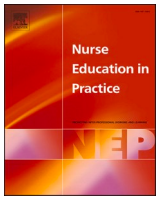
Nurse Education in Practice 84 (2025) 104330

Contents lists available at ScienceDirect

Nurse Education in Practice

journal homepage: www.elsevier.com/locate/issn/14715953



Redefining pedagogy with artificial intelligence: How nursing students are shaping the future of learning

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ARTICLE INFO

Keywords:
Artificial intelligence
Nursing education
Student experience
Digital divide
Personalized learning
Ethical AI
International students

ABSTRACT

Aim: This study aimed to explore the factors influencing undergraduate nursing students' use of artificial intelligence (AI) tools in their studies, examining how this usage shapes their learning experiences and perceptions of traditional pedagogical approaches.
Background: The integration of AI into healthcare is rapidly transforming clinical practice, which in turn necessitates a corresponding shift in nursing education. While AI's potential benefits and challenges in education are widely discussed, limited research has focused on how nursing students specifically use these tools in their nursing studies and how this impacts their learning processes.
Design: A qualitative study employing exploratory and descriptive designs.
Methods: Participants were recruited from an undergraduate nursing program at a tertiary university. Thematic analysis was used to analyze interview data.
Results: Key findings revealed that nursing students use AI for personalized learning, bridging the theory-practice gap and managing time constraints. International students particularly found AI valuable for cultural adaptation and language support. A significant finding was the "open secret" of AI use, with students actively using tools despite institutional discouragement, highlighting a disconnect between student needs and institutional practices. Ethical concerns, such as bias, data privacy and accountability, were also prominent.
Conclusion: This study provides novel insights into the student-driven demand for AI integration in nursing education. It highlights the need for institutional responsiveness, transparency and the development of ethical AI frameworks. By acknowledging student agency and fostering collaborative dialogue, nursing education can leverage AI's benefits effectively while upholding the profession's core values: compassion, empathy and human-centered care.

1. Introduction

Artificial intelligence (AI) is rapidly transforming numerous sectors globally and healthcare is at the forefront of this revolution. AI encompasses a broad range of technologies, including machine learning, natural language processing and simulation-based medical education (SBME) (Gilotra et al., 2023; Komasawa and Yokohira, 2023; Priyadarshini et al., 2020). In healthcare, AI offers the potential to revolutionize diagnostics, personalize treatments, accelerate drug discovery and enhance patient care delivery (Bajwa et al., 2021). AI-driven tools are being developed for applications such as analyzing medical images for early disease detection, predicting patient risk for adverse events and providing personalized recommendations for treatment plans (Khalifa and Albadawy, 2024; Olawade et al., 2024). This rapid integration of AI into healthcare necessitates a corresponding shift in healthcare education to prepare future professionals for an AI-augmented practice environment. The World Health Organization WHO (2023) and the Organization for Economic Co-operation and Development (OECD) have emphasized the importance of digital health literacy and the need for health professionals to be equipped with the skills to effectively use and critically evaluate AI-based technologies (Almyranti et al., 2024). This global push for digital transformation in healthcare underscores the

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https://doi.org/10.1016/j.nepr.2025.104330
Received 10 January 2025; Received in revised form 26 February 2025; Accepted 11 March 2025
Available online 13 March 2025
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urgent need to understand how AI impacts health professional education, particularly in fields like nursing, which are central to patient care delivery. The increasing complexity of healthcare, coupled with the growing volume of data generated in healthcare systems (Dash et al., 2019), makes AI a potentially invaluable tool for improving efficiency, accuracy and patient outcomes. However, this transformative potential must be carefully managed to ensure ethical and equitable implementation, highlighting the importance of studying the impacts of AI in educational settings.

The transformative potential of AI is not limited to healthcare; it is also reshaping the landscape of higher education globally. AI-powered tools are being used to personalize learning experiences, provide automated feedback and enhance student engagement (Darvishi et al., 2024). For example, AI-driven learning platforms can adapt to individual student needs by adjusting the difficulty of assignments, offering tailored learning pathways based on performance and providing supplementary resources that target identified knowledge gaps (Strielkowski et al., 2024). Automated feedback systems, powered by Natural Language Processing (NLP), can provide students with instant feedback on written assignments, identifying areas for improvement in grammar, style and argumentation (Wambsganss et al., 2022). Furthermore, AI-powered tools can facilitate interactive learning environments by answering student questions, providing 24/7 support and stimulating discussions, thereby increasing engagement, particularly in large classes or online learning settings (Garcia et al., 2025).

In Australia, the higher education sector is increasingly embracing digital technologies, including AI, to improve teaching and learning outcomes (Lee et al., 2024; Parliament of Australia, 2023b). Specific examples include the use of AI-powered plagiarism detection software to uphold academic integrity (Lodge, 2024), learning analytics dashboards that provide educators with insights into student progress and identify at-risk learners and adaptive learning platforms that personalize the learning experience for students across various disciplines (Susnjak et al., 2022). Furthermore, some institutions are piloting AI-driven virtual assistants to provide administrative and academic support to students, streamlining enrollment processes and providing instant answers to common queries (Khan and Balapumi, 2024).

This push for digital innovation is driven by a desire to enhance the quality of education, improve student access and equity and prepare graduates for the demands of a rapidly changing workforce (McCarthy et al., 2023; Thelma et al., 2024). AI enhances the quality of education by facilitating data-driven insights into student learning patterns, enabling educators to refine their teaching methods and curriculum design for greater effectiveness (Mishra et al., 2024). It improves student access and equity by providing automated translation services for students from diverse linguistic backgrounds and offering AI-powered assistive technologies for students with disabilities, ensuring a more inclusive learning environment (Monika Singh et al., 2025). Finally, AI helps prepare graduates by integrating AI-related concepts and practical applications directly into the curriculum, exposing students to real-world uses of AI in their chosen fields and fostering adaptability and innovation (Imran, 2025).

