyperthermia scenarios and found substantial increases in clinical decision-making confidence and critical thinking.

This tendency also finds a reflection in one meta-analysis, according to which the simulation-integrated curricula always outperform the traditional rotations in terms of self-reported preparedness; assessment performance; and clinical adaptability. Next, another randomized controlled trial was conducted by Nas, et al.(2020) and evaluated virtual reality CPR simulation with Oculus headsets, reporting not only improvement in technical skills but an increase in motivation and self-regulated behaviours of learning. Taken together, these studies substantially prove that simulation-based methodologies are not only effective, but in many instances, more superior than conventional methods of learning in various aspects of learning.

3.3 Domains of Impact: Clinical Competency, Confidence, and Critical Thinking

Simulation has different dimensions that it affects in regards to the development of skills. Increased clinical competency is one of the most often mentioned ones. As stated by Fenzi, et al. (2025), simulation offered great results in enhancing student preparedness of bedside environmental management skills- an aspect that is not covered well in the traditional training. Moreover, digital simulation and messaging apps use in the context of nursing disaster response nursing education, and the simulation was found to promote both technical and organizational response skills.

Other important outcomes are self-efficacy and learner confidence. In a longitudinal study of faculty development (Wahid et al., 2025), self-efficacy of the nursing faculty to provide simulation-based education improved, leading to an increase in the quality of student learning. Likewise, virtual simulations on managing patient agitation was found to increase not only the competence but also the empathy and emotional intelligence of the students (Tay et al., 2025).

The above outcomes are important with debriefing and reflection. According to Persico et al. (2025), one of the most efficient tools is structured debriefing that helps to reinforce knowledge, respond to emotional reactions to developments, and develop clinical judgment. Student who participated in well-built simulation scenes showed significantly better results in critical thinking in the form of performance assessments and peer ratings. In addition, Soomar et al. (2025) present an example of simulation in gestalt chemotherapy clinic, outlining how the immersive training can enhance responsiveness of nurses to medical emergencies including extravasation situation, ultimately leading to safety of the patient.

3.4 Integration Challenges and Future Directions

Although the efficiency of the simulation is strong, there are some obstacles on the way of implementation of simulation to nursing curricula. The cost and infrastructure needs, especially that of high-fidelity manikins and VR technologies, are still of concern. Additionally, they point out that simulation may mandate low student-faculty ratios and prepared facilitators and is thus unlikely to scale in massive programs.

Another important issue is curricular alignment In the view of Bouazza, et al. (2025), the scenarios of the simulation have to be thoroughly tied to the learning outcomes and course objectives otherwise it will be seen as secondary or peripheral. Lack of acceptance among traditionally trained faculty members and non-uniformity in following debriefing guidelines further dilutes the learning potential of simulations.

However, promising trends are emerging. Several institutions are exploring hybrid models that combine simulation with flipped classroom techniques and problem-based learning. Other models incorporate adaptive AI-driven simulations tailored to individual student progression and errors. Furthermore, cross-cultural studies—such as the Chilean analysis reveal that learner satisfaction in simulation is highly influenced by personalized feedback and the accommodation of individual learning styles. These findings suggest that future simulation design must be inclusive, flexible, and grounded in learner diversity to maximize effectiveness. Ultimately, the literature makes a compelling case for simulation as a transformative educational strategy. Yet, its future impact depends on sustained investment, faculty development, pedagogical innovation, and an evidence-driven approach to curriculum design.

METHODOLOGY

This study employs a secondary qualitative research design, utilizing a narrative literature review approach to explore the effectiveness of simulation-based learning (SBL) within nursing education. A narrative review enables the researcher to synthesize findings from a broad spectrum of existing literature, thereby constructing a coherent and holistic understanding of trends, outcomes, and theoretical frameworks without the collection of primary data. The focus on qualitative secondary analysis allows for a rich exploration of subjective and experiential outcomes—such as learner confidence, critical thinking, and communication—typically emphasized in simulation-based education but not easily captured through quantitative measures alone.

