



## Commentary Article

# The Fourth Industrial Revolution and its Implications for Nursing Education

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### Abstract

Rapidly emerging AI technologies provide promising opportunities in many industries, including healthcare. AI health technologies (AIHTs) have gained popularity within health systems due to their ability to sort and analyze vast amounts of research evidence, clinical data, and patient information. AI enables the identification of patterns that can enhance knowledge generation and improve decision-making. As a result of these capabilities to transform various aspects of health systems, nurses will need to function in vastly different roles and care delivery models as AIHTs become more pervasive in many healthcare systems. Increasing evidence in the literature shows how AI algorithms and robots are already changing the nurse's role in healthcare delivery. The emergence of new roles and models in the nursing profession will require changes in the core competencies and educational requirements of nurses in all domains of their practice, including administration, clinical care, education, policy, and research. As researchers delve deeper into the potential impacts of AI health technologies (AIHTs) on nursing, particularly in nursing education, it is essential to consider the implications of these developments for nursing education. How will today's nurses be trained to function in an ever-changing healthcare system where AI is increasingly pervasive? This article discusses the implications of AI and the changes needed in nursing education to ensure that nurses can deliver quality care in healthcare systems as AI becomes pervasive.

**Keywords:** Nursing education; artificial intelligence; AI; Healthcare

### Introduction

According to the World Economic Forum, humanity is on the brink of a technological revolution that will fundamentally alter how we live, work, and relate to one another [9].

The scale of this technological revolution and its scope and complexity will bring a transformation unlike anything humankind has experienced before. The Fourth Industrial Revolution, also known as the current technological revolution, is bringing about a significant transformation in our lifestyles and work environments. It is marked by the integration of cutting-edge technologies such as artificial intelligence, robotics, and the Internet of Things, which fundamentally alter how we interact with machines and each other. This revolution is expected to have far-reaching implications for

businesses, industries, and societies, offering opportunities and challenges that require thoughtful consideration and strategic planning. Unlike its predecessors, which mechanized production, harnessed electric power for mass production, and introduced IT for automation, this revolution is characterized by the convergence of digital, physical, and biological technologies. The integration of cutting-edge technologies has the potential to transform and reshape our daily lives and professional endeavors completely.

As we navigate this shift, we must remain mindful of its implications. Often referred to as the "new electricity," Artificial Intelligence (AI) is the driving force behind this technological evolution, much like how the invention of electricity revolutionized our way of living, working, and playing [5].

AI is poised to transform the world. In 2017, China announced its goal to become a global leader in AI by 2030. In 2019, the US

issued the executive order Maintaining American Leadership in Artificial Intelligence, directing all federal government agencies to implement strategic objectives to accelerate AI research and development [4]. By 2025, research predicts that global AI healthcare spending will equal \$36.1 billion [8]. With technology investments of this magnitude and extensive government programs to advance AI, healthcare teams will be significantly impacted as innovations such as intelligent robots are launched into healthcare and patient home settings.

## Discussion

So, what exactly is AI? Sara Castellanos provides a description of AI that captures the essence of what it aims to deliver: “Artificial intelligence encompasses the techniques used to teach computers to learn, reason, perceive, infer, communicate and make decisions similar to or better than humans.” AI is further described as a term which usually refers to one or more computing technologies, including cognitive technology, machine learning, deep learning, neural networks, and natural language processing [8].

Rapidly emerging AI technologies provide promising opportunities in many industries, including healthcare. Within health systems, the use of AI Health Technologies (AIHTs) has become increasingly popular [2]. These technologies have the capacity for sorting and analyzing large amounts of research evidence and clinical and patient data, which is required to identify patterns that enhance knowledge generation and decision making. This potential of AI to enhance healthcare knowledge and decision-making should inspire optimism about the future of healthcare professionals.

As a result of these capabilities, AIHTs are predicted to transform various aspects of health systems in the coming years [2]. However, this transformation also brings about potential challenges and ethical considerations. For instance, the use of AIHTs may raise concerns about patient privacy and data security. It is further predicted that nurses will function in greatly different roles and care delivery models as AIHTs become more pervasive in the Canadian health system—the evolving roles and models in nursing demand a shift in core competencies and educational prerequisites [2]. The expected impact of artificial intelligence (AI) on nursing is far-reaching, transforming all domains of nursing practice, from administration to research. Experts are currently examining the potential impact of AI health technologies (AIHTs) on nursing education and the broader nursing field. [2]. Increasing evidence in the literature shows how AI algorithms and robots are already changing. The integration of AI into healthcare delivery poses challenges for the nursing profession. How can we improve nurse education so they can deliver high-quality care?

Several areas where AI has the potential to significantly impact

nursing education has been identified, bringing about numerous benefits [1]. These impacts can be achieved by enhancing prepared teaching methodologies, improving student learning experiences, and facilitating better healthcare outcomes. For instance, AI can enable personalized learning, where adaptive learning systems powered by AI technologies can provide personalized learning paths and analyze individual student’s performance. These systems can identify knowledge gaps, recommend targeted educational resources, and tailor the curriculum to the needs of each student, promoting more efficient and effective learning. A personalized approach toward learning can significantly enhance learning outcomes and prepare nurses for their profession.

AI-powered adaptive learning systems can provide personalized learning paths and analyze student performance for intelligent tutoring and personalized learning. One of the most common applications of AI in personalized learning is chatbots. Chatbots have a tremendous impact on learning [3]. They are available 24 hours a day, seven days a week. They provide learning opportunities at a convenient time and place and in small chunks or short pieces, which suits the fast-paced lives of modern students well. Chatbots also provide immediate feedback, validating the student’s comprehension and patiently repeating the information or processes that need to be understood, remembered, and put into practice in a safe environment with no expectations or judgments [10], a critical component for stress-free learning. Chatbots are helpful for shy learners who find it challenging to learn communicative skills of a new language through talking to a natural person and prefer to practice independently, using systems that will not judge them and will allow time to speculate before responding [11]. In addition, bots can also provide teachers and students with a continuous stream of progress information on how the student is performing, including how many assessments were completed and the areas of difficulty [7]. This progressive learning information can be used to develop personalized student learning plans further.

Simulation and virtual reality systems also have an impact on nursing education [1]. These systems can provide immersive learning experiences for nursing students to practice clinical decision-making and critical thinking skills in a safe, controlled, realistic virtual environment. AI algorithms can help assess student performance, provide feedback, and develop personalized learning plans.

In research, AI algorithms can analyze large amounts of healthcare data to identify patterns, trends, and potential risks. In nursing education, the same technologies can help students analyze patient data, interpret, or validate diagnostic tests, and make informed clinical decisions [1]. They can also assist educators in identifying areas where students need additional support or interventions or where more research is needed.

## Conclusions

Despite the strengths and weaknesses of generative AI tools and technologies, AI technology in nursing education has the potential to revolutionize nursing roles in healthcare delivery, mainly by providing personalized learning experiences and improving efficiency and outcomes. As such, they will require education, preparation, and adoption by nurse educators in collaboration with other health disciplines [2]. These benefits can be actualized with deliberate, careful, ethical, and responsible use of these technologies through continued research and innovation, examining its impact on student learning and program outcomes [7]. Students and educators should cautiously pursue a curious and collaborative approach to learning about these tools and technologies and explore how they can be used, with a focus on enhancing critical thinking and digital literacy skills while preparing the next generation of nurses to be able to function effectively and efficiently, in the age of the fourth industrial revolution [6].

## Disclosure

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