

Application Of Ai In Higher Education: Evidence And Challenges

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The spectrum of artificial intelligence (AI) applications in education is expanding at a rapid pace, however generalization appears to be a long way off. Despite the immense benefits that AI may provide to enhance teaching and learning, developing applications for higher education has various consequences and ethical dangers. There are few research studies that focus on the roles, consequences, and implications of using AI in higher education. Furthermore, what AI algorithms are commonly utilized and how they affect higher education remain unknown. The results sexperience:1) the roles of AI applications in higher education include prediction of learning status, performance or satisfaction, resource recommendation, automatic evaluation, and improvement of the learning experience; (2) traditional AI technologies are widely adopted while more sophisticated techniques (e.g., genetic algorithm, deep learning) are rarely used yet; and (3) the effects generated by AI applications include high-quality predictions with multiple input variables, high-quality recommendations based on student characteristics, improved academic performance, and increased online engagement and participation. In this context, the purpose of this paper is to provide a survey of AI applications in higher education, beginning with the scientific legacy established over the previous two decades. It investigates the concepts of AI in education, as well as the aspects and approaches that AI applications might contribute to higher education, before examining the obstacles that arise and providing some conclusions.

Keywords: Artificial intelligence, higher education, innovation, educational technology, deep learning.

1. Introduction

Artificial intelligence (AI) is a fast-emerging technology that is often regarded as one of the most dynamic and promising of its time. One of the key factors driving AI's increasing acceptance is its capacity to analyze vast amounts of data with great speed and efficiency (Dafina Xhako S. H., 2023). AI is already being employed in many areas of life, including the economy, transport, health care, manufacturing, and finance. In the healthcare sector, AI algorithms are used to analyze data and help with diagnosis, prediction of disease progress, and personalization of treatment plans (Dafina Xhako E. S., 2023). With the incorporation of AI into autonomous vehicles, the transportation industry is going through a significant

transition. These vehicles use machine learning algorithms to navigate complex terrains, analyze real-time traffic conditions, and make split-second choices for safe and efficient travel (Young, February 2024). In manufacturing, AI-driven automation has transformed industrial processes. AI is used by smart factories to evaluate equipment performance, estimate maintenance requirements, and streamline production schedules. The finance industry has also adopted AI to simplify operations and improve decision-making. AI-powered algorithms examine market trends, identify risks, and optimize investment portfolios.

AI has also had an influence on education in recent decades, with personalized learning platforms and intelligent tutoring systems becoming increasingly common (Çlirim Duro, 2023). Previously, the classroom was the focal point of higher education institutions, where students and professors interacted and most work was done by hand. In conventional education, the teacher shares knowledge with the students in the classroom. However, the Covid-19 epidemic, which touched every nation in the world, particularly the education sector, is credited for bringing online learning into the mainstream. The Covid-19 epidemic has had a significant influence on education, causing a transition from traditional classrooms to virtual ones (Rroy, 2023).

AI enhances humans' ability to solve complicated issues while silently disrupting numerous normal processes in higher education, such as administrative functions, teaching, learning, and research. AI also has a lot of potential for the academic sector, providing chances to assist students in selecting the best college, learning more effectively, graduating on time, and entering professional life. The potential to personalize learning is among the biggest advantages of implementing AI in education. AI systems can adjust to each student's specific demands and learning methods, enabling them to attain higher academic results. Another advantage of employing artificial intelligence in education is the capacity to improve learning outcomes (Ivanov, November 2022). Many of the tasks now carried out by teachers, such as checking papers giving guidance and remarks may be automated by AI systems. With the help of AI, virtual learning environments may be created so that students can study anywhere, at any time (Rroy, 2023). This is particularly true for students who don't have many opportunities to attend classes like those who live far from campus or have disabilities. Against this context, this paper offers a review of AI applications in higher education developed in the last decades. It explores the elements and methods that AI applications could bring to higher education, including the challenges that emerge along the way.