The Australian higher education system emphasizes the development of critical thinking, problem-solving and digital literacy skills, all of which are essential for navigating the complexities of an AI-driven world (Australian Human Rights Commission, 2023; Parliament of Australia, 2023a). In this context, the integration of AI into curricula is becoming increasingly prevalent across various disciplines, including health sciences and nursing (Ahmed, 2024). For instance, in nursing education, AI-powered virtual patients are used to simulate clinical scenarios, allowing students to practice diagnostic reasoning and treatment planning in a safe and controlled environment (De Mattei et al., 2024; Verma et al., 2024). The Australian Qualifications Framework also emphasizes the importance of graduates possessing the skills and knowledge necessary to adapt to technological advancements in their respective fields, further highlighting the need for research into the impact of AI on student learning and professional development (Department of Education, 2019). This broader context of AI adoption in Australian higher education sets the stage for a more focused examination of its specific application in undergraduate nursing programs.

The International Council of Nurses (ICN) has recognized the impact of digital health on nursing practice. It has issued a position statement emphasizing the role of nurses in leveraging digital technologies to improve patient care and access to health services (ICN, 2023). The ICN acknowledges the potential of digital tools, including AI, to enhance nursing practice but also cautions against the "digital divide"—the gap between those with access to modern information and communication technology and those without (ICN, 2023). This divide creates a world where the benefits of digital transformation are not equally distributed, both between countries and within societal groups. This warning is particularly relevant to nursing education, as unequal access to technology and varying levels of digital literacy among students can create disparities in learning opportunities and preparedness for practice (Harerimana et al., 2022; Makhene, 2023). The ICN's emphasis on equitable access to digital technologies and the need to bridge the digital divide underscores the importance of studying how AI impacts nursing students from diverse backgrounds. This highlights the need for research that examines not only the potential benefits of AI in nursing education but also the potential for it to exacerbate existing inequalities if not implemented thoughtfully and equitably.

In Australia, the Australian Nursing and Midwifery Accreditation Council (ANMAC) oversees the accreditation of nursing programs (Ralph et al., 2015), ensuring they meet national standards for curriculum content and graduate competencies. The Nursing and Midwifery Board of Australia (NMBA) sets the registration requirements for nurses, ensuring that graduates possess the necessary skills and knowledge to practice safely and effectively (NMBA, 2024). The Australian Bachelor of Nursing program is designed to cultivate generalist knowledge and skills, preparing graduates for practice across various healthcare settings (Forrest and Fisher, 2022; Schwartz, 2019). This emphasis on generalist practice means that nursing students must develop a broad understanding of diverse patient populations, healthcare contexts and technological advancements. Given the increasing integration of AI into healthcare settings, it is crucial to understand how undergraduate nursing students in Australia engage with AI in their education and how this engagement shapes their preparedness for practice. The structure and standards of Australian nursing education provide a specific context for examining the impact of AI on student learning and professional development.

While the potential benefits and challenges of AI in healthcare and higher education are widely discussed, there is a distinct lack of research exploring how undergraduate nursing students are specifically integrating AI tools into their learning and how this integration influences their understanding of traditional pedagogical approaches. Existing literature often focuses on the application of AI in clinical practice (Alowais et al., 2023; Ghimire and Neupane, 2024; Karalis, 2024; Rony, Parvin, et al., 2024; Ruksakulpiwat et al., 2024). However, there is a significant gap in understanding nursing students' nuanced experiences and perspectives when navigating this evolving educational landscape. This study addresses this critical gap by investigating how undergraduate nursing students use AI tools and how it shapes their learning experiences and perceptions of the interplay between AI-enhanced learning and traditional teaching methods. By focusing on the intersectional experiences of both domestic and international students in the Australian undergraduate nursing program, this research aims to provide valuable insights into the complex dynamics of AI integration in nursing education. This study seeks to understand how students use AI and how it influences their understanding of effective pedagogy. Therefore, this study asks: How does the integration of AI tools by undergraduate nursing students shape their learning experiences and their perceptions of the interplay between AI-enhanced learning and traditional pedagogical approaches?

2. Methods

2.1. Study design

This qualitative study aimed to explore the perspectives and experiences of undergraduate nursing students regarding their use of artificial intelligence (AI) tools in their studies, employing both exploratory and descriptive designs (Doyle et al., 2020; Rendle et al., 2019). This approach allowed for collecting detailed, contextualized data from domestic and international undergraduate nursing students, contributing to a nuanced understanding of AI integration in nursing education. The study followed the Consolidated Criteria for Reporting Qualitative Research (COREQ) guidelines (Tong et al., 2007).

3. Sample and setting

This study was conducted in a metropolitan tertiary institution in Melbourne, Australia. Participants were recruited from the institution's undergraduate Bachelor of Nursing program. A purposive sample of 17 final-year undergraduate nursing students was recruited, consisting of 10 domestic and 7 international students. Final-year students were targeted because of their comprehensive understanding of nursing practice and experience with clinical placements, which provide insight into the potential applications of AI in the profession. Inclusion criteria require students to be enrolled in their final year of the Bachelor of Nursing program and to have experience using or an interest in exploring AI tools for academic purposes.

4. Data collection

Data were collected through 17 individual, semi-structured interviews, each lasting approximately 60 minutes. Interviews were conducted face-to-face by the first author (AG) in a location convenient for participants in the university. A semi-structured interview guide was used to facilitate in-depth exploration of students' experiences and perspectives on using AI tools in their nursing studies (see Table 1). The interview guide was developed based on a comprehensive review of the relevant literature on AI in higher education and nursing education. It was further refined through discussions in the research team to ensure relevance to students' learning experiences. The research team's experience as nursing academics in a tertiary setting provided valuable insider knowledge of the trends and use of AI in an academic context, informing the development of relevant and targeted interview questions. The guide included questions exploring how students use AI tools, the perceived benefits and challenges they encounter and how this usage influences their learning experiences and perceptions of traditional pedagogical approaches. All interviews were audio-recorded with the explicit informed consent of all participants. No prior relationship existed between the researchers and the participants.

Table 1
Interview Questions.

