

Artificial Intelligence in Nursing Education: Challenges and Opportunities in the Chinese Context

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Abstract

In China, where nursing education faces challenges such as unequal resource distribution, limited access to clinical training, and scalability issues, artificial intelligence (AI) has emerged as a transformative force. This study examines the integration of AI technologies, particularly virtual simulations and personalized learning systems, in Chinese nursing education. It explores how these advancements address educational inequities, improve teaching efficiency, and enhance student outcomes. Through case studies and performance evaluations, the benefits of AI tools in creating immersive and tailored learning experiences are highlighted. However, the study also acknowledges challenges, such as ethical concerns surrounding sensitive student data and the infrastructural disparities that may limit AI's effectiveness in under-resourced areas. Finally, the global implications of China's AI applications in nursing education are evaluated, offering recommendations for future research, including emotional intelligence algorithms and adaptive learning systems, to further enhance healthcare practice and decision-making.

Keywords

Artificial Intelligence, Nursing Education, Virtual Simulations, Personalized Learning, China, AI-Powered Assessments, Educational Equity, Technological Infrastructure, Data Privacy

1. Introduction

Artificial intelligence (AI) has become a transformative force, particularly in education and healthcare (Bahroun et al., 2023; Mhlanga, 2021). Adaptive learning systems, intelligent tutoring, and virtual simulations reshape traditional educational

methods by enhancing individualized learning experiences (Cheung et al., 2021). These technologies improve instructional effectiveness and provide customized student support, addressing their specific learning needs (Chen et al., 2020). AI applications—from diagnostic tools to predictive analytics—play a crucial role in patient care management and clinical decision-making (Alowais et al., 2023). Nursing education, positioned at the intersection of these fields, has particularly benefited from AI-powered advancements. Through technologies like virtual reality and machine learning, nursing schools can offer realistic simulations, automated assessments, and personalized learning pathways that were previously impossible through traditional methods (Liaw et al., 2023). These developments are crucial as nursing students must be prepared for the increasing complexity of patient care in a rapidly evolving healthcare landscape (Buchanan et al., 2021).

However, along with the benefits, the integration of AI in education and healthcare also presents certain challenges. Ethical concerns, such as algorithmic bias and data privacy, are increasingly being raised as AI becomes more prevalent in educational settings. Additionally, the over-reliance on AI tools could potentially diminish students' critical thinking skills, as well as increase the risk of inequality in education access due to infrastructural disparities (Wang & Ji, 2021).

China's vast and diverse nursing education system faces unique challenges, which have driven the adoption of AI technologies. One of the primary issues is the unequal distribution of educational resources, particularly between urban and rural areas (Guo et al., 2019). This disparity leads to varying levels of access to advanced learning tools, qualified instructors, and clinical training opportunities. Additionally, the limited availability of clinical placements restricts students' opportunities for practical experience, a crucial component of nursing education (Panda et al., 2021). Large class sizes further complicate the ability to provide personalized attention and sufficient instruction for each student.

In response to these challenges, AI technologies offer promising solutions. For instance, virtual simulations can supplement limited clinical rotations by offering students immersive, hands-on learning experiences (Davies et al., 2021). Similarly, adaptive learning systems powered by AI can tailor educational content to individual student needs, promoting more equitable and efficient teaching (Gligorea et al., 2023). Nonetheless, to fully capitalize on AI's potential, it is essential to address the accompanying ethical and infrastructural concerns.

2. Literature Review

2.1. Virtual Simulations and Intelligent Systems

Particularly in China, where resource distribution might be unequal and clinical practice possibilities limited (Yu et al., 2019), artificial intelligence (AI)-powered virtual simulations and intelligent learning platforms have tremendously changed nursing education (Božić, 2024). These technologies give nursing students immersive, interactive learning environments (Rapaka et al., 2025), allowing them to practice and hone their abilities in a regulated environment simulating real-life

clinical circumstances (Coyne et al., 2021). This approach not only improves traditional hands-on learning but also helps to minimize some of the challenges connected to big class numbers and restricted clinical placements (O'Connor et al., 2023).

