AI-Based Learning Ecosystem: Health Education Innovation in the Digital Era

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Abstract

Artificial intelligence is becoming increasingly sophisticated and developing rapidly in this digital age. Many organizations and public services are utilizing artificial intelligence, including in the health sector. However, many have not yet implemented artificial intelligence systems and still rely on manual methods. The main objective of this study is to evaluate the current state of artificial intelligence (AI) training and the use of AI tools to improve the learning experience in health education. A systematic review using journal references and articles and selection criteria, as well as synthesis analysis and thematic analysis, focused on the development of health education using artificial intelligence. This systematic review suggests that integrating artificial intelligence (AI) training into health education curricula is recommended. A systematic review exploring the current state of artificial intelligence (AI) education in health education. Since AI curricula have not been standardized and competencies have not been defined, a framework for specialized AI training in health education is proposed.

Keywords: Artificial Intelligence, Learning Ecosystem, Health Education, Digital Transformation, Adaptive Learning

Introduction

Artificial intelligence is growing and many people are using it in organizations and public facilities. Its ease and practicality in making decisions is what makes it easy to use [1]. Composed of various complex models and algorithms, artificial intelligence is highly sought after[2]. This is especially true in the field of health, as artificial intelligence can help manage, answer questions, and even serve as an effective learning method when difficulties arise[3]. The use of artificial intelligence in healthcare greatly assists professionals in this field, such as doctors, nurses, healthcare administrators, and even hospital security

personnel. Of course, this innovation in artificial intelligence is very helpful in the development of healthcare. However, this method of artificial intelligence has not been fully implemented in healthcare, especially in health education[4]. This artificial intelligence innovation will be highly effective if widely adopted, especially if integrated into healthcare education curricula[5, 6, 7]. In this study, we will summarize all the technologies that can be utilized as innovations in healthcare education.[8,9].

Material and Method

Based on a literature review of several narrative literature sources, namely: Google Scholar, Scopus, SpringerLink, PubMed, UNESCO, and BMC, as well as several selected journals from 2025 to 2020[1, 2,3,4,5,6,7,8,9,10], and the use of synthesis and thematic analysis methods, there are several materials that we use for innovation in the field of health education, namely: the use of artificial intelligence (including simulators and meta-analysis of randomized controlled trials) is effective in improving the learning outcomes of health students, The synergistic combination of Artificial Intelligence (AI) and Virtual Reality (VR) enhances interdisciplinary learning and directly contributes to improved patient safety outcomes, and Large Language Models (LLMs) [11,12].

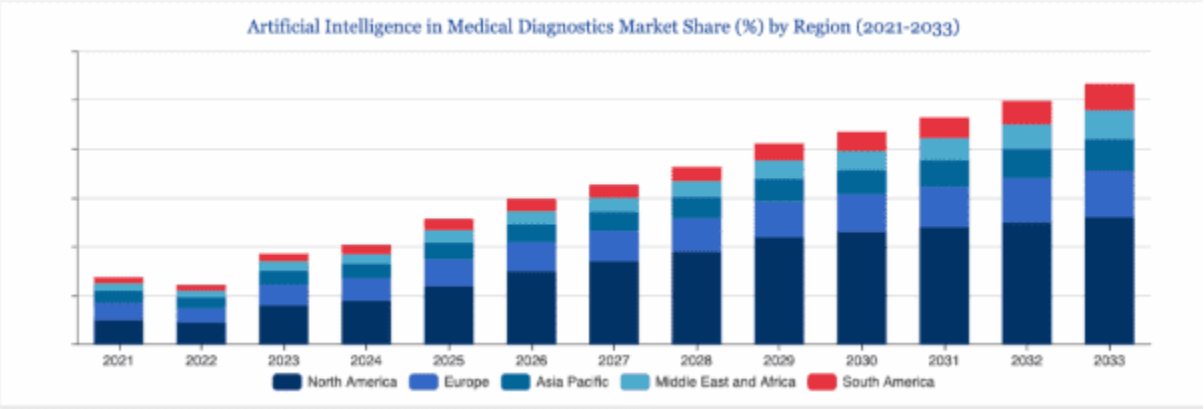

Figure 1. source: Artificial Intelligence in Medical Diagnostics Market Share (%) by Region (2021–2033).