Question Number	Open-Ended Question
1	Can you describe your experience using AI tools in your nursing studies? What specific tools have you used and for what purposes?
2	How, if at all, do you think using AI tools has impacted your learning process in your nursing courses? Can you give specific examples?
3	Have you used AI tools to help you with specific aspects of your nursing studies, such as understanding complex concepts, preparing for exams, completing assignments, or practicing clinical skills? If so, how?
4	What are the benefits, if any, of using AI tools in your nursing education, in your opinion?
5	What are the challenges or concerns, if any, associated with using AI tools in your nursing education?
6	How do you think using AI tools compares to traditional teaching methods in nursing education? What are the strengths and weaknesses of each?
7	How do you feel about the role of your instructors in guiding you on the use of AI tools in your studies? What kind of guidance or support would be helpful?
8	Are there any ethical considerations or concerns that you have about using AI in nursing education or practice?
9	Do you think using AI tools will impact your preparedness for entering the nursing profession? If so, how?
10	Is there anything else you would like to share about your experiences or perspectives on the use of AI tools in nursing education that we haven't discussed?

5. Data analysis

A thematic analysis, guided by the six-phase framework outlined by Braun and Clarke (2006), was employed to analyze the qualitative data collected from the semi-structured interviews. All interviews were conducted and transcribed verbatim by the principal investigator (AG). The research team then engaged in multiple readings of the transcripts to gain a deep familiarity with the data. Meaningful units of text were extracted from the transcripts, representing distinct ideas or experiences and then condensed to preserve their core meaning. Codes were assigned to these condensed units and a comprehensive codebook was developed to organize the codes and categorize them based on conceptual similarities. The study focused on achieving code and thematic saturation rather than data saturation (Rahimi and Khatooni, 2024).

A collaborative approach was adopted to ensure rigor and consensus in the thematic analysis. The research team, comprised of nursing academics with experience in qualitative research and nursing education, engaged in regular meetings to discuss the coding process, emerging categories and potential themes. Initial coding was conducted independently by two researchers, with the codebook refined iteratively through comparison and discussion. Any discrepancies in coding or interpretation were resolved through consensus meetings to reach a shared understanding. This iterative process continued until consensus was achieved on the final themes and sub-themes.

Through this rigorous process, the initial codes coalesced into overarching themes that captured the salient patterns and insights in the data. In the final phase, a detailed narrative was constructed to present the thematic analysis findings, incorporating illustrative quotes from the participants to provide rich, contextualized evidence (see Table 2). To further enhance the trustworthiness of the analysis, peer debriefing was conducted by an external expert in qualitative research and nursing education. This process allowed for critical feedback and helped to identify potential biases or inconsistencies. The research team revisited the transcripts and audio recordings as needed to ensure the final report accurately reflected the participants' voices (Table 3).

6. Rigoor and reflexivity

To ensure the trustworthiness of the qualitative data and subsequent analysis, this study adhered to established criteria for rigor, encompassing credibility, dependability, confirmability and transferability (Forero et al., 2018).

Credibility was established through several strategies, including two phases of member checking. First, during each semi-structured interview, the interviewer (AG) summarized key points and emerging interpretations for immediate confirmation, ensuring alignment with their intended meanings. This ongoing member checking during data collection ensured that the researcher's interpretations were aligned with the participants' intended meanings as the conversation unfolded. Second, after the initial thematic analysis, a summary of the key themes and supporting quotes was compiled and emailed to all 17 participants. They were invited to review the summary and provide feedback on the accuracy and resonance of the themes with their experiences. Participants were given two weeks to respond and any feedback received was

Table 2
Data analysis process.

Exemplar Meaning Unit	Code	Category	Sub-theme	Theme
"I could upload lecture notes…and the AI would generate personalized quizzes, flashcards…even predict potential exam questions…" (SN5)	AI-generated study aids; Personalized learning; Exam preparation	Personalized learning resources	Tailored study plans, practice quizzes and simulations	AI as a Personalized Learning Accelerator: Bridging the Gap Between Theory and Practice
"I used AI translation tools to understand complex medical terms…culturally relevant case studies…" (SN13)	Language support; Cultural relevance; Case studies; Terminology	Support for international students	Adapting to different teaching styles and assessment formats	AI as a Personalized Learning Accelerator: Bridging the Gap Between Theory and Practice
"It provided feedback not only on my clinical skills but also on my communication style and cultural sensitivity." (SN13)	Feedback; Clinical skills; Communication style; Cultural sensitivity	Developing culturally sensitive communication	Adapting to different teaching styles and assessment formats	AI as a Personalized Learning Accelerator: Bridging the Gap Between Theory and Practice
"The AI patient would react realistically to my interventions, providing immediate feedback…" (SN8)	Realistic reactions; Immediate feedback; Interventions	Feedback on clinical decisions and actions	Practicing complex scenarios without fear of harming real patients	AI as a Clinical Confidence Builder: Navigating the Complexities of Real-World Scenarios
"I could practice interacting with virtual patients from diverse backgrounds…feedback…on my nonverbal communication and cultural appropriateness." (SN11)	Virtual patients; Diverse backgrounds; Nonverbal communication; Cultural appropriateness	Developing culturally sensitive communication	Practicing culturally sensitive communication and adapting to new environments	AI as a Clinical Confidence Builder: Navigating the Complexities of Real-World Scenarios
"It even simulated different emotional responses from the virtual patients based on my interactions…" (SN11)	Simulated emotional responses; Patient interactions	Realistic patient interactions	Practicing culturally sensitive communication and adapting to new environments	AI as a Clinical Confidence Builder: Navigating the Complexities of Real-World Scenarios
"I also use AI to create personalized study schedules that fit around my family commitments." (SN1)	Personalized study schedules; Family commitments; Time management	Balancing academic and personal life	Balancing academic commitments with work or family responsibilities	AI as a Time Management and Efficiency Multiplier: Balancing Academic Demands and Personal Life
"…I can quickly use AI tools…to access relevant information, generate a quick outline, or even get help with grammar and phrasing in English." (SN17)	Quick access to information; Support while working; Language support	Quick access to information and support resources	Balancing academic demands, personal life and additional challenges	AI as a Time Management and Efficiency Multiplier: Balancing Academic Demands and Personal Life
"AI-powered translation tools have also been essential for understanding complex lectures and communicating with patients…" (SN17)	Translation tools; Understanding lectures; Patient communication	Language support for international students	Balancing academic demands, personal life and additional challenges	AI as a Time Management and Efficiency Multiplier: Balancing Academic Demands and Personal Life
"AI tools that could convert text to speech…create visual aids to help me understand abstract concepts. It was like finally having a key to unlock my learning potential." (SN14)	Text to speech; Visual aids; Accessibility; Learning differences	Support for learning differences	Providing equitable access to high-quality educational resources	Bridging the Digital Divide: AI as an Equalizer for Access to Quality Education
"I can now access online libraries, research databases and virtual simulations from anywhere with an internet connection…It's like having a window to the world…" (SN6)	Online resources; Global access; Virtual simulations; Access to information	Access to diverse learning materials	Providing equitable access to high-quality educational resources	Bridging the Digital Divide: AI as an Equalizer for Access to Quality Education
"It's frustrating because if AI was properly integrated…we could use it even more effectively, with guidance and support." (SN9)	Need for integration; Guidance; Support	Desire for formal AI integration	Student desire for more proactive integration of AI into the curriculum	Overcoming Institutional Inertia: Student-Driven Demand for AI Integration in Nursing Curricula
"We need to be AI-literate nurses, capable of understanding and critically evaluating AI-driven healthcare technologies." (SN16)	AI literacy; Critical evaluation; Ethical use; Real-world preparation	Importance of AI literacy	Preparing for AI-driven healthcare	Overcoming Institutional Inertia: Student-Driven Demand for AI Integration in Nursing Curricula
"Resisting AI integration is not only hindering our learning but also doing a disservice to our future patients." (SN16)	Hindered learning; Negative impact on patients; Need for AI integration	Negative consequences of resistance	Preparing for AI-driven healthcare	Overcoming Institutional Inertia: Student-Driven Demand for AI Integration in Nursing Curricula
"It made me realize that AI isn't objective; it's trained on data created by humans and humans have biases…It's crucial that we don't blindly accept AI-generated information." (SN4)	Bias in AI; Critical evaluation of AI; Human-centered care	Need for critical evaluation of AI tools	Maintaining human-centered care and critical evaluation of AI tools	Beyond the Hype: Critical Evaluation and Ethical Awareness of AI in Nursing Practice
"I realized that inputting patient information into AI tools…could potentially compromise their privacy if the data isn't properly protected." (SN12)	Data privacy; Confidentiality; Data security	Importance of data security and privacy	Maintaining human-centered care and critical evaluation of AI tools	Beyond the Hype: Critical Evaluation and Ethical Awareness of AI in Nursing Practice
"It's important for our educators and preceptors…to emphasize the importance of verifying information that we got from AI and also safeguarding the information we input into AI tools." (SN12)	Verification of AI information; Safeguarding data; Role of educators/preceptors	Importance of human oversight and guidance	Maintaining human-centered care and critical evaluation of AI tools	Beyond the Hype: Critical Evaluation and Ethical Awareness of AI in Nursing Practice