2. Literature Review: The evolution of AI in Education

The history of artificial intelligence and education is replete with groundbreaking developments that have molded the face of contemporary education. The origins of AI in education date back to the 1950s and 1960s, when researchers first started investigating how computers could replicate human cognitive functions. The 1970s and 1980s saw a key advancement with the creation of Intelligent Tutoring Systems (ITS), designed to offer personalized and adaptive learning experiences through AI algorithms (Young, February 2024). In the 1990s, there was a notable transition as educational software became widespread. With the growing availability of personal computers, both schools and individuals started

using AI-powered programs for various educational tasks, such as language learning and math exercises. The emergence of AI-powered adaptive learning systems in the 21st century marked a paradigm change (Roy, 2023). These platforms evaluate student performance data using machine learning algorithms, which allow them to dynamically modify learning paths. Khan Academy is one of the notable examples.

Over the past decade, AI has also merged with Massive Open Online Courses (MOOCs), utilizing technologies like natural language processing and machine learning to improve the flexibility and efficiency of online education. With the development of educational chatbots and virtual assistants like ChatGPT, Midjourney, and Stable Diffusion which produce photorealistic images, videos, and animations based on textual and image prompts, AI is making major progress in the modern era (Hu, 17 July 2023). These tools, known as generative AI tools, can assist students in creating better project designs and learning plans. These AI-powered interfaces may help instruct students by providing quick feedback and guiding them through challenging topics, whilst virtual assistants can help manage administrative duties such as scheduling and reminders, making learning more effective (Francesc Pedró, 2020) (Toby Baker, 2019). They help to make educational environments more accessible and conducive to communication. Each of these steps in the development of intelligent tutoring systems and adaptive learning platforms, from their inception to the present, represents a deliberate attempt to use AI's potential to improve educational opportunities.

3. Implementation of AI in Education

Artificial intelligence is a game-changer that has shown promise across several industries, including education. The use of AI applications in educational technology has the potential to completely transform the way that teachers teach, students learn, and educational institutions function. This thorough analysis highlights the various applications of AI in educational technology and examines how it affects administrative tasks, evaluation, and individualized learning (Mrs.Reshma Tushar Ladda, April 2019).

3.1. Personalized Learning

For years, educators have prioritized adapting instruction to meet the unique requirements of each student, but AI will enable a degree of differentiation that is presently unattainable for teachers who are responsible for large classes with many students. To customize instructional content, AI systems examine individual student data, such as learning preferences, performance, and styles. Machine learning-driven intelligent tutoring systems (ITS) tailor the intensity and complexity of lessons to the individual talents of each student, offering customized guidance (Young, February 2024) (Francesc Pedró, 2020). Typically, these ITSs concentrate on giving students access to educational materials while assisting them in completing the suggested tasks by identifying their challenges or mistakes and offering adaptive feedback and solutions to questions pertaining to the material (Jungwoo Ryoo, 2018). By targeting each student's unique strengths and shortcomings, this individualized strategy not only improves learning results but also increases student engagement (Ivanov, November 2022).

3.2. Adaptive Assessment

A teacher dedicates a significant amount of time to marking assignments and exams. Here's where AI can help, doing these tasks quickly. Adaptive assessment technologies brought about by AI have completely changed the evaluation process. AI-driven evaluations adjust to each student's unique requirements, whereas traditional assessments frequently take a one-size-fits-all approach (Young, February 2024). These systems evaluate student answers using machine learning techniques, and then dynamically modify the next question's difficulty. Rather than giving up time to review answer scripts, they may reallocate their workloads based on their priorities (Jungwoo Ryoo, 2018). Adaptive assessments provide a more accurate depiction of a student's competency and quick feedback, enabling early support to close learning gaps. With this method, the emphasis is shifted from simple evaluation to formative assessment that actively helps in the process of learning (Fan Ouyang).

3.3. Intelligent Content Creation

The preparation of educational material is increasingly using AI technology. Algorithms for natural language processing (NLP) can produce excellent, contextually appropriate instructional content (Young, February 2024). AI-powered chatbots and virtual assistants enable verbal and interactive learning (Takyar, n.d.). AI-driven solutions may also help teachers create personalized assignments, tests, and learning materials, saving time and guaranteeing that the information is in accordance with curriculum objectives (Hu, 17 July 2023).

3.4. Language Learning and Translation

AI is essential to language learning systems because it provides real-time pronunciation and translation assistance. NLP is used by language learning apps to evaluate written or spoken language and provide users immediate feedback (Young, February 2024). This helps people communicate across linguistic barriers and fosters cultural understanding in addition to improving language acquisition (Ivanov, November 2022).

