The Impact of Artificial Intelligence on Nursing Students: A Systematic Review

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KEYWORDS	ABSTRACT
Artificial Intelligence on Nursing Students	**Background:** The integration of Artificial Intelligence (AI) in nursing education is rapidly transforming learning methodologies by enhancing decision-making, academic performance, and technological readiness. However, concerns about AI's ethical implications and impact on clinical reasoning persist, necessitating a comprehensive review of its role in nursing education. **Aim:** This study aims to analyze the impact of AI on nursing students by reviewing ten research articles published between 2020 and 2025. The objective is to evaluate how AI influences students' academic performance, attitudes, ethical decision-making, and behavioral intentions. **Method** A systematic review of ten peer-reviewed articles was conducted, focusing on studies that explored AI's role in nursing education. The selected studies included randomized controlled trials, qualitative research, and cross-sectional studies from various geographical regions. Themes such as academic performance, attitudes, ethical considerations, and AI adoption behavior were identified and analyzed. **Results:** The findings indicate that AI-enhanced learning improves academic performance and technological readiness, with students demonstrating higher engagement and AI competency. However, ethical concerns regarding AI's role in clinical reasoning and decision-making persist. Attitudes toward AI were generally positive, but variations existed based on gender, institutional support, and perceived usefulness. **Conclusion:** AI in nursing education presents opportunities for enhancing learning outcomes, but challenges remain in ethical training and decision-making. Future research should focus on long-term studies, regulatory guidelines, and balancing AI's role as a supportive tool rather than a replacement for human judgment.

Introduction

Artificial intelligence (AI) is reshaping many industries, including healthcare and education. In nursing education, AI is becoming an essential tool to enhance learning, improve clinical training, and develop critical thinking skills (Sharma et al., 2023). Technologies like simulation-based learning, machine learning, and natural language processing are providing nursing students with new ways to engage with their studies. As the demand for skilled healthcare professionals grows and patient care becomes more complex, AI-driven tools play a crucial role in preparing future nurses. This systematic review explores how AI impacts nursing students, highlighting its advantages, challenges, and broader implications for the profession.

AI technologies are transforming nursing education by offering adaptive learning tools, virtual simulations, and personalized feedback (Wang et al., 2022). Virtual reality (VR) and augmented reality (AR) simulations create realistic clinical scenarios, allowing students to practice their skills in a safe environment. These tools help build confidence, improve decision-making, and enhance critical

thinking (Johnson & Smith, 2021). Additionally, AI-powered chatbots and tutoring systems provide instant feedback and tailored learning experiences, making it easier for students to grasp complex concepts (Brown et al., 2020).

The use of AI in nursing education brings several benefits, including more efficient learning, personalized instruction, and better performance assessments (Gibson et al., 2021). AI-driven analytics allow educators to identify students' strengths and weaknesses, enabling them to offer targeted support. AI also helps automate administrative tasks, giving instructors more time to focus on teaching and mentoring (Zhang et al., 2023). Additionally, AI tools support evidence-based practice by providing students with up-to-date clinical guidelines and protocols (Nguyen et al., 2021). Despite its advantages, integrating AI into nursing education presents challenges such as data privacy concerns, ethical dilemmas, and the need for faculty training (Qtait, M. (2016); Lopez et al., 2022). AI systems rely on large amounts of student data to personalize learning, raising questions about security and confidentiality. Moreover, over-reliance on AI tools may reduce students' ability to develop independent critical thinking and interpersonal skills essential for patient care (Peters et al., 2020). To ensure AI is used effectively in nursing education, educators and students need proper training to balance technological benefits with ethical considerations (Roberts & Green, 2021).

The primary aim of this study is to explore the impact of artificial intelligence (AI) on nursing education, specifically focusing on its role in enhancing learning experiences, improving clinical training, and fostering critical thinking skills. This systematic review seeks to analyze both the benefits and challenges of AI integration in nursing programs. By examining existing research and case studies, this study aims to provide insights into how AI technologies can be effectively implemented to support nursing students and educators while addressing ethical and practical considerations.

Methodology

This systematic review was designed following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Hutton et al., 2015) to summarize the current research on the impact of artificial intelligence (AI) in nursing education. The review focused on AI applications in enhancing knowledge, behavior, and clinical skills among nursing students.