A structured search strategy was applied to academic databases including PubMed, ScienceDirect, CINAHL, SpringerLink, and Google Scholar. The search was restricted to peer-reviewed articles published between 2018 and 2025 to ensure the inclusion of recent pedagogical innovations and post-pandemic adaptations in nursing education. Keywords such as “simulation-based learning,” “nursing education,” “clinical simulation,” “virtual simulation,” “manikin-based training,” and “nursing student outcomes” were used in various Boolean combinations. Inclusion criteria were: (1) articles written in English, (2) studies

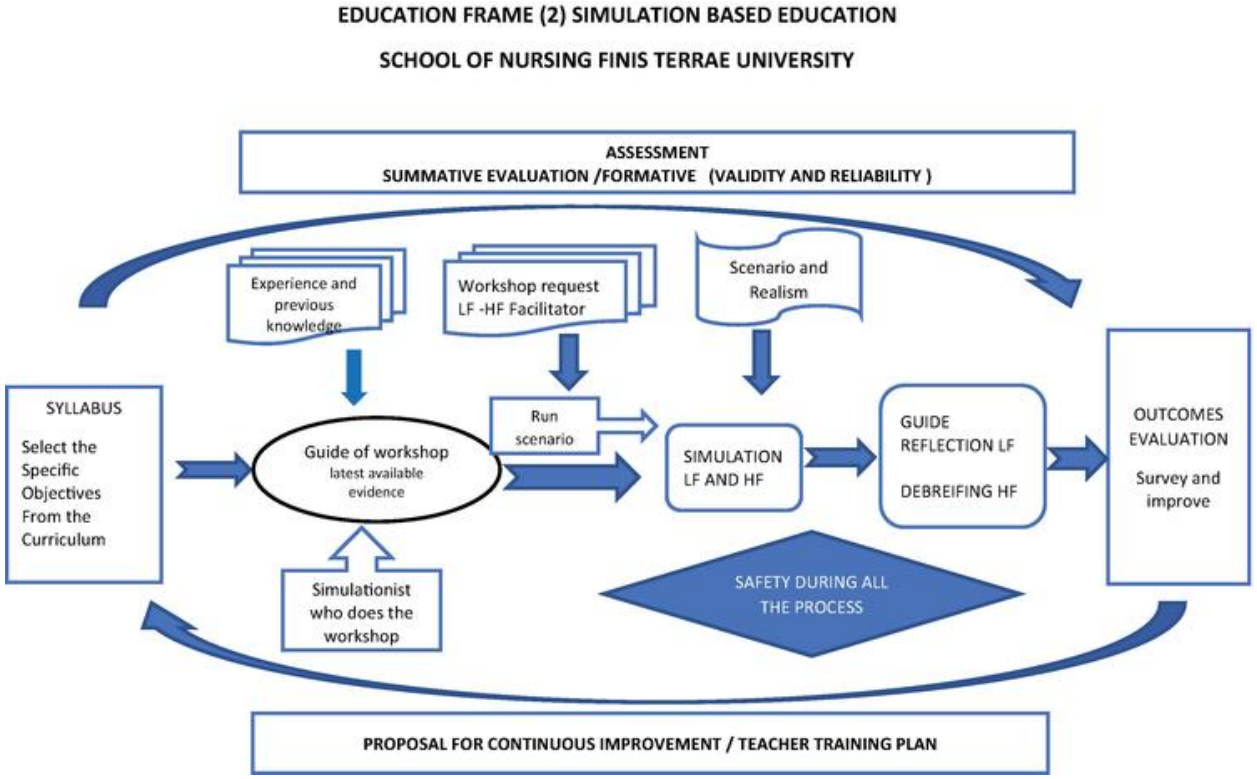
explicitly focusing on nursing students or nurse educators, (3) discussions involving at least one simulation modality, and (4) documented outcomes related to learning, skill development, or confidence. Excluded were conference abstracts, opinion articles, or studies lacking methodological transparency.

