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REVIEW

Utilization of Artificial Intelligence in Nursing education: a scoping review

Utilización de la inteligencia artificial en la educación de Enfermería: una revisión del alcance

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ABSTRACT

Introduction: Recent technological advances in education, including nursing education, have provided an opportunity for the introduction of Artificial Intelligence in education to increase the quality of education and the Teaching-Learning Process. AI offers an interactive, adaptive and data-driven environment that benefits students' theoretical knowledge and clinical competence. Although its potential use includes personalized learning, live feedback or immersive simulations, its incorporation in nursing education is limited due to ethical implications, high costs and lack of infrastructure. **Objective:** To describe the use of artificial intelligence in nursing education.
Methods: This scoping review was organized based on the Joanna Briggs Institute methodology, identifying the use of AI in nursing education**.**
Results: A comprehensive literature search identified 16 relevant studies between 2020 and 2025. The findings, categorized into three topic areas, highlighted the role of AI in competency development, benefits and challenges, and nursing student perspectives.
Conclusion: This study highlights the need for integration of AI into the nursing education curriculum to prepare students for the changing demands of healthcare. Although AI improves student engagement and decision-making, further research is needed to assess its long-term effectiveness and ethical implications.

Keyword: Artificial Intelligence; Nursing Education; Nursing Students

RESUMEN

Antecedentes: Los recientes avances tecnológicos en la educación, incluida la educación en Enfermería, han dado oportunidad para la introducción de la Inteligencia Artificial en la enseñanza para

incrementar la calidad de la educación y del Proceso de Enseñanza- Aprendizaje. La IA ofrece un entorno interactivo, adaptable y basado en datos que beneficien los conocimientos teóricos y la competencia clínica de los estudiantes. Aunque su posible uso incluya el aprendizaje personalizado, la retroalimentación en vivo o simulaciones inmersivas, su incorporación en la enseñanza de la Enfermería están limitadas debido a las implicaciones éticas, altos costos y falta de infraestructura. **Objetivo:** Describir el uso de la inteligencia artificial en la enseñanza de la Enfermería.
Métodos: Esta revisión de alcance se organizó basándose en la metodología del Instituto Joanna Briggs, identificando el uso de la IA en la educación de Enfermería.
Resultados: Una búsqueda bibliográfica exhaustiva identificó 16 estudios relevantes entre 2020 y 2025. Los hallazgos, categorizados en tres áreas temáticas, destacaron el papel de la IA en el desarrollo de competencias, los beneficios y desafíos, y las perspectivas de los estudiantes de Enfermería.
Conclusiones: Este estudio destaca la necesidad de integrar la IA en el plan de estudios de Enfermería para preparar a los estudiantes para las cambiantes demandas de la atención sanitaria. Aunque la IA mejora el compromiso y la toma de decisiones de los estudiantes, es necesario seguir investigando para evaluar su eficacia a largo plazo y sus implicaciones éticas.

Palabra clave: Inteligencia Artificial; Educación en Enfermería; Estudiantes de Enfermería.

INTRODUCTION

Technological advances in education have significantly transformed learning methodologies, including in nursing education. One of the most impactful innovations is the integration of artificial intelligence (AI) into nursing education, which offers promising opportunities for enhancing teaching and learning experiences [(1)]. AI has the potential to enhance nursing education through an interactive, adaptive, and data-driven learning environment that improves both theoretical knowledge and practical skills [(2,3)]. For example, AI-driven platforms such as intelligent tutoring systems and daptive learning technologies can adjust learning materials to match each student's pace, address specific knowledge gaps, and respond to individual learning styles. This personalized approach creates more meaningful and effective learning experiences.

Moreover, AI technologies enable the development of immersive and interactive educational scenarios, particularly within clinical contexts that are often difficult to replicate in traditional settings[(4,5)]. These tools offer students the opportunity to repeatedly engage in clinical simulations within a safe, controlled environment, allowing them to build competence and confidence before entering actual practice. Real-time, personalized feedback provided during these simulations enhances learning by enabling immediate error correction and reinforcing clinical decision-making skills. Such adaptability makes it possible to cater to diverse learning needs and preferences.