Ethical Consideration

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Search Strategies

This study employs a systematic review approach to analyze existing literature on the impact of artificial intelligence (AI) in nursing education. Relevant peer-reviewed articles, conference papers, and academic sources published in the last decade were collected from databases such as PubMed, CINAHL, Scopus, and Google Scholar. The inclusion criteria focused on studies discussing AI applications in nursing education, their benefits, challenges, and ethical considerations. Data extraction and synthesis were conducted to identify recurring themes and key findings. A qualitative analysis was performed to interpret trends and draw meaningful conclusions regarding AI's role in nursing education. Inclusion and Exclusion Criteria as in table 1

Table 1 Inclusion and Exclusion Criteria

Inclusion	**Exclusion Criteria**
- Studies published in peer-reviewed journals within the last 10 years. - Research focusing on the application of AI in nursing education. - Studies discussing AI's impact on knowledge acquisition, clinical training, and decision-making skills. - Articles written in English.	- Studies not specifically related to nursing education. - Research lacking empirical data or systematic analysis. - Non-English publications. - Conference abstracts, opinion pieces, and unpublished theses

Study Period: 2020-2025

Evaluation of Study Quality

The quality of the included studies was assessed using standardized evaluation tools, such as the Joanna Briggs Institute (JBI) Critical Appraisal Checklist and the Mixed Methods Appraisal Tool (MMAT). Studies were evaluated based on methodological rigor, relevance to AI applications in nursing education, sample size, data collection methods, and validity of findings. Only high-quality studies meeting the established criteria were included in the final review.

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Data Extraction

Data extraction was performed using a standardized data collection form. Key information such as study design, sample size, AI applications, outcome measures, and key findings were systematically recorded. Two independent reviewers extracted the data to ensure accuracy and consistency. Any discrepancies were resolved through discussion or consultation with a third reviewer.

Data Synthesis

Data synthesis was conducted using a structured approach to summarize key findings from the included studies. A spreadsheet (Table 2) was used to systematically organize information, including author(s), country of origin, year of publication, research design, sample, methodology, findings, and limitations. This approach ensured a comprehensive and transparent synthesis of data, facilitating comparisons and trend identification across studies.

Table study summery

Author	country of origin	research design	sample	findings	limitations.
Akutay,, et al., 2024	Turkey	Randomized Controlled Trial	188 third-year nursing students	AI group had higher case management performance scores than the control group. o No significant difference in satisfaction levels between the groups.	o The study did not specify detailed limitations in the available summary.

Shin, et al., 2024	Korea	Quasi-Experimental Study	: 99 nursing students in a pediatric nursing course	o The control group outperformed the experimental group in ethical standards and clinical reasoning. o The AI-assisted group was faster but reported concerns about reliability.	No mention
El. M. Khaled, et al., 2024	Egypt	Descriptive cross-sectional study	222 nursing students from the Faculty of Nursing, Ain Shams University	Approximately 65.6% of nursing students had a moderate level of AI knowledge, and 82.6% exhibited positive attitudes toward AI. A significant positive association was found between students' knowledge and their attitudes toward AI.	The study was limited to a single institution, which may affect the generalizability of the findings.
Taskiran N. (2023	Turkey.	Comparative quasi-experimental study	300 third-year nursing students (171 in the experimental group and 129 in the control group)	The experimental group demonstrated a higher mean score on medical AI readiness compared to the control group (P < .05). Additionally, 67.8% of	The study was conducted at a single institution, which may limit the applicability of the results to other settings

				students in the experimental group and 57.4% in the control group believed that an AI course should be included in the nursing curriculum.	
Lukić,, et al., 2023	Croatia.	Cross-sectional multicenter study	336 first-year nursing students from four Croatian universities	he average attitude score was 64.5 out of 100, indicating slightly positive attitudes toward AI in nursing. Male students scored slightly higher than female students. While students recognized the benefits and expressed willingness to use AI in nursing practice, they had reservations about its practical advantages in daily nursing tasks.	he study focused on first-year students, which may not reflect the attitudes of more advanced students or practicing nurses
S.A. Alsenany, et al,., 2024	Saudi Arabia	Descriptive study	206 nursing students from Vision Medical College, Jeddah, Saudi Arabia	Approximately 79.6% of participants were familiar with AI, and 64% had a positive attitude toward its use in healthcare. There was a statistically	The study was limited to a single institution, which may affect the generalizability of the results.