The final inventory in accordance with relevance, methodological soundness, and compatibility with the purpose of the study. These were a combination of randomized controlled trials, quasi-experimental studies, systematic reviews, and qualitative interviews or thematic syntheses. The information was retrieved and deciphered by means of thematic coding, distinguishing main patterns including the simulation modality, the area of learning that was affected (cognitive, affective, psychomotor), and the reported advantages or constraints. Key findings were further divided into recurring themes that focused on clinical competence, communication, confidence and curriculum integration. This strategy helped to both maintain the concrete quantitative outcomes and the subtle qualitative findings and place them in context.

The research methodology is informed by the principles of rigor, transparency, and sense of context sensitivity that are usually promoted in the study of nursing education. Owing to the complex and dynamic nature of simulation pedagogy, a qualitative synthesis has the required flexibility as well as rigorous process of exploring the complex outcomes. Through triangulating the evidence gathered in various geographic locations, student levels, and within different simulation modalities the review will present an evidence-based, globally applicable vision on simulation use in the curricula of modern day nursing education.

RESULTS AND DISCUSSION

The thorough overview of the existing literature shows that one of the major and unanimous trends is the fact that simulation-based learning (SBL) has a positive, rather significant impact on clinical competence, critical thinking, confidence, and readiness of nursing students to handle real-life situations. The simulation breeds as the effective addition to the traditional teaching methods but, in many studies, it can be seen as a better alternative to them as well according to the range of outcomes in different research designs, quasi-experimental, randomized controlled, or systematic review of studies. Learners who received structured simulation activities rated handbook/skill-based examination higher and on a self-report over the skills of confidence and clinical decision-making. In addition, the results seem to be generalizable to various nursing education levels, such as undergraduate, emergency and critical care nursing and advanced practice areas (Fenzi, et al. 2025).



The most frequently reported result is the improvement in clinical judgment and technical skill proficiency. For example, high-fidelity simulations were found to be particularly effective in preparing students for high-acuity and emergency scenarios—such as CPR, advanced cardiovascular life support (ACLS), and chemotherapy reactions (Tank & Taşdemir, 2025; Soomar et al., 2025). Participants in simulation groups consistently outperformed those in lecture-based groups when evaluated on their ability to recognize symptoms, initiate protocols, and collaborate in interdisciplinary care environments. Importantly, simulation enables students to experience rare but critical events (e.g., cardiac arrest, medication errors) that are unlikely to arise in typical clinical rotations, thereby broadening the scope and depth of learning opportunities.

Simulation Type	Primary Learning Domain	Reported Outcome(s)
High-fidelity mannequin simulation	Technical skills, decision-making	Improved CPR accuracy, faster response time, higher confidence
Virtual reality (VR) simulation	Psychomotor skills, self-regulation	Increased skill retention, lower anxiety in high-stress tasks
Standardized patient scenarios	Communication, empathy, cultural sensitivity	Enhanced emotional intelligence, better patient interaction
Game-based/escape room simulation	Critical thinking, teamwork	Boost in collaboration, motivation, and scenario recall
Disaster response digital simulation	Organizational response, crisis management	Improved triage accuracy, faster team coordination
Chemotherapy scenario simulation	Emergency preparedness, clinical judgment	Better identification of extravasation, faster intervention time

Another major theme across the literature is the boost in self-efficacy, clinical confidence, and reduced anxiety among learners. Nursing students often enter clinical settings with hesitation, fear of errors, and a lack of communication skills. Simulation mitigates these concerns by providing a risk-free, repetitive, and reflective learning environment. Studies by Wahid et al. (2025) and Tay et al. (2025) demonstrated that simulated patient encounters and debriefing sessions foster psychological safety, enabling students to speak up, ask questions, and practice assertiveness. Furthermore, students trained in simulation reported feeling better prepared to care for patients, particularly in high-stress areas like emergency rooms and intensive care units. This emotional readiness has a direct correlation with patient safety, confidence in care delivery, and long-term retention of knowledge.