Nursing education differs from other professional education, which is not only theoretical but also emphasizes the importance of clinical competence. Teaching that still uses conventional methods, such as face-to-face lectures in classrooms and clinical practicums, is a challenge in terms of flexibility, accessibility, and the ability to learn independently for students[(6)]. In these conditions, AI-based learning systems can bridge these limitations by adapting educational materials to the needs of students and providing feedback. In addition, AI can also create virtual and augmented reality scenario simulations[(7,8)].

In addition, AI can also contribute to enhancing learner engagement and creativity through the introduction of dynamic and interactive strategies that can promote deeper understanding and motivate students[(9,10)]. It can accelerate learners' understanding of more complex concepts and improve knowledge retention through evidence-based

learning techniques[11]. AI can make it possible to access patient condition data in real time and analyze it so that nursing students can hone their critical thinking skills and skills to be able to make more informed decisions and support more accurate patient assessments to provide appropriate interventions[12]. The integration of AI into teaching and learning methods not only makes learning strategies more modern but can also prepare learners to be better prepared for real nursing care. By ensuring the development of learners' skills, competencies, and confidence, students will be able to deliver more effective clinical practice.

Although AI brings many benefits to nursing education, its implementation poses complex challenges. Previous studies have shown that the use of AI, such as ChatGPT, creates an ethical dilemma that ultimately affects skill development, especially students' critical thinking skills [13]. In addition, the high cost, limited infrastructure, and cultural and language barriers hinder the application of AI in nursing education[14,15].

With the rapid development of AI, nursing education institutions should start adopting and integrating it into the learning system to enhance effective education. The application of AI has great potential to improve competence and equip students so that students can meet labor market demands and ultimately contribute to quality of patient care.

METHOD

This study utilized the scoping review framework developed by Arksey and O'Malley, and refined by the Joanna Briggs Institute (JBI) methodology [16]. The research began with the development of research questions, specifically: How is AI used in nursing education?

Strategy A literature search was conducted in electronic databases, including PubMed, Cochrane, and EBSCOhost. The article search strategy used keywords such as "Artificial Intelligence," "Nursing," and "Education" and to assist in the process of identifying relevant articles also used Medical Subject Headings (MeSH). The search strategy, including all identified keywords and index terms, was customized for each bibliographic source. Searches were performed on February 26, 2025, and all results were imported into Rayyan. Duplicate studies were subsequently removed.

Study selection

Inclusion and exclusion criteria will be established to ensure the relevance of the selected studies.

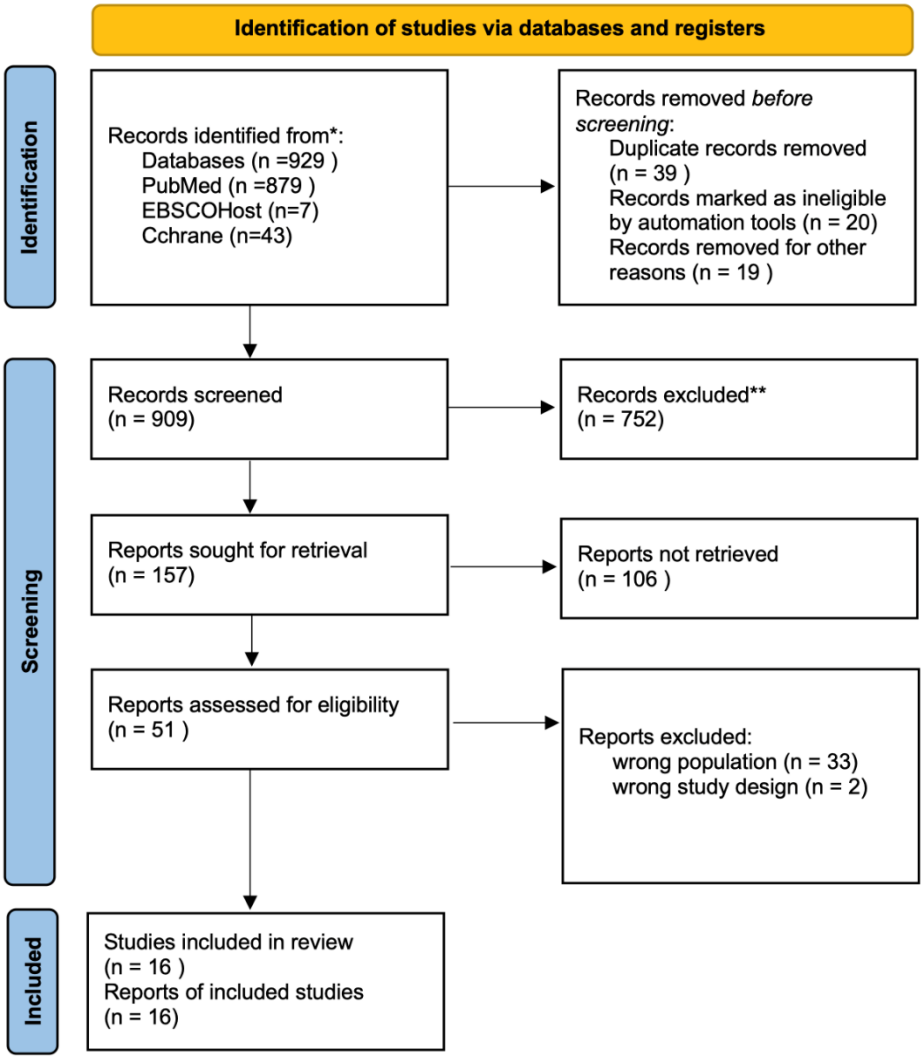
Table 1: Inclusion and exclusion criterio.