carefully considered and incorporated into the final analysis. This two-phase member-checking approach strengthened the findings' credibility by ensuring the interpretations accurately reflected the participants' perspectives. Peer debriefing was also employed, wherein an independent expert in qualitative research and nursing education reviewed the transcripts, methodology and emergent themes, offering critical feedback and ensuring the fidelity of the research process.

Dependability was achieved by developing a semi-structured interview guide based on a comprehensive literature review of AI in education, nursing education and student learning. The research team's experience as nursing academics further strengthened this, providing valuable context and insider knowledge of the trends and use of AI in an

Table 3
Socio-demographic characteristics of nursing students.

Characteristic	Sub-Category	Number (n = 17)	Percent (%)
Gender	Female	12	70.6
	Male	5	29.4
Age Group	Generation Z (22–26)	12	70.6
	Over 30	5	29.4
Residency Status	Domestic	10	58.8
	International	7	41.2
Nursing as 1st Choice	Yes	14	82.4
	No	3	17.6

academic context. The clear and detailed description of the data collection and analysis processes, as outlined in the respective sections, also contributes to the study's dependability.

Confirmability was ensured through transparent and detailed documentation of the analytical process. This included descriptions of how data were summarized, meaning units extracted, condensed, coded and ultimately synthesized into categories and themes. The use of a codebook, developed and refined through collaborative discussion among the research team, further enhanced the confirmability of the findings. The independent coding of a portion of the data by two researchers, followed by consensus meetings to resolve discrepancies, also contributed to the rigor of the analysis.

Reflexivity was addressed through several strategies to enhance the confirmability and trustworthiness of the findings. The research team, comprised of nursing academics with extensive clinical teaching backgrounds, engaged in ongoing reflection throughout the study. Recognizing that our own experiences as educators and clinicians might influence our interpretations, we maintained reflexive journals to document our assumptions, preconceptions and potential biases related to AI in education. These journals served as a tool for critical self-reflection, allowing us to examine how our perspectives might shape the research process, from data collection to analysis and interpretation. Regular team meetings allowed for open dialogue and reflexive discussions, where we challenged each other's interpretations and ensured that the emerging themes were grounded in the data rather than our own preconceived notions.

Finally, transferability, which pertains to the potential applicability of the findings to other contexts, was supported through detailed descriptions of the study participants, the specific setting of the study and a clear account of the research process. This comprehensive documentation allows readers to assess the relevance and transferability of the findings to their own settings and situations.

7. Ethical consideration

Ethical clearance was obtained from the Monash University Human Research Ethics Committee (approval number- 46091). Written voluntary informed consent was obtained from each participant, who was assured of their right to withdraw from the study at any time.

8. Results

8.1. Participant characteristics

The participant group consisted of 17 final-year undergraduate nursing students enrolled at a metropolitan university in Melbourne, Australia. This sample comprised 12 female and 5 male students. Reflecting the broader demographic trends in the nursing profession in Australia, where 87.97 % of employed nurses and midwives identify as female and 12.01 % as male (Australian Nursing and Midwifery Federation, 2024). This near-proportional gender representation adds to the study's ecological validity.

The age range of participants also provided a valuable dimension to the study. Twelve participants belonged to Generation Z (aged 22–26), a demographic well-versed in digital technologies and often considered "digital natives" (Goryunova and Jenkins, 2023). Their familiarity with technology likely influenced their perceptions and use of AI tools. The remaining five participants were over 30 years of age and were all domestic students. This older cohort brought valuable life experience and diverse perspectives to the study, often having experienced different educational and professional contexts before entering nursing. Their decision to pursue nursing as a second career or later in life added a unique perspective to the study, particularly regarding the perceived need for flexible and accessible learning resources, such as those offered by AI. Most participants, both domestic and international, indicated that nursing was their first-choice career path. This suggests a high level of intrinsic motivation and commitment to the profession, which may have influenced their willingness to explore and adopt new technologies to enhance their learning.