3.5. Adaptive learning

One of the initial advantages of computer-based or online learning has been the much-heralded adaptive learning. In adaptive learning, a software may determine when someone needs to study an earlier lesson or be exposed to a new one (Saaida, 2023). They have the ability to monitor learning outcomes and ascertain which information is suitable for each student's proficiency level, (Vanlehn, 2006).

When students make mistakes, these systems offer them explanations, feedback, and just intime assistance (Jungwoo Ryoo, 2018) (Francesc Pedró, 2020). The learning process for the students is therefore more concentrated on the most pertinent topics.



Figure 1. Uses of AI in Education (AIEd) (Collidu, n.d.).

3.6. Predictive Analytics and Early Detection

Predictive analytics algorithms that identify students who are at possibility of falling behind academically are being used by educational institutions using artificial intelligence (Young, February 2024). Artificial intelligence (AI) systems can forecast possible difficulties a student may encounter by examining past data, attendance records, and performance evaluations. Then, early intervention techniques, such focused assistance or more resources, can be utilized to avoid academic failures.

3.7. Smart Campuses

Universities will turn to the Internet of Things to convert their campuses into better places to teach and learn (Mrs.Reshma Tushar Ladda, April 2019). IOT is essentially a straightforward technology that focuses on using the internet to link objects and enable them to communicate with users and one another (Young, February 2024). Teachers will find it easy to keep an eye on student attendance and administer exams due to this advanced technology (Rroy, 2023).

3.8. Virtual Reality (VR) and Augmented Reality (AR) in Education

Immersion-enhancing VR and AR technologies are generated by AI. Through dynamic and captivating worlds created by virtual simulations (LESYA CHERVONA, 2023) and augmented reality programs, students may investigate scientific theories, historical events, or intricate mathematical models in a hands-on way (Young, February 2024). By modifying information in response to student interactions, AI improves these experiences and creates a dynamic, customized learning environment.

3.9. Administrative Tasks

Artificial Intelligence (AI) helps with administrative responsibilities at educational institutions, making procedures more efficient (Ivanov, November 2022). Chatbots take care of repetitive questions, registration procedures, and administrative work, freeing up staff members for more challenging tasks (Saaida, 2023). AI-driven analytics help institutions allocate resources more effectively, maximizing workforce, using facilities, and managing budgets (Young, February 2024).

4. Challenges of AI in Education

4.1. Faculty and Staff Readiness: In order for AI to be successfully incorporated into higher education, faculty and staff members must develop new skills and knowledge (Hu, 17 July 2023). Academic investigations have demonstrated that staff and faculty preparedness for implementing AI presents a significant challenge (Francesc Pedró, 2020), and that offering professional development opportunities and strong support networks is essential for successful integration (Saaida, 2023) (Owoc ML, 2021).

4.2. Access Issues and Equity: A number of academic studies have highlighted equity and access issues in the context of AI-driven changes in higher education. (Saaida, 2023) Concerns have been expressed about biases in AI algorithms and how they can amplify already-existing educational inequalities. It is crucial to undertake initiatives that attempt to reduce prejudices and promote inclusion and diversity in the application of AI (Young, February 2024) (G.U., 2020).

4.3. Cost and Implementation challenges: There are significant financial and multifarious implementation challenges when using AI technology in higher education (Toby Baker, 2019). Educational institutions research has identified obstacles to the smooth incorporation of AI into current systems, guaranteeing cost-effectiveness, scalability, and interoperability during the AI adoption process (Saaida, 2023).

4.4. Privacy and Ethical Issues: In the context of AI-driven changes in higher education, the ethical and legal issues around data privacy, security (UNESCO, 2019), and bias present significant concerns (Young, February 2024) (Francesc Pedró, 2020). Academic studies have underscored the necessity of tackling issues related to accountability, transparency, and fairness in AI algorithms in order to guarantee the responsible and ethical adoption of AI in learning environments (Saaida, 2023) (Hu, 17 July 2023).



Figure 2. Challenges of implementing AI in schools (Gogus, 2022).

4.5. Accuracy and Transparency: While AI can already respond quickly and with a natural voice, accuracy is not always guaranteed (Young, February 2024). Transparency is still another important issue. It is challenging for most people to comprehend how AI makes judgments since the AI system is opaque and sophisticated. These characteristics may become a barrier to public trust if AI-driven interactions gain popularity (Ivanov, November 2022).