According to sources from the picture website, it can be seen that the growth trend of artificial intelligence use from 2021 to 2023 has increased, and many even say that artificial intelligence will one day replace humans. According to picture, the healthcare sectors that most frequently use AI are: 1. Radiology & Medical Imaging: AI is used to interpret CT scans, MRIs, X-rays, and mammograms with high accuracy, helping with the early detection of cancer, stroke, and lung disease. 2. Digital Pathology: AI helps analyze tissue slides to detect abnormal cells, including cancer and infections. 3. Cardiology: AI analyzes ECGs, detects arrhythmias, and predicts the risk of heart failure from patient data. 4. Ophthalmology (Eye Health): Automated diagnosis of diabetic retinopathy and glaucoma using AI based on retinal images. 5. Electronic Medical Records (EMDR): AI is used for auto-filling medical records, extracting critical information, and generating clinical summaries. 6. Telemedicine & Medical Chatbots: Used for initial patient symptom screening, text/voice-based consultations, and triage. 7. Oncology: Used for cancer treatment planning, predicting response to chemotherapy, and genomic analysis. The use of virtual reality is also increasingly widespread. virtual reality, or VR, can simplify human work. For example, in the healthcare sector, CT scans can be used to diagnose and monitor various health conditions. The most common use is ultrasound (USG), which can be used to examine pregnancy status and detect various problems in body tissues, organs, and blood vessels. According to

an international journal on virtual reality, what are the strategies for implementing virtual reality in the healthcare sector[13, 14,15,16,17,18,19].

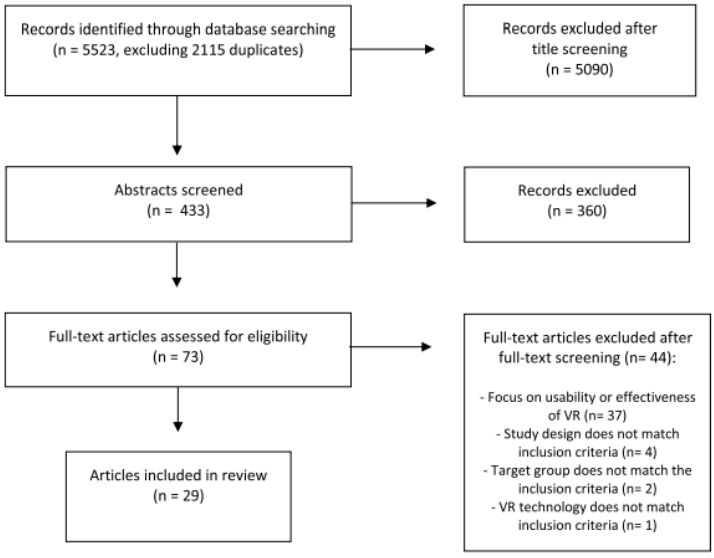

Figure 2. strategies for implementing virtual reality. Source : [20]

Result and Discussion

Tabel 1. Results of the application of innovative methods of health education technology

AI Application Domain	Core Findings (Results)	Impact on Health Education	Supporting References
Skill Enhancement & Learning Outcomes	AI utilization (including simulators and RCT meta-analyses) is effective in improving learning outcomes for health students.	Provides quantitative evidence on AI's efficacy, especially in psychomotor skills and practical competencies.	[4], [7]
Immersive Simulation & Patient Safety	The synergistic combination of AI and Virtual Reality (VR) enhances interdisciplinary learning and directly contributes to improved patient safety outcomes.	Offers realistic, safe, and risk-free clinical environments to strengthen decision-making and critical thinking.	[12]
Personalization and Learning Guidance	Intelligent Tutoring Systems (ITS) and Adaptive Learning personalize learning pathways and deliver smart, tailored feedback.	Creates sustainable education and learning systems customized to individual student needs.	[5], [6]
Frameworks and Curriculum Development	Clear mapping, frameworks, and programs are necessary to promote AI competencies among medical and health students.	Prepares future healthcare professionals to be ready to work collaboratively with AI technologies in clinical practice.	[1], [3], [2]
Ethical and Practical Challenges	Large Language Models (LLMs) present significant practical and ethical challenges, including academic integrity and data privacy concerns.	Requires the development of ethical guidelines and human oversight to ensure responsible AI implementation.	[11]
Perception and Human Resource Readiness	Surveys highlight the need to address faculty and academics' readiness and align their perceptions regarding AI integration.	Supports sustainable implementation strategies and minimizes adoption barriers within the academic environment.	[9], [10], [15]