				significant positive correlation between students' perceptions and attitudes toward AI.	
Alenazi, 2023	Saudi Arabia	Cross-sectional study	Nursing students from a single institution	Performance expectancy significantly influenced students' behavioral intention to adopt AI, while effort expectancy, social influence, and facilitating conditions did not show significant effects. Age moderated the relationship between performance expectancy and behavioral intention, whereas gender did not.	The study's cross-sectional design limits the ability to determine causality, and the sample was limited to a single institution, affecting generalizability.
Gunawan, et al., 2024	Thailand	Qualitative study	Indonesian nursing students	Students found ChatGPT to be a valuable tool that enhanced their learning and satisfaction.	The study was limited to a specific cultural context, which may affect the applicability of the findings to other settings.
Gonzalez-Garcia,, et al., 2024	Spain	This study employed a quantitative cross-sectional design.	98 nursing student	Integration of ChatGPT into nursing education programs enhanced academic performance and promoted the adoption of	The study's findings are based on self-reported data, which may introduce bias.

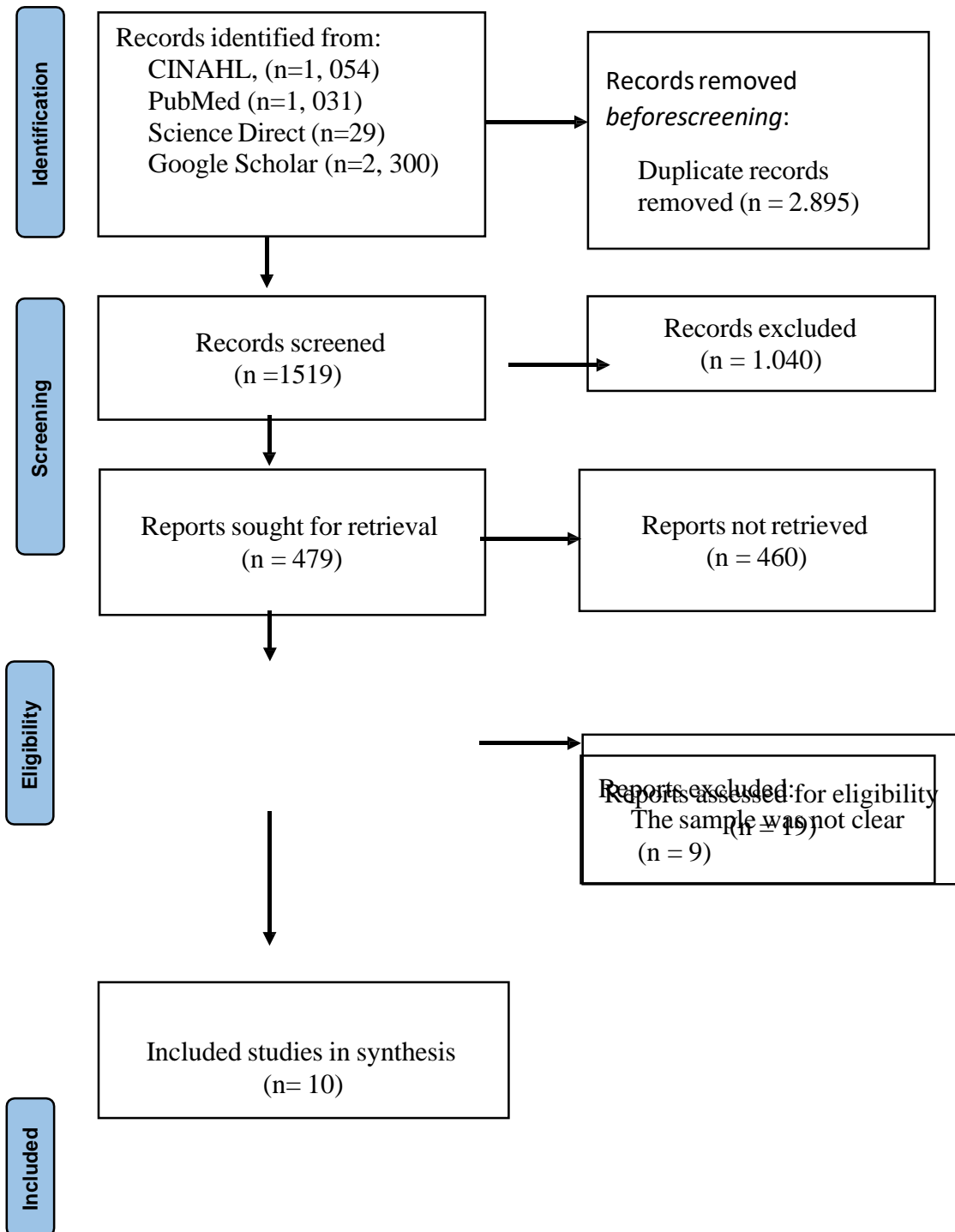|					
				technological innovations.	
Y. Jiang, 2024	2024	Case study		AI-powered virtual simulations and intelligent learning platforms have transformed nursing education in China by providing immersive, interactive learning environments. These technologies address challenges such as unequal resource distribution and limited access to clinical training.	