Criterion	Inclusion	Exclusion
Phenomenon of interest	Studies that address the utilization of AI in nursing education	Studies that were not related to education or nursing students
Time period	Articles published within 2020-2025	Before 1 January 2020 or after 27 February 2025
Type of study	Qualitative, quantitative, and mixed-methods studies on the phenomenon published	Letters, comments, conference abstracts, editorials, books, any type of review, and Articles not available in full text
Type of participant/ population on study	Population in study is Nursing student	Studies whose subjects were lower than level bachelor nursing students
Language	English and Indonesian	All other language

Data from selected studies will be extracted using a standardized data extraction form. The information collected will cover study characteristics, including year of publication, study design, and location of research, as well as key findings related to the use of artificial intelligence in nursing education. In the initial phase, three reviewers independently screened article titles and abstracts for eligibility criteria using the Rayyan QCR platform. Subsequently, the full text of potentially relevant evidence was assessed against the inclusion criteria by two independent reviewers. To systematize the review process and minimize research bias, three independent reviewers were involved in each screening phase. Any disagreements were addressed and resolved by consensus with a third reviewer until complete agreement was reached.

The results will be synthesized narratively and presented thematically. The major themes identified relate to the effectiveness of artificial intelligence, its application, and the challenges faced by nursing students. A descriptive analysis will be employed to identify trends in the use of artificial intelligence in nursing education. The initial search yielded 929 articles. After removing duplicates, 909 articles were reviewed by title and abstract for relevance. A total of 53 full-text articles were analyzed, and 16 articles met the inclusion criteria for this review. The results of the research will be fully described in the final review and presented in the PRISMA-ScR flowchart (Figure 1).

Figure 1: PRISMA ScR flow diagram



RESULT

The database search yielded a total of 929 publications. After eliminating 20 duplicates, the titles and abstracts of the publications were reviewed. Based on the inclusion and exclusion criteria, the abstracts of the publications were read, and a total of 857 articles were excluded. The remaining 51 articles were read in full text, and finally, 16 study publications were selected for review. A total of 16 articles were found, published between 2020 and 2025; the majority were (50%) published in 2024.

How can observed in the Table 2, the included studies were conducted in South Korea (n = 5), China (n = 3), Spain (n = 2), the USA (n = 2), Saudi Arabia (n = 1), and Singapore (n = 1). Sample sizes ranged from 14 to 1,788 nursing students. Eleven studies used a quantitative method, eight of them with a descriptive and cross-sectional correlational design [17–24] a pre-experimental design [18] and a Quays experimental design [19]. Most studies analyzed non-specific AI (n=10), three studies focused on the use of GPT chat in the learning process of nursing students [20,25].