4.6. Holistic competencies: One of the primary concerns regarding its effects on people and their personal development is an over-reliance on AI, which over time may impede people's ability to grow, acquire new skills, and advance intellectually (Hu, 17 July 2023). This might cause people to become less critical thinkers and rely all of their judgments only on the data that AI gives them. This will affect people's creativity as well as critical thinking, making it harder for them or making them less eager for them to think for themselves (Young, February 2024).

4.7. Human values: Another potential threat is associated with the value system. AI may become dangerous to humans if it doesn't accord with our values. It could, for instance, exacerbate inequality and social injustice (Hu, 17 July 2023). It may also be unjust to students who choose not to utilize it, thereby expanding the wealth inequality. Additionally, the extensive use of AI in education and academic institutions may have an impact on the interaction between students and professors since it may cause students to become dissatisfied and lose respect for their teachers (LESYA CHERVONA, 2023).

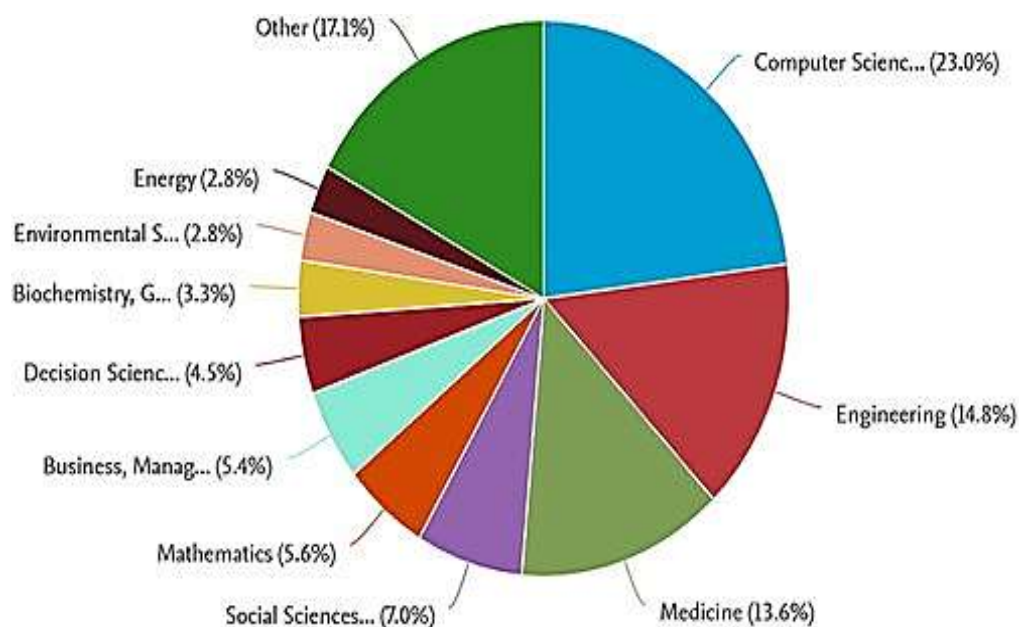


Figure 3. AI in different programs of Higher Education in global view (Gogus, 2022).

According to Figure 3, the discipline of computer science accounts for the greatest portion of research on AI (23%), followed by engineering (14.8%), medicine (13.6%), and other scientific domains. Thus, these statistics indicate that research on AI in education is still lacking.

5. Conclusions

The use of artificial intelligence in everyday life appears to be expanding every day. Artificial Intelligence (AI) began to make an impact in education by supporting the teaching and learning process. Both students' learning strategies and teachers' skills have improved as a result. The benefits of AI for education are numerous and varied. AI can support a more dynamic and productive educational ecosystem by enhancing engagement, streamlining administrative procedures, and providing individualized learning experiences. A more efficient and student-centered approach to education is being promoted by personalized learning, which uses AI to customize information, offer real-time feedback, and consider different learning styles.

AI's ability to improve education is expected to grow as technology advances, providing new opportunities for both teachers and students. There is a lot of room for cost savings and scalability when AI is used in education. The use of AI in education raises ethical issues that emphasize the necessity of thorough planning, transparency, and continuing assessment. Collaboration between educational institutions, legislators, and tech developers is necessary to create ethical standards and frameworks that put the welfare of teachers and students first.

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