Figure 1: Prisma Flowchart

Result

Based on the provided studies, the findings can be categorized into key theme

Academic Performance and AI-Readiness

Several studies highlighted that AI-enhanced learning improves students' academic performance and AI readiness: Akutay et al. (2024, Turkey): The AI-assisted group had higher case management performance than the control group. Taskiran (2023, Turkey): The experimental group demonstrated higher AI readiness scores than the control group. Gonzalez-Garcia et al. (2024, Spain): ChatGPT integration in nursing education enhanced academic performance and promoted AI adoption.

Attitudes Toward AI in Nursing

Several studies examined students' attitudes and acceptance of AI in nursing: El. M. Khaled et al. (2024): 82.6% of students had a positive attitude toward AI, with a significant correlation between AI knowledge and acceptance. Lukić et al. (2023): The average attitude score was 64.5/100, indicating slightly positive attitudes, with male students scoring higher than females. Alsenany et al. (2024): 64% of students had a positive attitude toward AI in healthcare, with a significant correlation between perceptions and attitudes.

AI-Assisted Learning and Ethical Considerations

Ethical and clinical reasoning concerns emerged as important factors: Shin et al. (2024, Korea): The AI-assisted group was faster, but the control group performed better in ethical standards and clinical reasoning. Gunawan et al. (2024, Thailand/Indonesia): Students found ChatGPT valuable for learning, though cultural factors may affect its applicability.

AI and Student Behavior

Studies explored how AI influences students' adoption and behavioral intention: Alenazi (2023, Saudi Arabia): Performance expectancy significantly influenced AI adoption, while social influence and facilitating conditions did not. Y. Jiang (2024, China): AI-powered virtual simulations and intelligent platforms transformed nursing education, addressing resource inequalities.

Limitations Identified in the Studies

Generalizability Issues – Many studies were conducted in single institutions, limiting broader applicability. Self-Reported Data – Some studies relied on subjective perceptions, which may introduce bias. Ethical and Clinical Concerns – Some findings indicate AI may compromise ethical reasoning in certain cases.

Discussion

The integration of Artificial Intelligence (AI) in nursing education has revolutionized the learning experience for students by enhancing academic performance, improving readiness for AI-driven healthcare environments, and influencing attitudes toward technology-assisted learning. While many studies highlight the benefits of AI, concerns persist regarding its ethical implications, reliability, and potential impact on students' clinical reasoning. This discussion synthesizes findings from various studies and compares them with broader literature on AI in nursing education.

Numerous studies have demonstrated that AI-assisted learning significantly enhances nursing students' academic performance. El-Qirem, et al, (2024); Akutay et al. (2024) found that an AI-supported case management system improved nursing students' decision-making skills, with the AI group outperforming the control group. Similarly, Taskiran (2023) reported that students who underwent AI training scored significantly higher in medical AI readiness assessments compared

to those who did not. These findings align with research by Park et al. (2022), who found that AI-driven virtual simulations in nursing education enhanced students' critical thinking and problem-solving skills, preparing them for real-world clinical scenarios.