Table 2: Characteristics of the articles reviewed.

No		Features	F	Percentage (%)
1	Year of publication	2020	1	6.25
		2021	0	0
		2022	3	12.5
		2023	4	18.75
		2024	9	56.25
		2025	1	6.25
		Total (N)	16	6.25
2	Study environment	Singapore	1	6.25
		South Korea	5	31.25
		China	3	18.75
		Saudi Arabia	1	6.25
		New York	2	12.5
		Spain	2	12.5
		USA	2	12.5
		Total (N)	16	100
3	Study design	Qualitative	4	25
		Descriptive and observational survey	8	50
		Pre-experimental	1	6.25
		Quasy-experimental	1	6.25
		randomized controlled trial	1	6.25
		Mixed method	2	12.5
		Total (N)	16	100
4	Type of AI	Chat GPT	3	18.75
		Gen-AI	2	12.5
		other AI (non-specific)	11	68.75
		Total (N)	16	100

To answer the research question regarding How AI is used in nursing education, the results are presented in three thematic groupings (Table 3).

Table 3: Thematic result of the articles

Theme	Number of items
Artificial Intelligence (AI) as a potential means to support the improvement of nursing students' competencies.	1, 2, 3, 5, 6, 7, 11, 16
Challenges in the use of AI in nursing learning environments.	2,3,6,7,8,11,14
Diverse perspectives and experiences of nursing students on the use of AI.	4, 9, 10, 13, 15

AI as a potential means to support the improvement of nursing students' competencies

Ten papers addressed AI as a potential means to support the improvement of nursing students' competencies. Some studies focus on the use of AI solely for knowledge enhancement and explain the ease of access to information, clarification of nursing

concepts, support for preparation of clinical tasks such as diagnostic collection, and health promotion [22]. In addition, the integration of AI into learning is also considered an effective strategy because of the ease of access, repetition, and measurable learning outcomes [23]. Other research also claimed that the use of AI can improve learners' communication skills, especially interprofessional communication (IPC) [24]. Other advantages that are also mentioned in other research findings are benefits in improved academic grades, enhanced understanding of technology use, economic benefits, enjoyable experiences, promotions, and ease of developing anamnesis skills [20,26–28].

Challenges in the use of AI in nursing learning environments.

Despite the many benefits to be gained from the use of AI, the challenges posed by its application in education cannot be overcome, as stated in 8 articles. One of these articles highlights the principle of ethics in its application. One study revealed that there were differences in the aspects of ethical understanding and critical thinking skills experienced by students using AI compared to students not using it. Although in terms of time efficiency, AI users can complete tasks faster than the control group, in terms of reliability, the control group showed higher competencies [22].

It is highly recommended to be able to combine AI with conventional learning approaches, so that it is expected to improve students' decision-making skills and ensure the confidentiality of the information they use. This balanced approach aims to develop versatile helping professionals who are prepared to understand the complexities of healthcare with technological prowess and critical analysis skills [22]. Another challenge of AI is its unavailability for nursing leaders and educators to bridge existing gaps and ensure that future nurses are equipped to use AI to improve patient care and healthcare outcomes [17]. In addition, several research findings also convey that the challenges that need to be addressed are the need for further research on the application of AI in the education world and the need for regulations by stakeholders so that they can hopefully regulate the use of AI more effectively in the education world to avoid misinformation or other undesirable things [20,24–27,29].

Diverse perspectives and experiences of nursing students on the use of AI.

This topic was raised because there are 5 studies that analyze nursing students' experiences and opinions on the use of AI during the learning process. One of the studies revealed that it turns out that the use of AI for the first time in the learning process causes a lot of chaos, there are feelings of confusion, excitement, embarrassment and helplessness, but in the end nursing students can adapt well to the AI used [17,35] identifies the influence of AI ethical awareness, attitude towards AI, anxiety and self-efficacy on nursing students' behavioral intentions to use AI-based healthcare technology. The findings showed that, in the fourth year, nursing students experienced a reduction in their ethical awareness, attitude toward AI, self-confidence, and anxiety after being introduced to AI.

Furthermore, it is urgent for educational institutions and clinical settings to review nursing curricula, enabling students to engage in safe and effective practical training in this AI-dominated era.

