

Chapter 4

The Role of Artificial Intelligence in Education

Wisdom Leaf Press

Pages number, 22–28

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<https://journals.icapsr.com/index.php/wlp>

DOI: 10.55938/wlp.v1i5.177



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Abstract

The research investigates the ethical implications of artificial intelligence (AI) in education (AIED) by examining current international organizations' rules and recommendations. It first discusses the prospects and possible ethical difficulties with AI in education, followed by a thematic study of important ethical concepts for AIED. The ramifications of these principles are examined for a variety of stakeholders, including learners, educators, software developers, legislators, and educational administrators. The objective is to establish a worldwide consensus on ethical AIED procedures. According to the study, resolving FATE in AIED-related concerns is critical as the system advances alongside individuals and specific circumstances. It advises encouraging participants to establish responsibility for AIED systems in order to adjust them to local settings, which is where major FATE challenges emerge. This article introduces Explainable Artificial Intelligence (XAI)-Education (XAI-ED), a platform for researching, planning, and implementing educational AI applications. It focuses on six important areas of explainability: stakeholders, benefits, explanations presentation approaches, AI models, human-centered interface designs, and potential dangers. The framework is implemented in scenarios demonstrating how XAI-ED can be leveraged with various educational AI technologies. The study emphasizes the special need of XAI in education. The government's educational tactics should prioritize perpetual learning, teacher training initiatives, and data protection. Reciprocal relationships must be established to enhance academic-industry collaboration. Relevant conceptual frameworks must guide technological development and testing. A discussion amongst supporters of "cold" technology and "warm" individuals might result in to an improved awareness of how technology, particularly the big data growth and AI revolution, can provide fresh challenges and possibilities for pedagogical practices and learning.

Keywords

Education 4.0, Artificial Intelligence (AI) in Education (AIED), Learning, Explainable AI (XAI), Educational Experience, Generative Artificial Intelligence (GAI)

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1. Introduction

High-tech artificial intelligence (AI) has transformed several industries, including the medical profession, the Armed Forces space, information technology, communication, and commerce. It has also made substantial contributions to education with programs including Vision AI, Virtual Assistants, Virtual Reality, Augmented Reality, Class craft, 3D Holograms, and Chatbots. During the Covid-19 epidemic, AI facilitated distance learning, preventing societies from falling behind in academics. As a result, technology have made significant contributions to our existence ^[1]. Many advancements have taken place in education, with technological innovation being one of the most noteworthy. AI, encompassing natural language processing (NLP), artificial neural networks (ANN), machine learning, and deep learning, has significantly enhanced education utilizing ICT, e-learning, and mobile learning multimedia. Today, AI provides an emerging breakthrough identified as Education 4.0, it offers hitherto unexplored educational possibilities ^[2]. AI is accessible in low-cost smart devices, with built-in capabilities for complicated computational tasks, edge computing, cloud-based services, utilization of massive data resources, and adaptable network connections. AI benefits education in two ways: by supporting and modifying pedagogy and educator conventional responsibilities, and by determining the type of learning required, making it readily available to the general public. AI also enables speedy network connections as well as access to massive information sources ^[3]. Big data and AI have considerably enhanced learning, with the integration of data collection and computational approaches facilitating big data analysis. This trend has grown beyond proof-of-concept presentations and finding substantial momentum in a variety of educational environments. Assessment, personalized learning, and precision education represent key research concepts. Model-driven data analytics techniques are intended to influence algorithm design, interpretation, and validation. However, educational analytics findings should be approached with sensitivity ^[4]. AI and big data have enormous promise for public policy applications in education, altering teaching techniques, curriculum, and administration. However, while there is an enormous opportunity for advancement in learning, new risks and dangers put into question the advantages of implementing AI in classrooms ^[5]. Learner-facing technologies increasingly incorporate both emotional and psychological factors that influence learning, as well as cognitive aspects. Data gathering and analytics techniques have resulted in dashboards for dynamic management and reflective understanding among learners, educators, and management. Concerns regarding weakened autonomy, potential exploitation of student data, possible discrepancies in educational recommendations, and AI's negative image all lead to ethical challenges. These worries originate from concerns about conceivable disparity, data misuse, and AI's detrimental influence on education ^[6]. AI, which integrates machine learning, algorithm development, and natural language processing (NLP), is transforming learning through personalized learning platforms, autonomous assessments, and facial recognition software. However, the ethical and social impact of AI in K-12 education is often neglected. Recognizing and resolving ethical issues is crucial to creating a more effective and inclusive learning environment for both teachers and students ^[7].