Still, some restrictions remain notwithstanding these advantages. Students living in resource-constrained environments might need access to the required infrastructure to properly use virtual simulations, depriving them of essential learning opportunities. Furthermore, depending too much on artificial intelligence simulations might make students less able to manage the uncertainty of real-life clinical environments, where results are usually more complicated and different than simulated situations (Seibert et al., 2021).

2.2. Personalized Learning and AI-Powered Assessments

Among the most transforming aspects of artificial intelligence in nursing education is its ability to offer customized learning experiences (Ronquillo et al., 2021). Unlike traditional one-size-fits-all solutions, AI systems may look at particular student data to create tailored learning routes that match each student's strengths, limits, and learning pace (Maghsudi et al., 2021). This is especially important in the framework of Chinese nursing education, where different student demands and high-class numbers may restrict the efficacy of conventional teaching approaches (Hwang et al., 2024).

However, depending too much on artificial intelligence in tailored learning environments might ignore students' emotional and personal requirements, lowering their motivation and involvement. Furthermore, although AI-powered tests improve grading efficiency, their absence of human judgment might make it more difficult for teachers to record non-standard student activities or extraordinary situations (Maghsudi et al., 2021).

2.3. AI in Remote Nursing Education

The COVID-19 epidemic hastened the use of remote learning technologies, and artificial intelligence was critical in guaranteeing the continuation of nursing education in China throughout this period (Jeffries et al., 2022). Using AI-powered platforms, nursing colleges might enable students in remote or resource-constrained settings to get high-quality education (Maleki & Forouzanfar, 2024).

Remote learning still struggles in rural or less developed areas, where access to consistent internet and sufficient gear might be limited, despite these developments. These problems worsen the digital divide by hindering students' capacity to completely engage in AI-powered learning opportunities (Maleki & Forouzanfar, 2024).

2.4. Enhancing Teaching Efficiency

Artificial intelligence technology has dramatically enhanced teaching efficiency in Chinese nursing education by automating numerous regular processes, often consuming much of teachers' time (Hwang et al., 2024). Automated grading—where

AI algorithms are used to evaluate student assignments, tests, and clinical performance with great precision and consistency—is among the most potent uses (Ng et al., 2022). This guarantees more timely student comments and helps faculty members have less work (Tam et al., 2023). Platforms like SimX, for example, employ artificial intelligence to assess clinical simulations and written assessments autonomously, enabling teachers to concentrate on more challenging, hands-on training and tailored mentorship (Dicheva et al., 2023).

Furthermore, AI-powered progress tracking allows teachers to monitor students' performance in real-time (Kamruzzaman et al., 2023). AI systems create thorough reports showing where students perform exceptionally well or poorly, enabling professors to intervene early and provide additional support when necessary (Liu et al., 2020). In large nursing schools, where managing the progress of hundreds of students without technological support can be challenging, the increased efficiency provided by these systems is particularly beneficial (Chen et al., 2020).

2.5. Improving Student Learning Outcomes

Particularly in fields like clinical decision-making and skills training, artificial intelligence has also helped to enhance student learning results (Shorey et al., 2019). Personalized learning experiences and real-time feedback enable artificial intelligence to assist students acquire the critical thinking abilities needed in demanding healthcare settings (Shorey et al., 2019). AI-powered simulations allow students to repeatedly practice clinical scenarios, adjusting their approach based on real-time system feedback. These models of real-world patient encounters let students hone their decision-making abilities in a secure, regulated setting (Božić, 2024).

Students who routinely interacted with AI-based simulations exhibited improved clinical decision-making abilities. These outcomes were notably better compared to those relying solely on conventional approaches. According to a study conducted at King Faisal University, students using computer-based simulations showed significantly higher scores in decision-making, with better knowledge retention and time management in completing case scenarios (Elcokany et al., 2021). Additionally, research from the Arab American University in Palestine found that high-fidelity simulation significantly impacted clinical decision-making among nursing students, further supporting the benefits of simulation-based learning (Ayed et al., 2023). Furthermore, students reported feeling more confident in their practical abilities, as the technology allowed them to repeat complex operations, ultimately building their expertise. Additionally, the same studies found that students using AI-powered platforms had a greater retention rate of clinical knowledge and demonstrated improved performance in their practical assessments, highlighting the effectiveness of artificial intelligence in improving learning outcomes (Elcokany et al., 2021).

