

Integration of AI with Simulation-based Education: A Narrative Review

Bhuvaneswari S.^{1*}, L. Lakshmi²

¹Department of Medical & Surgical Nursing, Sathyabama College of Nursing, Sathyabama Institute of Science & Technology, Chennai, Tamil Nadu, India

²Department of Nursing, Sathyabama College of Nursing, Sathyabama Institute of Science and Technology, Chennai, Tamil Nadu, India

*Corresponding Author: bhuvana.nursing@sathyabama.ac.in

Received Date: January 07, 2026; Published Date: January 21, 2026

Highlights

- AI enhances simulation through adaptive scenarios and real-time personalized feedback.
- Intelligent tutoring systems improve clinical reasoning and skill acquisition.
- AI-driven simulations increase learner engagement and self-regulated learning.
- Automation improves scalability and reduces instructor-dependent limitations.
- Ethical, human-centered AI design is essential for equitable implementation.

Abstract

Simulation-based education has emerged as a transformative pedagogical approach across healthcare, engineering, and STEM disciplines, providing learners with safe, controlled environments to develop critical competencies without real-world consequences. Traditional simulation-based learning, however, often employs static scenarios and generalized feedback mechanisms that may not adequately address the diverse learning needs of individual students. The integration of Artificial Intelligence (AI) technologies including Intelligent Tutoring Systems (ITS), machine learning algorithms, and generative AI models offers unprecedented opportunities to personalize learning experiences, enhance real-time feedback mechanisms, and optimize skill development trajectories. Recent evidence demonstrates that AI-driven simulations enable dynamic content adaptation, individualized learning pathways, and data-driven assessment strategies that significantly improve learning outcomes compared to conventional simulation approaches. Despite these promising developments, persistent challenges remain regarding ethical implementation, algorithmic bias mitigation, data security, scalability, and equitable access across diverse educational contexts. This narrative review synthesizes current evidence on AI integration within simulation-based educational frameworks, examining facilitators of effective implementation, emerging applications, and critical challenges requiring attention. The review emphasizes the transformative potential of AI-enhanced simulations while underscoring the necessity for human-centered design, transparent algorithmic practices, and institutional policies that prioritize learner equity and pedagogical integrity. By integrating technological innovation with educational best practices, AI-enhanced simulation-based education promises to reshape learning outcomes globally across multiple disciplines.