Another different study found that AI perception, anxiety, and acceptance are key factors influencing the intention to use AI [30]. Likewise, anxiety and acceptance act as dual mediators in the relationship between AI perception and intention to use among nursing students.

DISCUSSION

AI can be a tool for enhancing the competencies of nursing students. Students can access personalized educational resources, virtual interactions with patients that closely resemble real clinical settings, and engage in immersive simulations [31]. These tools are essential to foster decision-making, critical thinking, and practical skills. It can effectively connecting theoretical learning with real-world application [32]. In addition, AI provides quick feedback, and also allowing students to identify areas that need improvement and track their learning progress. Integrating AI into nursing education helps create a more engaging and personalized learning environment. It allows students to learn at their own pace, adapt to different challenges, and gain the skills they need to succeed in their future careers as compassionate and competent healthcare professionals [33].

Several articles in this review highlight that AI holds great promise in supporting nursing students' learning and academic success. They show a clear positive link between students' knowledge, attitudes, perceptions, and their willingness to embrace AI in their education. Simply put, the more students understand and feel confident about AI, the more likely they are to use it as a valuable learning tool [17].

Another study points out that AI can significantly enhance students' understanding, especially when it comes to core nursing concepts. Interestingly, two studies also mention that nursing students have started using tools like ChatGPT as part of their learning process, showing how AI is becoming a practical and helpful companion in their educational journey [20,34]. AI gives nursing students the opportunity to explore a wide range of perspectives and resources, which helps sharpen their critical thinking skills and makes learning more enjoyable. In fact, two separate studies found that using AI chatbots can boost students' satisfaction, making the learning experience feel more interactive and supportive [25,28]. Supporting this finding, another study also noted that AI can play a helpful role in developing nursing students' communication skills and empathy, especially when it comes to caring for older adults. With the right guidance, AI doesn't just teach facts; it can also support the human side of nursing [29]. Based on these findings, it's clear that AI has the potential to bring real benefits to nursing education. It can help students strengthen their critical thinking and deepen their understanding of nursing concepts. It also supports the development of communication skills, empathy, especially in caring for older adults, and even enhances the experience of learning in interprofessional education (IPE) programs. Overall, AI contributes to a more satisfying and meaningful learning journey for nursing students.

This aligns with earlier research, which shows that AI can be a valuable tool for nursing students, especially in simulation and virtual learning. By offering realistic scenarios and tailored feedback, AI helps improve clinical judgment and creates a more personalized and effective learning experience [35]. Another study emphasized that investing in AI-based tools and methods can really pay off in the long run for nursing education. It can lead to better learning outcomes, make the learning process more efficient, and support educators in delivering lessons more effectively. In short, AI has the potential to make

both teaching and learning in nursing more impactful and future-ready [36]. In the end, AI doesn't just enhance the way nursing students learn, it also brings valuable support to the nursing profession as a whole. One study pointed out that using AI in nursing practice can be a helpful tool for nurses, managers, and supervisors alike, offering insights and support that improve decision-making and patient care. It's a step forward for both education and everyday practice in the field [27]. AI has the potential to transform how nurses work day to day. By streamlining workflows and supporting clinical decisions, it can become a valuable tool that helps nursing professionals provide high-quality care while ensuring patient safety. It's not about replacing the human touch, it's about enhancing it with smarter, more efficient systems.

One of the main challenges in incorporating AI into nursing education lies in effectively integrating it with traditional learning methods to prepare competent and professional nursing graduates. This requires well-developed strategies that guide the ethical use of AI while simultaneously fostering critical thinking skills among students. Furthermore, another study emphasized that although AI holds great potential to revolutionize nursing education by enhancing efficiency and supporting clinical decision-making. It should not be viewed as a replacement for human intelligence and critical reasoning. Therefore, it is essential that AI be used with responsibility and caution, ensuring it serves as a supportive tool rather than a substitute for the human aspects of nursing practice [37]. Similar findings were also reported in another study, emphasizing the importance of adopting thoughtful strategies when integrating AI into educational settings. These strategies should promote ethical awareness and encourage original, independent thinking among students, while also acknowledging and addressing the limitations of AI. This balanced approach ensures that AI serves as a meaningful complement to, rather than a replacement for, the human elements of learning and professional development [35].