Moreover, the capacity of artificial intelligence technologies to fit different learning styles has proved especially helpful for students from many backgrounds

(Pardamean et al., 2022). Platforms powered by artificial intelligence, such as Smart Sparrow, evaluate students' learning patterns and adjust study materials and hands-on assignments (Gharehchopogh et al., 2023). While high-achieving students might go more rapidly through the program (Mukhamadiyeva & Hernández-Torrano, 2024), this customized approach guarantees that students who might struggle with specific facets of nursing school get the focused attention they need. This personalizing enhances academic achievement and creates a more exciting and encouraging classroom (Xie et al., 2019).

2.6. Reducing Educational Resource Disparities

One of artificial intelligence's most transforming impacts on Chinese nursing education is its capacity to tackle long-standing resource disparities between urban and rural areas (Huang et al., 2022). Lack of resources and qualified teachers historically have hindered access to high-quality education and clinical training opportunities for students in remote locations (Qian et al., 2020). Including artificial intelligence technologies—particularly via virtual simulations and remote learning platforms—has helped close this disparity (Reece et al., 2021).

Still, there are significant challenges in applying AI techniques in rural regions. Many rural schools need more infrastructure for artificial intelligence technology, including current hardware and dependable internet connections. These differences restrict the efficacy of artificial intelligence in leveling the educational playing field and need focused infrastructural expenditures to ultimately achieve AI's ability to lower resource inequality (Kiegaldie & Shaw, 2023).

2.7. Technical and Infrastructure Deficiencies

Although artificial intelligence presents excellent possibilities to improve nursing education in China (Ahmad et al., 2024), its broad use presents numerous significant technological and infrastructure difficulties. Rural and less developed areas, where access to high-quality hardware, consistent internet connectivity, and innovative software are sometimes limited, especially show these issues (Jiang & Kong, 2024). AI-powered technologies like virtual simulations and personalized learning platforms require robust technical infrastructure to function effectively—something not now generally accessible across all Chinese nursing schools (De Gagne, 2023).

2.8. Data Privacy and Ethical Issues

Apart from data privacy issues involving sensitive personal and health-related information, the widespread application of artificial intelligence in nursing education raises serious ethical questions, including algorithmic bias and the possibility of unequal treatment of students (Köbis & Mehner, 2021). Artificial intelligence systems usually use large datasets to customize learning opportunities and raise educational results (Colchester et al., 2017). In nursing education, this might include behavioral patterns in learning settings, health data during clinical

simulations, and personal information relating to student academic success, as well as behavioral patterns in nursing education.

Protecting this data is crucial as student implications might be significant depending on breaches or the use of private information. Moreover, if not well-watched, artificial intelligence algorithms might provide biased results that disfavor particular groups of pupils, hence aggravating educational inequality (Shrestha et al., 2022).

2.9. Teacher and Student Acceptance of AI

Notwithstanding the advantages artificial intelligence presents, the integration of AI in nursing education mainly rests on the approval of both professors and students (Wang et al., 2021). AI technologies can call for significant changes in teaching strategies and student interaction with instructional materials (Chen et al., 2020). Teachers and students have to be open to adopting these new instruments and including them in their regular schedules if AI is to be successful (Zhang & Zhang, 2024).

2.10. Lessons from China's AI Experience for the Global Community

China's extensive experience integrating AI into nursing education offers valuable insights for other countries, particularly those facing similar challenges in healthcare education. China has shown how artificial intelligence may improve the quality and reach of nursing education by using AI technology to solve problems such as uneven access to educational resources, huge student populations, and restricted clinical training opportunities (Xu et al., 2019).