9. Findings

9.1. Theme 1: AI as a personalized learning accelerator: bridging the gap between theory and practice

This theme highlights how students perceive AI as a powerful tool for personalized learning, effectively bridging the often-challenging gap between theoretical knowledge and practical application in nursing. Many participants described how AI tools provided customized learning experiences, addressing their individual learning styles and needs, ultimately boosting their confidence and preparedness for clinical placements. As one domestic student explained:

> In my first year, I was drowning […] lectures felt like a firehose of facts. I barely scraped by. But then, in my second year, a friend introduced me to AI-powered study tools […] It was a complete game-changer. I could upload lecture notes and textbook chapters and the AI would generate personalized quizzes and flashcards and even predict potential exam questions based on past papers […] The AI helped me connect the dots between different concepts and see how they apply to real-world scenarios. I felt genuinely prepared for clinical placements. I could anticipate patient needs, think critically about interventions and explain the rationale behind my actions […]. (SN5, Domestic Student)

This student's experience demonstrates AI's capacity to transform learning for those struggling with traditional methods, fostering deeper understanding and boosting confidence for clinical practice:

> Coming from overseas, the Australian healthcare system and the teaching style were completely different […] I felt lost […] But AI became my bridge. I used AI translation tools to understand complex medical terms and AI-powered resources provided culturally relevant case studies […] One particularly helpful tool was an AI simulation that allowed me to practice patient interactions in various cultural contexts […]. Without these AI tools, I honestly don't think I would have been able to succeed in this degree. (SN13, International Student)

For international students, AI provides crucial support for cultural and linguistic adaptation, facilitating integration into new educational and healthcare environments:

> The thing about AI is that it is constantly evolving and improving […] What I found most helpful was the ability to use AI to focus on my specific weaknesses. For example, I struggled with pharmacology calculations. The AI provided instant feedback, explaining the correct answers and highlighting my mistakes. This targeted practice was so much more effective than traditional methods […]. This

helped me immensely to perfect my medication administration skills during clinical placements. (SN2, Domestic Student)

This participant illustrates how AI facilitates targeted practice and skill mastery through personalized feedback and adaptive learning, leading to improved clinical skills.

9.2. Theme 2: AI as a clinical confidence builder: navigating the complexities of real-world scenarios

Before using AI simulations, I was terrified of responding to an emergency situation. I worried I'd freeze under pressure. The AI simulations changed everything. I could practice responding to various emergency scenarios […] in a safe, virtual environment […] I made mistakes – plenty of them – in the simulations, but that's the point. By the time I encountered my first real emergency on clinical placement, I wasn't panicked […] I felt calm and confident; AI-integrated simulations helped me gain confidence in clinical settings. (SN8, Domestic Student)

This student's experience highlights how AI simulations provide a safe space to practice high-stakes scenarios, fostering confidence for real-world clinical encounters:

In my culture, direct eye contact can be considered disrespectful. In Australia, it's often seen as a sign of attentiveness. These subtle cultural differences were a major source of nervousness […] The AI-powered virtual patient simulations were invaluable in helping me navigate these cultural nuances. I could practice interacting with virtual patients from diverse backgrounds. The AI provided feedback not only on my clinical skills but also on my communication skills and cultural appropriateness […] This gave me the confidence to communicate effectively and respectfully with patients from all backgrounds in my clinical placements. (SN11, International Student)

For international students, AI simulations offer a crucial opportunity to practice culturally sensitive communication and build confidence in navigating diverse patient interactions.

9.3. Theme 3: AI as a time management and efficiency multiplier: balancing academic demands and personal life

Being a mature student with two young children, time is my most precious commodity. I was constantly stressed […] AI has been absolutely invaluable in getting my university work done in half the time […] Instead of spending hours sifting through countless research articles, I use AI-powered literature review tools. This saves me hours, allowing me to spend more time with my kids. (SN1, Domestic Student)

For mature students with family responsibilities, AI facilitates efficient time management, enabling them to balance academic demands with personal life:

Adapting to a new culture while juggling a full-time degree and a part-time job has been challenging. AI has been my greatest support system. When I'm working a late shift and suddenly remember I have an assignment due, I can quickly use AI tools to access relevant information, generate a quick outline, or even get help with grammar and phrasing in English […] AI has helped me feel more confident and independent in navigating this new world. (SN17, International Student)

AI provides crucial support for international students in managing the combined pressures of academic work, cultural adjustment and employment.

9.4. Theme 4: Bridging the Digital Divide: AI as an Equalizer for Access to Quality Education

I have a learning disability, which made traditional learning incredibly challenging. But then I discovered AI tools that could convert text to speech, provide summaries of complex articles and even create visual aids. It was like finally having a key to unlock my learning potential. AI didn't just make learning easier; it made it possible. It leveled the playing field and gave me the confidence to believe in myself […] as a nurse. (SN14, International Student)

For students with learning disabilities, AI tools provide crucial accessibility, leveling the playing field and fostering self-confidence:

I've always struggled with traditional lecture-based learning. I'm a very visual learner. I often felt lost and overwhelmed […] But AI has been a lifesaver. I can use AI tools to convert lecture notes into mind maps, create interactive flashcards and even access virtual reality simulations […] It's like AI has opened a window to a whole new way of learning, a way that finally clicks with my brain. It has allowed me to learn alongside my peers, regardless of our learning styles. (SN6, Domestic Student)

AI offers diverse learning formats and materials, catering to various learning styles and promoting inclusivity for neurodiverse learners.