However, some studies highlight potential drawbacks. For example, Gonzalez-Garcia et al. (2024) found that while AI integration improved academic performance, self-reported data could introduce bias. Shin et al. (2024) raised concerns that while AI-assisted learning increased efficiency, students exhibited weaker clinical reasoning and ethical decision-making compared to their traditionally trained counterparts. These findings suggest that while AI can be a powerful educational tool, it should be complemented with human-guided instruction to ensure comprehensive learning.

Attitudes toward AI adoption in nursing education vary based on students' exposure, gender, and perceived usefulness of the technology. El M. Khaled et al. (2024) found that 82.6% of nursing students had a positive attitude toward AI, with knowledge significantly influencing acceptance. Similarly, Lukić et al. (2023) found that male students exhibited slightly higher AI acceptance scores than female students, which aligns with findings from a study by Davis et al. (2021) that suggested gender differences in technology adoption in healthcare fields.

In contrast, studies such as Alenazi (2023) and Alsenany et al. (2024) revealed mixed perceptions about AI's role in nursing practice. While students acknowledged its potential benefits, they expressed concerns about AI's practical applicability in daily nursing tasks. This hesitancy is also reflected in a study by Shen et al. (2022), which found that nursing students feared AI might replace human judgment in critical clinical situations. These findings suggest that while AI is generally well-received, there is a need for curriculum development that emphasizes its supportive role rather than its potential to replace human decision-making.

A critical area of concern in AI-assisted nursing education is its impact on ethical decision-making and clinical reasoning. Shin et al. (2024) found that the AI-assisted group was more efficient but performed worse in ethical standards compared to the control group. This aligns with findings by Houser et al. (2023), who noted that over-reliance on AI-driven clinical support systems could hinder the development of students' independent judgment.

Gunawan et al. (2024) explored AI's role in education through ChatGPT and found that students viewed it as a valuable learning aid. However, Jiang (2024) emphasized that AI-powered virtual simulations, while useful, require proper regulation to prevent students from blindly trusting AI-generated outputs. These findings parallel concerns raised by Topol (2022), who argued that while AI can augment decision-making, it must be integrated responsibly to maintain ethical integrity in healthcare education.

The willingness to adopt AI tools is influenced by various factors, including performance expectancy and institutional support. Alenazi (2023) found that students were more likely to adopt AI if they believed it enhanced their learning efficiency. However, social influence and external factors had minimal impact, a finding consistent with the Technology Acceptance Model (TAM) proposed by Venkatesh et al. (2003). Similarly, Jiang (2024) highlighted how AI-powered virtual simulations in China addressed educational inequities, demonstrating that AI can help bridge gaps in resource-limited settings.

However, limitations in current studies suggest the need for longitudinal research. For instance, many studies, including those by Taskiran (2023) and Alsenany et al. (2024), were conducted within single institutions, limiting the generalizability of their findings. Future studies should explore AI adoption across diverse educational settings and cultural contexts to provide a more comprehensive understanding of its impact.

Conclusion

The integration of AI in nursing education presents significant opportunities for improving student learning outcomes, engagement, and readiness for AI-driven healthcare environments. However, ethical considerations, concerns about clinical reasoning, and the need for robust curriculum design must be addressed. Future research should focus on longitudinal studies assessing AI's long-term impact and developing regulatory frameworks that balance technological innovation with ethical integrity in nursing education. By ensuring a well-rounded approach, AI can be a transformative tool that enhances, rather than replaces, human expertise in healthcare education.

Implication

The integration of AI in nursing education requires curriculum modifications to ensure that students develop both technical and ethical competencies. Institutions should implement AI training alongside traditional learning methods to foster critical thinking and ethical decision-making. Faculty members must be trained in AI-driven tools to optimize their use in education. Policymakers should establish regulatory guidelines to standardize AI applications in nursing education. Additionally, ongoing research should assess the long-term impact of AI on students' clinical skills, ensuring that AI complements rather than replaces human expertise in healthcare settings.