Qualitative results also point to simulation's role in developing soft skills such as communication, empathy, and ethical reasoning. In the virtual agitation simulation study by Tay et al. (2025), students exhibited growth not only in clinical responses but also in emotional regulation and patient-centered dialogue. Similarly, using standardized patients and role-play methods helped improve empathy, cultural competence, and collaborative behaviors—skills often difficult to teach in traditional classrooms. These findings suggest that simulation provides a holistic educational impact, addressing both the technical and interpersonal dimensions of nursing care. When supported by structured debriefing and feedback, these scenarios reinforce self-reflection, enhance ethical sensitivity, and prepare students for the relational complexities of nursing practice.

Simulation Type	Avg. Reported Skill Improvement (%)	Avg. Confidence Gain (Likert Δ /5)	Knowledge Retention Improvement (%)
High-fidelity simulation	28.5%	1.4	31.0%
Virtual reality simulation	25.2%	1.2	26.7%
Standardized patient scenarios	21.4%	1.6	24.3%
Game-based simulation	23.1%	1.3	22.9%
Disaster response simulation	19.6%	1.1	20.5%

However, the literature also highlighted practical challenges and inconsistencies in implementation. The benefits of SBL are closely tied to the quality of simulation design, facilitator expertise, and institutional support. In resource-constrained institutions, access to high-fidelity equipment or trained simulation educators remains limited. Additionally, not all simulation experiences are standardized or formally integrated into the curriculum, leading to variability in outcomes. A recurring issue is the lack of clear outcome measurement tools, especially for soft skills and long-term professional behavior. Therefore, while simulation is widely acknowledged as effective, the degree of its impact depends on systematic planning, instructional alignment, and post-simulation debrief quality.

In summary, the collective evidence underscores simulation as a high-impact educational strategy that enhances clinical competence, builds learner confidence, and prepares nursing students for modern healthcare environments. When implemented effectively, simulation enables active learning, emotional resilience, and skill mastery—cornerstones of safe and competent nursing practice. Yet, to unlock its full potential, institutions must invest in simulation infrastructure, faculty training, and consistent assessment frameworks to ensure equitable and sustainable educational outcomes.

CONCLUSION

Simulation-based learning (SBL) has emerged as a transformative pedagogical strategy in nursing education, offering a bridge between theoretical instruction and real-world clinical practice. Through a synthesis of recent literature, this study affirms the widespread effectiveness of simulation in improving nursing students' clinical competence, decision-making ability, communication skills, and confidence. Whether delivered via high-fidelity manikins, virtual reality, or standardized patient interactions, simulation provides a safe and structured environment for experiential learning—allowing students to make mistakes, reflect, and adapt without risking patient safety. It has proven particularly effective in preparing learners for high-acuity scenarios and rare clinical events that are unlikely to be encountered during limited clinical rotations.

In addition to technical skills, simulation facilitates affective and knowledge development in the attainment of empathy, resilience, and critical thinking. Such a comprehensive view is compatible with the expectations of modern-day healthcare and not just because nurses are expected not only to be skilled but also emotionally competent and ethically aware. Furthermore, the post-pandemic boom in digitalized education has demonstrated the challenges to scalability and customizability of simulation processes, particularly in distance or resource-constrained conditions. Students learning in a simulated setting have also repeatedly performed better in knowledge retention, less anxiety during clinical encounters, and interprofessional collaboration exercise-markers of long-term professional preparedness.

Nevertheless, regardless of the benefits ensured by this, there are challenges associated with the integration of simulation in nursing education. Prohibitive implementation expenses, faculty preparation needs, inconsistent curriculum fit and lack of equal simulation structure access, especially in low- and medium-income countries, are obstacles to large-scale usage. Moreover, there have been no agreed upon outcome measures on soft skills and long-term behavior change thus restricting quantification of the simulation.'

As a final comment, simulation-based learning cannot be thought of as adjunct to nursing education, but rather as a core that is quickly going mainstream. The full potential of simulation can be achieved by investing in faculty infrastructure and technological support, curricular design, and development that systematically integrates simulation and focuses on pedagogically meaningful integration. The increasing complexity of healthcare means that simulation can be one of the best grounds to prepare nurses when they graduate as not only clinically competent but also confident, caring, and prepared to face the unpredictability of the current practice of patient care.

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