On the other hand, although the use of AI may facilitate more efficient access to diverse perspectives on nursing, AI can also lead to dependency, so it is hoped that with proper navigation, it will not reduce students' critical thinking skills, careful selection of data, and strict verification of sources. This coincides with a study stating that nursing professors are concerned that their students will become dependent on AI so that they may later ignore critical thinking, relationship-building skills, and communication skills. In addition, there is also the possibility of plagiarism, which can damage academic integrity [35]. In addition, the resistance of AI implementation by stakeholders or leaders and educators is answered by the results of another study in which several factors influence the clinical implementation of AI, including anticipating the resources needed to enable implementation, involving all adopters from the beginning of implementation, and remaining reflective and reactive during implementation. It is hoped that these factors can be linked to nursing education to improve student competencies [38]. It is hoped that these factors can be associated with nursing education in the development of student competencies. However, we are also challenged to conduct more research related to the use of AI and its impact on the development of nursing education [26]. A similar result was also revealed in another study explaining students' perspective on the use of AI, in which students felt that there were negative aspects that could arise, such as fake health news, hoaxes, political and personal credibility issues, and others [27]. Research also revealed that the perceived disadvantages of using AI were subscription fees, over-reliance, and accuracy issues that could affect confidence [22]. However, on the other hand, they also felt that AI technology could bring positive benefits in the commercial, advertising, and entertainment fields, as well as helping to improve

diagnosis and aid learning. However, the students also argued that it was important to be able to take this aspect into account in future AI-related learning in nursing education to raise awareness of the dangers of AI in all its forms, but also of its benefits and advantages [22,27].

A representative model for describing the phenomena and solutions in this review is Patricia Benner's novice-to-expert model. This model has been used as a framework in nursing education [39,40]. This framework outlines the progression of nursing students through five stages of competence: novice, advanced beginner, competent, proficient, and expert. AI has the potential to play a meaningful role in supporting this development by providing personalized learning experiences that are carefully tailored to each stage. By adapting to individual needs and skill levels, AI can help guide students through their learning journey more effectively and confidently.

AI-based tools can support both novice learners and those with some clinical experience by providing foundational clinical scenarios accompanied by structured guidance. For more advanced or expert-level students, AI can facilitate complex simulations and real-time decision-making exercises that reflect the challenges of actual practice. Importantly, nurse educators will continue to play a vital role in ensuring that AI is used thoughtfully and effectively, as a tool to prepare future nurses who are not only clinically competent and technologically skilled but also compassionate in their care [35].

Furthermore, AI systems have the capability to track students' progress over time, enabling educators to more accurately identify where each student falls within the Novice-to-Expert framework. This allows for the provision of targeted support tailored to individual learning needs. The thoughtful integration of AI with the Novice-to-Expert Model can create a dynamic and supportive educational environment, one that enriches the learning experience and promotes the professional growth of nursing students.

The limitation in this research is that there is not much literature discussing the utilization of AI from the perspective of lecturers as educators. The perspective of lecturers can add complexity to the information that can support how the benefits of AI in the field of Nursing education are understood.

CONCLUSION

The integration of AI technology into the world of nursing education is able to present transformative potential that can have an impact on improving students' cognitive, psychomotor, and affective competencies. AI-based learning tools enable personalized learning, real-time feedback, and immersive stimulation that enhances nursing students' critical thinking and decision-making skills.

In addition to the advantages it has, we are also faced with several challenges that arise, such as ethical issues, high costs, limited infrastructure, the impact of dependence on AI, and the impact on student cognition.

Further studies are needed to be able to analyze the long-term impact of AI on nursing education outcomes. In addition, collaboration is needed between nursing educators and technology developers in order to be able to develop a standardized AI-based learning model that is in line with the nursing competencies needed.

Ultimately, collaboration from many parties including educators, educational institutions, and policy makers is also an important foundation in developing the application of AI in nursing education so that a strong strategy can be formulated and used as a joint guideline in creating an innovative curriculum in accordance with the era of increasingly rapid digitalization.

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