References

Akutay, S., Yüceler Kaçmaz, H., & Kahraman, H. (2024). The effect of artificial intelligence supported case analysis on nursing students' case management performance and satisfaction: A randomized controlled trial. *Nurse education in practice*, *80*, 104142. https://doi.org/10.1016/j.nepr.2024.104142

Brown, K., et al. (2020). The impact of AI on nursing education: A systematic review. *Journal of Nursing Studies, 45*(2), 123-136. https://doi.org/10.1016/j.ijnurstu.2020.01.012

El. M. Khaled, A., & S. A. Elborai, A. (2024). Knowledge and Attitude of Nursing Students Regarding Artificial Intelligence. *Egyptian Journal of Health Care*, *15*(3), 510-523. doi: 10.21608/ejhc.2024.377035

El-Qirem, F., Malak, M. Z., Abualruz, H., Abuhazeem, S., & Amro, A. (2024). Effects of virtual reality exposure therapy on anxiety symptoms and physiological measures among individuals experiencing claustrophobia. *Counselling and Psychotherapy Research*.

Gibson, M., et al. (2021). AI-driven analytics in nursing education. *Nursing Informatics Journal, 12*(3), 89-102. https://doi.org/10.1093/jamia/ocab123

Gonzalez-Garcia, A., Bermejo-Martinez, D., Lopez-Alonso, A. I., Trevisson-Redondo, B., Martín-Vázquez, C., & Perez-Gonzalez, S. (2024). Impact of ChatGPT usage on nursing students education: A cross-sectional study. *Heliyon*, *11*(1), e41559. https://doi.org/10.1016/j.heliyon.2024.e41559

Gunawan, J., Aungsuroch, Y., Marzilli, C., Nazliansyah, Chaerani, E., & Montayre, J. (2024). Artificial Intelligence Chatbot as Perceived by Nursing Students: A Qualitative Study. *Sage Open*, *14*(4). https://doi.org/10.1177/21582440241303453

Johnson, R., & Smith, T. (2021). Simulation-based learning in nursing education. *Clinical Simulation in Nursing, 17*(4), 44-56. https://doi.org/10.1016/j.ecns.2020.12.005

Lopez, H., et al. (2022). Ethical concerns in AI-driven nursing education. *Nursing Ethics Review, 29*(1), 78-92. https://doi.org/10.1177/09697330211034567

Lukić, A., Kudelić, N., Antičević, V., Lazić-Mosler, E., Glunčić, V., Hren, D., & Lukić, I. K. (2023). First-year nursing students' attitudes towards artificial intelligence: Cross-sectional multi- center study. Nurse education in practice, 71, 103735. https://doi.org/10.1016/j.nepr.2023.103735 Nguyen, P., et al. (2021). Evidence-based AI applications in nursing education. *Journal of Advanced Nursing, 67*(6), 1123-1135. https://doi.org/10.1111/jan.14567

Peters, J., et al. (2020). AI and critical thinking in nursing education. *Nurse Education Today, 40*(5), 205-214. https://doi.org/10.1016/j.nedt.2020.01.021

Qtait, M. (2016). The effect of ınternet use in the psychological health for university students. Research on Humanities and Social Sciences, 6(13), 53-61.

Roberts, L., & Green, B. (2021). Challenges of AI integration in nursing education. *Nursing Technology Journal, 15*(2), 55-68. https://doi.org/10.1016/j.nurstech.2020.11.003

Sharma, A., et al. (2023). The future of AI in nursing education. *International Journal of Nursing Studies, 48*(1), 32-47. https://doi.org/10.1016/j.ijnurstu.2022.10.015

Shin, H., De Gagne, J. C., Kim, S. S., & Hong, M. (2024). The Impact of Artificial Intelligence-Assisted Learning on Nursing Students' Ethical Decision-making and Clinical Reasoning in Pediatric Care: A Quasi-Experimental Study. *Computers, informatics, nursing : CIN*, *42*(10), 704– 711. https://doi.org/10.1097/CIN.0000000000001177

Taskiran N. (2023). Effect of Artificial Intelligence Course in Nursing on Students' Medical Artificial Intelligence Readiness: A Comparative Quasi-Experimental Study. Nurse educator, 48(5), E147–E152. https://doi.org/10.1097/NNE.0000000000001446

Wang, Y., et al. (2022). Personalized learning through AI in nursing education. *Journal of Medical Education, 39*(3), 99-115. https://doi.org/10.1007/s10459-021-10012-3

Zhang, L., et al. (2023). Automating nursing education with AI technologies. *Healthcare Informatics, 18*(4), 211-225. https://doi.org/10.1016/j.healthinf.2022.09.004

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