AI-Enhanced Instructional Design	Adaptive AI frameworks enable dynamic curriculum mapping and real-time adjustment of instructional materials according to learner progress.	Promotes individualized learning pathways and competency-based progression in medical and nursing education.	[16]
Assessment Transformation	AI tools facilitate continuous, formative assessment using learning analytics and predictive modeling to detect at-risk learners.	Strengthens diagnostic feedback loops and supports early intervention strategies for clinical competency gaps.	[17]

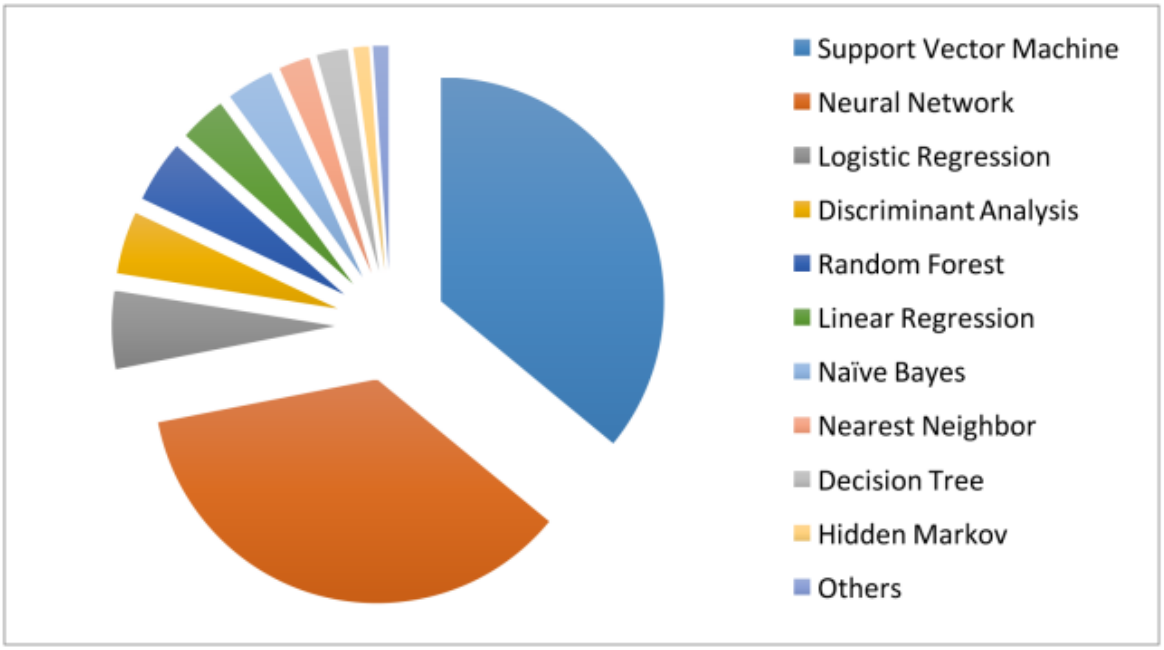

Figure 3. The machine learning algorithms used in the medical literature.
The data are generated through searching the machine learning algorithms within healthcare on PubMed.
Source: [20].

Quoted from one of the journals, the results of artificial intelligence produce several very complex algorithms to form an innovation that will later be used in the health sector[20].

Conclusion

Artificial intelligence is very helpful in the healthcare sector, especially in education, because it simplifies learning systems, scheduling, and helps solve problems when difficulties arise. Artificial intelligence is also designed in such a way that it is very complex, consisting of various algorithms and models, and is designed to assist tasks in the healthcare sector, especially those that cannot be performed by humans[13]. AI in healthcare education. However, many limitations have prevented many from using this technology, one of which is the availability of inadequate technology. However, artificial intelligence innovation in healthcare education should be a highly recommended curriculum for the future[14-19].

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