9.5. Theme 5: overcoming institutional inertia: student-driven demand for ai integration in nursing curricula

The biggest irony is that everyone knows we're using AI. We talk about it amongst ourselves, sharing tips and tools. But in class, it's like this unspoken rule – you don't mention it. Lecturers often discourage its use, framing it as 'cheating' or 'not developing critical thinking.' But that's just not true. We're using AI to enhance our learning, to understand complex concepts, to prepare for clinicals[…] It's not about replacing thinking; it's about augmenting it. It feels like our educators are stuck in the past. It's frustrating because if AI was properly integrated into the curriculum, we could use it even more effectively, with guidance and support. It's like they are forcing us to learn how to drive a car but are not letting us use the GPS [Global Positioning System]. I hope this becomes a thing of the past as AI grows more and future students will have a much easier time acknowledging the use of AI in their nursing studies. (SN9, Domestic Student)

This quote captures the frustration and hypocrisy surrounding the unofficial use of AI in nursing education. It highlights the disconnect between students' lived experiences and the institutional stance on AI. This is pedagogically significant because it exposes a hidden reality in nursing education and calls for a more open and honest dialogue about AI:

In my home country, AI is already used in educational and clinical settings. When I came here [Australia], I expected to see a similar level of integration in nursing education, but that was not the case. We're being trained for a healthcare system that doesn't exist anymore […] We need to be AI-literate nurses. Resisting will lead to more rebellions from students. (SN16, International Student).

This international student emphasizes the gap between current nursing education and real-world practice, advocating for AI literacy and predicting increased student demand for its integration.

9.6. Theme 6: beyond the hype: critical evaluation and ethical awareness of ai in nursing practice

I've used AI to research different treatment protocols […] But then I started noticing patterns […] the AI consistently suggested interventions primarily studied on Caucasian populations. It made me realize that AI isn't objective; it's trained on data created by humans and humans have biases. We mustn't blindly accept AI-generated information. We must evaluate the data critically, consider potential biases and prioritize patient-centered care. (SN4, Domestic Student)

This student's experience reveals an awareness of bias in AI algorithms, emphasizing the need for critical evaluation and patient-

centered care:

> Back home, we didn't have the same strict data privacy laws as in Australia […] Using AI tools for my nursing studies has made me more aware of the importance of data security and patient confidentiality. Our educators and preceptors must emphasize safeguarding the information we input into AI tools. Relying blindly on AI is not a good practice, where a simple breach of confidentiality can have devastating consequences […] (SN12, International Student)

This international student's perspective highlights the ethical tension between AI utility and patient confidentiality, emphasizing the role of educators in reinforcing ethical data practices:

> If an AI tool provides incorrect information, who is responsible? This is why human oversight is essential […] AI can be a powerful tool, but it should never replace human judgment. Our educators and preceptors play a crucial role in teaching us how to critically evaluate AI-generated information and ultimately make informed decisions based on our own clinical expertise and ethical principles. (SN7, Domestic Student)

This student raises the complex issue of accountability in AI-driven healthcare, stressing the importance of human oversight, critical thinking and ethical decision-making.

10. Discussion

The transformative potential of artificial intelligence (AI) in healthcare is undeniable, with promising advancements in diagnostics, treatment and patient care access, as recognized by the International Council of Nurses (ICN, 2023). The ICN appropriately warns that the "digital divide"—which refers to the uneven access to information and communication technologies—poses a significant risk of exacerbating inequalities in the realization of the benefits associated with this transformation. This study reveals a critical extension of this digital divide in nursing education itself. Our findings demonstrate that this divide is not solely about access to hardware or software, but also about access to equitable and effective learning experiences in the AI era. The intricate dynamics of the digital divide in educational contexts underscore the necessity of transcending mere technological access. It is crucial to emphasize the integration of technology within pedagogical frameworks and its effects on varied student demographics. This approach necessitates a critical examination of both the infrastructural elements and the pedagogical methodologies employed to ensure equitable and effective technological application in diverse learning environments.

AI, in this context, functions as a double-edged sword. On one hand, it offers powerful tools that can mitigate existing educational inequalities. For instance, AI-driven personalized learning platforms can cater to diverse learning styles and provide tailored support for students with learning disabilities or those who struggle with traditional pedagogical approaches, as evidenced in our findings. This resonates with the concept of "universal design for learning" (UDL), which emphasizes creating learning environments that are accessible and engaging for all learners (Jian, 2023; Priyadharsini and Sahaya Mary, 2024). AI-powered simulations, as highlighted in the participant's account, can offer safe spaces for students to practice complex clinical skills, regardless of their access to real-world clinical placements, thus democratizing access to practical experience (Kamalov et al., 2023; Riddle et al., 2024).

Conversely, without careful consideration, AI can also exacerbate existing inequalities. Unequal access to reliable internet, suitable devices and digital literacy training can create a new form of educational disadvantage (Al-Zahrani, 2024). The risk of algorithmic bias, as discussed by Agarwal et al. (2023) and O'Connor and Booth (2022), is particularly concerning in the context of nursing education, potentially perpetuating disparities in how different patient populations are represented in learning materials and simulations. This study's findings reveal a significant level of student awareness regarding the ethical dilemmas associated with AI, including concerns about bias, data privacy and accountability. Students also expressed apprehension about algorithmic bias potentially perpetuating health disparities. The issue of data privacy, particularly when inputting sensitive patient information into AI tools, was also a prominent concern, reflecting the broader anxieties about data security and confidentiality in the digital age (Yadav et al., 2023). This awareness highlights a critical need for educators to carefully evaluate and address these biases in AI tools used in education.

A key contribution of this study lies in its focus on the intersectional experiences of both domestic and international nursing students with AI. While research has begun to explore AI in nursing education (Glauberman et al., 2023; O'Connor and Booth, 2022; Srinivasan et al., 2024), there is a paucity of studies that specifically examine the diverse perspectives of these student groups. This study provides valuable insights into how AI shapes students' educational journeys from different cultural and educational backgrounds, setting the stage for a more comprehensive discussion of the specific findings related to personalized learning, institutional resistance and ethical awareness. This focus on diverse student experiences represents a novel contribution to the field, offering a crucial lens for understanding the complex interplay between AI, education and equity.

Building on the understanding of the digital divide in nursing education, this study highlights AI's potential to create more equitable and effective learning experiences. Participants noted that AI facilitates personalized learning in contrast to the "one-size-fits-all" approach often seen in traditional pedagogy, which can leave some students, particularly those with diverse learning needs, feeling disengaged and underserved (Collins-Warfield et al., 2023).