2.11. Interdisciplinary Collaboration and the Future of AI in Nursing Education

The future of artificial intelligence's use in nursing education will rely on multidisciplinary cooperation and the inclusion of innovative technologies into the learning environment as it develops (Rony et al., 2024). AI in nursing education is part of a more significant movement toward multidisciplinary approaches combining nursing, computer science, education, and ethics (Buchanan et al., 2021); it is not only a technology breakthrough.

3. Discussion

3.1. Policy and Financial Support

Artificial intelligence (AI) should be constantly included in Chinese nursing education under significant financial backing and government guidance. Although government initiatives have been beneficial in advancing these technologies (Knox, 2020), a strategic framework is essential to leverage artificial intelligence fully. Emphasizing sustainable financial investment, notably targeted at developing digital infrastructure in disadvantaged regions (Mhlanga, 2021), this framework

should also handle ethical issues, including data privacy and algorithmic prejudice. The government must provide priority infrastructure in rural and resource-constrained areas to guarantee fair access, therefore supporting artificial intelligence technologies with modern tools and consistent internet. Policies should also be developed to routinely check artificial intelligence systems for bias and apply explicit data security guidelines to stop illegal access to private student data. Constant public-private cooperation guarantees the ethical usage of artificial intelligence (Schiff, 2022) and accelerates the speed of invention.

3.2. Future Research Directions

Emerging artificial intelligence technologies provide nursing education with transforming opportunities like emotional AI, augmented reality (AR), and adaptive learning systems (Dimitriadou & Lanitis, 2023). Future studies should thus not only give the possible advantages top priority but also concentrate on reducing the ethical and privacy issues related to these technologies. Research should examine how AI systems may be tailored to match various cultural and educational environments to guarantee scalability and accessibility (Hwang et al., 2024). Investigating how to balance technical progress and ethical issues—such as guaranteeing fairness in AI-powered tests and avoiding algorithmic bias—is still much required. Maximizing the benefits of artificial intelligence while protecting against its possible adverse effects will depend on cooperative, interdisciplinary methods, including educators, AI developers, healthcare practitioners, and legislators (Berendt et al., 2020). Furthermore, investigating strategies to include artificial intelligence in nursing education in many settings—including resource-constrained areas—will assist in guaranteeing that the advantages of AI are reachable to every student from every geographical or socioeconomic background.

4. Conclusion

Artificial intelligence has dramatically changed nursing education in China by offering creative answers to long-standing problems such as restricted access to clinical training and resource restrictions (Shorey et al., 2019). Teaching effectiveness and student results have been much improved by AI-powered platforms like virtual simulations and tailored learning systems (Ouyang & Zhang, 2024). Still, some issues have to be resolved if we are to enjoy these developments.

First, it is essential to eliminate infrastructure differences between urban and rural areas, thereby guaranteeing fair access to artificial intelligence technology. Many rural schools need the infrastructure that supports artificial intelligence tools, including contemporary equipment and consistent internet access. Targeting digital infrastructure will help close the disparity between resource-rich and resource-poor areas, compromising educational fairness (Nguyen et al., 2023).

Second, we really have to give much thought to data privacy and algorithmic bias. The extensive application of artificial intelligence in education entails processing enormous volumes of sensitive student data, which calls for rigorous data

security measures to stop access without authorization or usage. To provide fair and accurate student assessments, artificial intelligence systems should also be routinely checked for prejudice (Berendt et al., 2020).

Future effective integration of artificial intelligence in nursing education will rely on a mix of infrastructure investments, ethical frameworks, and ongoing teacher training. Policies should be in place to protect the ethical use of artificial intelligence technology in education; educators have to be ready with the required abilities to employ AI tools. Ensuring that artificial intelligence advantages all students, regardless of their geographical or socioeconomic background, will depend on cooperative efforts among governments, educational institutions, and technology companies (Fu et al., 2022).

Even if artificial intelligence has immense power to transform nursing education worldwide, its practical use will depend on solving the infrastructure, ethical, and pedagogical issues accompanying it. China can lead the worldwide change in nursing education and guarantee a future workforce that is better prepared, more efficient, and fairer in the healthcare system by keeping multidisciplinary collaboration and supporting research on developing technologies, including emotional AI and augmented reality, under active development (Gunawan, 2023).

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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