2. Role of Artificial Intelligence in Education

The rapid expansion of computing technology has made it possible for the establishment of Artificial Intelligence (AI) in Education (AIED) applications in learning environments. AIED facilitates teaching, learning, and decision-making by imitating human intelligence in order to generate inferences, judgments, and predictions. Computing devices offer customized guidance, support, and feedback to students while

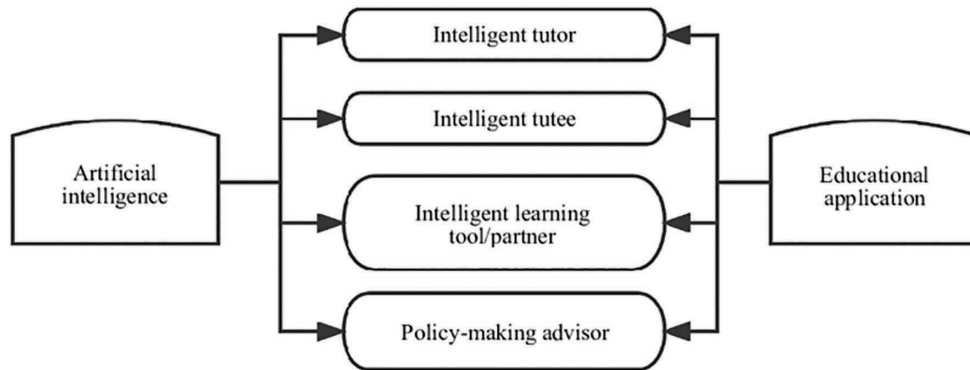


Fig 1: Role of AI in Education.

additionally helping educators and administrators in decision-making [8]. In recent years, the application of trustworthy AIEDs has considerably enhanced the learning experiences of learners and comprehension. However, this has prompted ethical questions regarding personal data protection and learner autonomy. Despite new standards for ethical AIED, disagreement regarding fundamental concepts underpinning ethical AIED remains [9]. The expansion of AIED has raised concerns regarding its ability to provide equitable and trustworthy recommendations for education and instruction. A lack of communication between AI developers and educators might result in incorrect results. Teachers and students in underserved professions demand tools that operate in culturally and socially diverse teaching situations, rather than simply technology-based solutions [10]. In figure 1 it shows that AIED has expanded into three paradigms: AI-directed, learner-as-recipient, AI-supported, learner-as-collaborator, and AI-enabled, learner-as-leader. These paradigms employ AI approaches to many educational and learning obstacles. In Paradigm One, AI represents knowledge models and facilitates cognitive learning, while learners acquire AI services. Paradigm Two facilitates learning through collaboration, however Paradigm Three empowers education by enabling learners to take control of their educational experience [11].

AI has transformed several sectors, resulting in extraordinary changes. It enables expert systems to communicate with their surroundings utilizing technologies inherent in humans including visual perception, speech recognition, and intellectual conduct. This technology has the potential to disrupt education by enabling the programming of expert systems to interact with the environment [12]. AI in education has substantial benefits, including the individualized learning, increased efficiency, and more accurate feedback. However, concerns involving as privacy and security, a lack of confidence, expenditure, and potential prejudice should be addressed. Ethical considerations in AI-based education systems include accessibility, transparency, and justice. Intelligent education systems, chatbots, and automated evaluations could assist educators save time while providing more accurate feedback. Addressing these challenges is critical to the effective application of AI in learning [13]. Researchers and educators are becoming increasingly interested in Generative Artificial Intelligence (GAI) applications like ChatGPT and Midjourney. However, educators are concerned about potential misconduct. With the adoption of GAI applications expected to grow significantly, it is essential to evaluate obstacles and

research topics through specific instances of employing GAI in education ^[14]. With the rapid advancement of AI, the deployment of AI-based robots (AI robots) for learning has become an increasingly popular research domain. Multiple studies indicate that AI robots could open up fresh opportunities for learning design in schools or professional training. However, there is no investigation that addresses the function and research areas of AI-Robots in Education (AIRE) deployment ^[15]. Concerns pertaining to the fairness, accountability, transparency, and ethics (FATE) of educational interventions that utilize AI algorithms are proliferating. A possible approach for building trust in AI systems is explainable AI (XAI), designed to encourage transparent justifications and reasoning for AI system decision-making ^[16]. The rapid advancement of AI has greatly assisted researchers and software users in a variety of domains, but it has also raised worries about the limitations and hazards of delegating control and decision-making to unreliable artificial entities. XAI approaches attempt to mitigate these risks and establish confidence in human-AI interactions, enabling an improved understanding of "what is happening in the black box." ^[17]. The XAI education frameworks. Machine learning is an essential part of AI, capable of categorizing data and forecasting results. It is crucial while evaluating student performance in educational institutions to find areas for advancement. EDM models utilize student data to anticipate unexpected and expected outcomes. Regardless of the approaches employed in learning, a student performance evaluation model is required to assist students and staff improve their performance and advance to the next level. ^[18]

3. Methodology

The research study employs a mixed method approach, integrating both qualitative and quantitative methodologies to guarantee a thorough comprehension of AI's influence on educational environments ^[19]. The first step is a thorough literature review which compiles previous studies from academic's sources to discover important AI applications including automated grading tools, learning platforms and intelligent tutoring systems. Interview and survey with educators, students and administrators are then used to gather primarily data about their experiences and difficulties with AI based learning resource. In addition to examine AI driven features in practical situations, secondary data is gathered from learning management systems and online learning environments ^[20].