This personalized learning enabled by AI can have a direct impact on bridging the theory-practice gap, a persistent challenge in nursing education (Singh et al., 2024). AI-powered simulations and virtual patients, as highlighted by participants, offer immersive and interactive learning experiences that allow students to apply theoretical knowledge in realistic, yet safe, environments (Medel et al., 2024). This aligns with the concept of "precision education," analogous to "precision medicine," as described by Glauberman et al. (2023), where data-driven insights are used to tailor learning and assessment to individual student needs. By providing opportunities for students to practice clinical decision-making, communication skills and technical procedures in virtual settings, AI tools can enhance students' confidence and preparedness for real-world clinical placements (Koukourikos et al., 2021; Motsaanaka et al., 2024). This is particularly valuable for situations that are difficult to replicate in traditional educational settings, such as responding to rare medical emergencies or practicing culturally sensitive communication with diverse patient populations, as demonstrated by participants' experience with AI-powered virtual patient simulations.

The findings of this study underscores the role of AI in achieving greater educational equity by offering personalized support. By providing tailored support and resources, AI tools can level the playing field for students who may struggle with traditional learning methods (Alkan, 2024). For example, an international student with a learning disability described how AI tools that convert text to speech, provide summaries of complex articles and create visual aids were like "finally having a key to unlock my learning potential." This exemplifies how AI can empower students with diverse learning needs to access and process information in ways that are more effective for them (Lin and Chen, 2024), promoting a more inclusive and equitable learning environment. This directly addresses the educational disparities associated with the digital divide discussed in the previous paragraph, moving beyond simply providing access to technology and focusing on how that technology can be used to create truly equitable and personalized learning experiences.

Another key contribution of this study is the focus on the convergent

and divergent perspectives of domestic and international nursing students regarding AI integration. This comparative lens offers a unique insight into how AI can address both shared and distinct learning needs in a diverse student cohort. A significant point of convergence was the shared appreciation for AI's potential to enhance learning efficiency. Both domestic and international students valued AI tools for their ability to streamline research, generate summaries and provide quick access to information. This shared experience underscores the universal appeal of AI as a tool for managing the demands of a rigorous nursing program (Rony, Kayesh, et al., 2024). Furthermore, both groups expressed a desire for greater integration of AI into the curriculum and voiced frustration with institutional resistance to its adoption. This shared frustration suggests a disconnect between student expectations and institutional practices, highlighting the need for greater dialogue and collaboration between students and educators regarding the role of AI in nursing education.

However, the study also revealed crucial points of divergence. International students emphasized AI's vital role in facilitating cultural and linguistic adaptation, with AI-powered translation tools, culturally relevant case studies and virtual simulations proving essential resources for navigating the nuances of the Australian healthcare system. This aligns with existing literature on international student experiences, which emphasizes the challenges of cultural adjustment, language barriers and the need for culturally sensitive support services (Lu et al., 2024; Oduwaye et al., 2023). This finding highlights how AI can play a crucial role in promoting inclusivity and supporting the success of international students in nursing programs. Domestic students, on the other hand, more frequently highlighted AI's role in addressing specific learning style needs and managing time constraints related to family or work commitments. They described using AI to create personalized study schedules, access learning materials on the go and receive tailored feedback on their work. This divergence underscores the importance of considering the diverse needs and contexts of different student populations when integrating AI into nursing education.

The divergent needs and experiences highlighted in this study underscore a crucial point: students are not passive recipients of AI integration; they are active agents who are driving the demand for its adoption in nursing education. This study reveals a clear disconnect between student desires and institutional practices, as evidenced by the recurring theme of institutional resistance. The "open secret" of AI use among students, as revealed in our findings, exemplifies this disconnect. Students are actively using AI tools, often without explicit guidance or encouragement from educators, creating a clandestine culture of AI use secrecy (Fawns et al., 2024). This covert behavior is not necessarily driven by a desire to cheat but rather by a desire to access the learning benefits that AI can offer, even in the face of institutional ambivalence or discouragement. This echoes the findings of Luo (2024) on student-teacher relationships, which highlighted students' fear of being penalized for AI use, preventing open communication with educators. This "open secret" dynamic directly relates to trust and transparency issues within the student-educator relationship. As discussed in the aforementioned article, the requirement of "one-way transparency," where students are expected to declare their AI use while educators remain opaque about their assessment criteria and AI policies, further erodes trust (Luo, 2024). This creates an environment of suspicion and surveillance, hindering open dialogue and preventing the development of a shared understanding of ethical and effective AI integration. This lack of transparency can be particularly damaging in higher education, where trust is crucial for fostering a positive learning environment and promoting student engagement (Lewicka, 2022). Furthermore, if educators are not transparent about their own use of AI, it undermines student trust and sends a mixed message about the appropriate role of AI in education. This calls for a shift towards a more collaborative and transparent approach, where students and educators work together to define the ethical and pedagogical boundaries of AI use in nursing education. Hence, this study's findings strongly advocate for institutional responsiveness to student voices. Institutions must move beyond simply discouraging or ignoring AI use and instead proactively engage with students to develop clear guidelines, policies and pedagogical approaches that leverage the benefits of AI while mitigating its risks. The "GPS" analogy, used by one of our participants to describe the need for clear guidance on AI use, powerfully illustrates this point. Students are not asking for carte blanche to use AI without any direction; they are asking for clear "directions" on how to navigate this new technological landscape ethically and effectively.

Addressing these ethical challenges necessitates a strong emphasis on AI literacy for students and educators. AI literacy extends beyond basic technical skills in using AI tools; it encompasses a deeper understanding of how AI works, its limitations, its potential biases and the ethical implications of its use. This includes the ability to critically evaluate AI-generated information, recognize potential biases in algorithms and understand the importance of data privacy and security. Educators play a crucial role in fostering this critical AI literacy, guiding students in developing the necessary skills to navigate the ethical complexities of AI in healthcare. This is crucial for ensuring that future nurses are not simply users of AI but also critical thinkers who can evaluate its impact on patient care and advocate for its responsible and ethical use. Critically, AI should be viewed as a tool to augment, not replace, the irreplaceable role of human educators and preceptors (Sağın et al., 2023). While AI can provide personalized learning experiences, enhance clinical simulations and streamline research, it cannot replicate the human qualities of empathy, compassion and nuanced clinical judgment that are central to nursing practice (Mohanasundari et al., 2023). Educators and preceptors play a crucial role in providing individualized guidance, fostering critical thinking skills and instilling the ethical values that underpin the nursing profession. They are essential for helping students navigate the complexities of applying AI tools in educational settings, ensuring that AI is used to enhance, rather than diminish, human-centered care.

11. Limitations and future research

This study, while offering valuable insights into undergraduate nursing students' experiences with AI, is not without limitations. The qualitative nature of the research, while allowing for rich and nuanced data collection, means that the findings are not generalizable to all nursing students. The sample size of 17 participants, while appropriate for an in-depth qualitative exploration, limits the statistical power of the findings. Future research with larger and more diverse samples, including students from regional, rural and other metropolitan institutions across Australia and internationally, is needed to explore the transferability of these findings. Furthermore, quantitative or mixed-methods approaches could provide broader statistical support for the trends identified in this study.

The study's focus on a single metropolitan tertiary institution in Melbourne, Australia, also presents a contextual limitation. While this setting provided a rich environment for exploring the research question, the specific institutional policies, curriculum and student demographics may not be representative of other nursing programs. Future studies could explore AI integration in different types of institutions, such as regional institutions and in different countries to examine the impact of cultural and healthcare system differences on AI adoption and understand how institutional and environmental context influences students' experiences.

Another limitation stems from the self-reported nature of the data. While interviews provide valuable insights into students' perceptions and experiences, they are subject to recall and social desirability bias. Future research could incorporate observational data, such as tracking students' actual usage of AI tools or observing their interactions with AI-enhanced simulations, to provide a more objective measure of their engagement with AI. Furthermore, the study focused primarily on student perspectives. Future research should also explore the perspectives

of nursing educators and preceptors to gain a more holistic understanding of the impact of AI on nursing education. Investigating how educators integrate AI into their teaching practices, their perceptions of its benefits and challenges and their strategies for addressing ethical concerns would provide valuable insights for informing curriculum development and professional development initiatives.

Finally, this study provides a snapshot of AI integration in nursing education at a specific point in time. Given the rapid pace of technological advancements in AI, further longitudinal research is needed to track the evolving relationship between AI, nursing education and professional practice. Such studies could explore how students' experiences with AI during their education translate into their use of AI tools in their professional careers and how AI is shaping the future of nursing practice. Exploring the long-term impact of AI on patient outcomes, nursing workflows and the evolving roles of nurses in an AI-driven healthcare system is crucial for ensuring that nursing education effectively prepares future nurses for the challenges and opportunities that lie ahead.

12. Conclusion and Recommendations

This study has illuminated the complex and multifaceted ways undergraduate nursing students engage with AI in their education. By exploring the convergent and divergent experiences of domestic and international students, we have revealed not only the transformative potential of AI for personalized learning and bridging the theory-practice gap but also the critical need for addressing the digital divide in nursing education and fostering ethical awareness. The "open secret" of AI use among students underscores the urgent need for institutional responsiveness and transparency in navigating this rapidly evolving landscape. Ultimately, this research highlights the significant role students play in driving the integration of AI in nursing education, challenging institutions to embrace change and create a more equitable, effective and ethically grounded learning environment.

Based on these findings, we offer the following recommendations, designed to be practical for nursing students, educators and institutions:

- **Establish Collaborative AI Literacy Hubs:** Institutions should create interdisciplinary "AI Literacy Hubs" that bring together nursing students, educators, computer scientists, ethicists and healthcare professionals. These hubs would serve as centers for collaborative learning, research and development related to AI in nursing. Students could participate in workshops on AI tools, ethical considerations and critical evaluation skills. Educators could receive training on integrating AI into their teaching practices and developing AI-enhanced curricula. Computer scientists and ethicists could provide expertise on AI development, bias mitigation and ethical frameworks. This collaborative approach would foster a shared understanding of AI and promote its responsible and effective use in nursing education and practice.
- **Develop AI-Augmented Clinical Simulation Ecosystems:** Move beyond individual AI-powered simulations to create comprehensive "AI-Augmented Clinical Simulation Ecosystems." These ecosystems would integrate various AI tools, such as virtual patients, AI-driven feedback systems and data analytics dashboards, to create immersive and personalized learning experiences. These ecosystems could also incorporate real-world patient data while ensuring privacy and security to create more realistic and relevant scenarios. This would allow students to practice complex clinical skills, make data-driven decisions and develop their clinical judgment in a safe and controlled environment, preparing them for the complexities of AI-driven healthcare.
- **Implement "Ethical AI Use" Badging Programs:** Institutions should implement "Ethical AI Use" badging programs for both students and educators. These programs would provide structured learning experiences focused on the ethical implications of AI in nursing, including bias detection, data privacy, accountability and the importance of human-centered care. On completion of the program, students and educators would receive a digital badge that signifies their commitment to ethical AI use. This would not only promote ethical awareness but also create a culture of responsible AI integration in the nursing community.
- **Co-create AI Ethics and Policy Frameworks with Students:** Instead of top-down policy creation, institutions should actively involve students in the co-creation of AI ethics and policy frameworks. This participatory approach would ensure that student perspectives and concerns are directly incorporated into institutional guidelines. Student representatives could work alongside educators, administrators and ethicists to develop clear and transparent policies on AI use in education and practice. This would not only foster trust and transparency but also empower students to become active stakeholders in shaping the future of AI in nursing.

By implementing these recommendations, nursing education can move beyond simply reacting to the emergence of AI and instead proactively shape its integration in a way that maximizes its benefits while upholding the core values of the nursing profession.

Ethics approval and consent to participate

Ethical clearance was obtained from the Monash University Human Research Ethics Committee (MUHREC-46091). Written voluntary informed consent was obtained from each participant, who was assured of their right to withdraw from the study at any time.

Funding

None.

Consent for publication

Not applicable.

CRediT authorship contribution statement

Ghimire Animesh: Writing – review & editing, Writing – original draft, Visualization, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Qiu Yunjing:** Writing – review & editing, Validation, Methodology, Formal analysis, Data curation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

None.

Data availability

The data supporting this study's findings are available on request from the corresponding author. However, the data is not publicly available due to privacy or ethical restrictions.

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