4. Recommendations

Based on our thorough literature review, we propose following recommendations for the future of AI in Education.

- Future resource design will require research on the monitoring and autonomy concerns of educators and learners equally. Curriculum developers and workshop designers should prioritize culturally relevant pedagogies, taking into account students' knowledge, family history, and cultural exposure while developing instructional materials that address monitoring, confidentiality, independence, and prejudice.
- AI technologies involving image recognition, speech recognition, expert systems, and natural language processing (NLP) may be employed in a variety of educational environments, including problem-based learning, contextual learning, and inquiry-based learning. These technologies can be applied in a variety of subjects, including social studies, science, engineering, mathematics, creative pursuits, medicine, and nursing.

- AI-powered platforms can increase student learning and teaching approaches. However, the research challenge is to determine the influence of AI-supported learning design on students' performance and perceptions rather than the system's efficacy. Learning motivation, anxiety, self-efficacy, and cognitive load are all important considerations.
- Exploring the use of AI-robots by individuals of all ages and professions, particularly senior citizens, with the goal to determine their overall satisfaction with AI-robot care, as well as its usefulness in supporting them with healthcare-related knowledge.
- Teaching effectively with AI technologies is crucial for learners with impairments, ensuring that globalized classrooms are accessible to everyone. AI solutions enable students with impairments to learn about specific courses while also improving their overall educational experience.
- GAI-based learning is a viable alternative to traditional teaching techniques, providing a more individualized and effective approach to education. Its success is determined by a variety of elements, including cognitive types and knowledge levels, and it may be used to a wide range of fields, including arts, music, and design courses, which are sometimes disregarded in traditional techniques.
- The effectiveness of GAI-based learning relies on how learners exploit the technology. Inappropriate applications can happen when there isn't proper guidance. It is critical to incorporate successful learning techniques into the learning design process. For example, "video sharing" may be an approach in which students capture and share how they utilize ChatGPT to create a report.
- Exploring multidisciplinary research teams and group engagement in AIED research, with a focus on integrating AI-robots with individual learning data to investigate how learners, educators, professionals, and individuals with illnesses view and respond to personalized assistance.
- The study investigates the role of AI in education, focusing on its many functions including educator, students, learning application, collaborator, and policy-making consultant. It implies that such positions can offer fresh perspectives on teaching and learning, reframing existing educational concepts and encouraging new interpretations of pedagogy and learning technologies.

Conclusion


AI has transformed computer-supported learning through the integration of human intelligence, facilitating smarter educators, resources, and decision-making in educational environments. The integration of AI with education creates new prospects for better teaching and learning. Intelligent technologies may help teachers with assessments, data collecting, and optimizing student learning progress. Learners can benefit from smart educators and asynchronous learning for superior outcomes. The combination of AI and education influences not just education but also human knowledge, mental abilities and societies, making it a main research area in the discipline of computers and education. AI breakthroughs are influencing several industries, including education, causing widespread skepticism. Explainable AI (XAI) is an emerging field of research that attempts to address challenges concerning equality, responsibility, transparency, and ethics. XAI is critical in education because it addresses concerns involving student autonomy, metacognitive processes, introspective processes, genuine assessment, credentialing, and academic credibility. The advancement of AI tools and technology outpaces the social and legal ramifications of widespread adoption. The article explores the positive aspects of AI in education, highlighting both its advantages and drawbacks. It examines AI uses and applications, emphasizing its potential to assist formal teaching and continuous learning. AI provides

adaptive, inclusive, personalized and effective educational solutions that make learning more accessible and fun. Gamification and project-based learning are utilized for enhancing learning experiences.

GAI has had a huge influence on education, changing the AI paradigm away from typical chatbots and information systems. Researchers and educators must approach GAI from a new viewpoint, emphasizing "programming prompts" rather than search-based solutions. Programming prompts direct GAI programs, such as ChatGPT, to accomplish tasks in accordance with logical instructions. A well-designed set of prompts can help ChatGPT accomplish excellent jobs. Developing teachers' and students' programming prompt competencies may have a major impact on the quality of GAI-based teaching and learning, especially learning material, training designs, assessment designs, and learning outcomes. As a result, developing instructors' and students' programming prompt competencies is critical for improving the quality of GAI-based teaching and learning.

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