



Artificial Intelligence's Role in Higher Education and its Application of AI tools

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Abstract

Higher education is one of the field that artificial intelligence (AI) has completely transformed. Large language models (LLMs) like GPT-4 and chatbot, along with natural language processing (NLP) approaches have greatly enhanced our comprehension of and application of AI in this field. This study discusses the possible effects of AI, NLP, and LLMs on higher education while offering a thorough introduction to each. Through an analysis of the advantages, this review gives educators, researchers, students, and readers a comprehensive grasp of how artificial intelligence (AI) may impact educational processes in the future, ultimately leading to improved results, difficulties, and creative applications of these technologies. Text generation, individual learning, grading transformation etc and literature reviews, are some of the major applications that are covered in the discipline of research.

Keywords: Artificial intelligence in higher education, Alexa, Natural language processing (NLP,) ChatGPT, large language models.

Introduction

“Alexa, good morning!” “Siri, which local coffs are the best?” “Google, shut the doors and turn out the lights.” “Hi, I'm David, the chatbot icon. How may I assist you right now?” These all serve as illustrations of how we apply manufactured insights (AI) to our day by day assignments. Both simple chores, like making coffee in the morning, and more complex ones, like sweeping the floor without ever using a vacuum cleaner, can be done with artificial intelligence (AI). The increasing influence of artificial intelligence on day-to-day existence cannot be ignored (Mandy Barret et al., 2019).

McCarthy (1937, 2016) developed artificial intelligence in 1956 as a follow-up to Turing's research. Turing explained the real possibility of intelligent reasoning and reasoning in machines. Since 1956, there have been substantial advances in AI capabilities, which have led to a growth and modification in the description of AI. According to (Popenici et al.,2017, page 2) “Computing systems that are able to engage in human like processes such as learning, adapting,

synthesizing, self-correction and the use of data for complex processing tasks” is the current definition of artificial intelligence (AI) (Crompton, H., Burke, D., 2023).

Artificial intelligence has become more and more common in higher education during the last five years. (Chu et al., 2022). This growth has coincided with the release of new AI tools. The growth of information and communication technology is responsible for the increased interest in college education surrounding the application of AI (Alajmi et al., 2020).

“Twenty-first-century citizens now live surrounded by artificial intelligence, which is advertised as a tool to improve and progress all facets of our life” (Górriz et al., 2020).

About thirty Research has been done on the application of artificial intelligence in higher education, or AIED. This year marks the 20th periodic AIED meeting. The International Journal of AI in Education (IJAIED) is published by the International AIED Society (IAIED), which was established in 1997. However, the exploration of implicit pedagogical pathways by which AI operations could support students over their entire academic journey is a relatively new endeavor for preceptors. Artificial intelligence (AI) has a lot of potential to improve teaching and learning, but as its use in higher education grows, it also presents new ethical issues and security risks. For occurrence, directors may discover it appealing to switch from instructing to productive robotized AI arrangements when cash is rare.. It's possible that chatbots, expert systems, and intelligent tutors will replace teachers, instructional assistants, pupil. professionals, and administrative staff members in their area of work. “While analytics for education could benefit from artificial intelligence (AI), these systems require massive amounts of data, including private student and teacher information, which poses significant privacy and data security risks”. (Zawacki-Richter et al., 2019).

Motivation

The study's background is the growing use of artificial intelligence (AI) in higher education. AI is being used to support students with particular needs, provide instant feedback on assignments and exams, enable virtual chatbots, analyze data quickly, and eradicate plagiarism. It might enhance diversity, accessibility, and support. They require vast amounts of data, including confidential student and teacher information, which raises serious privacy and data protection issues.

Paper Organization

The paper is organized into several sections. Background information and the study's motivation are presented in the introduction. The second section discusses the characteristics of Artificial intelligence. The third section discusses the role of AI in individual learning, transform the grading environment, fostering psychological health condition in students, text generation and enhancing the curriculum. Fourth section literature survey, which reviews existing research on use of Artificial intelligence in higher education fifth section provides purpose of the study. Finally, the conclusion. The paper is well organized and structured, making it easy to navigate and understand.

Characteristics of AI

We are getting closer to a time when staff and instructors will be able to be freed of a lot of labour-intensive yet eventually repetitive chores thanks to advancements in machine learning and artificial intelligence (AI). Though a higher education world straight out of science fiction is still a long way off, innovators in the market are already starting to take on that challenge. AI solutions available today free up time and brainpower so we can continue to pursue a demanding, flexible, and individualized education for students.

Companies across various industries are eager to integrate AI technologies, aiming primarily for scalability. When tasks can be automated, eliminating the need for human labor, they become more cost-effective, efficient, and valuable to customers, either by lowering costs or by delivering more for the same price. Before we delve into how artificial intelligence is transforming higher education, its future role on campuses, in the job market, and beyond, it is essential to understand what AI is and its capabilities. It is proposed that artificial intelligence encompasses at least some, if not all, of the characteristics outlined on the following page, as there is no universally agreed-upon definition. (Figure 1 depicts the attributes of AI).

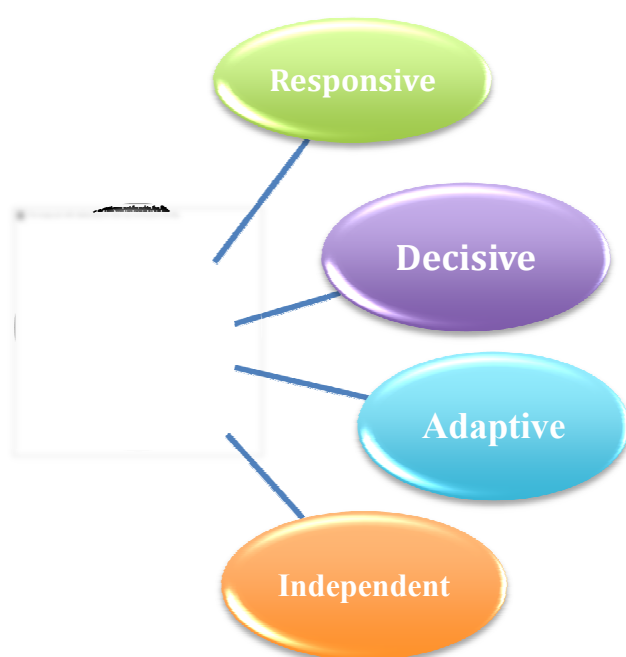


Figure 1: characteristics of Artificial Intelligence

Responsive: When interacting with humans or other robots, responsive AI can understand what is being said and respond appropriately.

Decisive: AI is Flexible Self-governing AI is capable of deciphering input and acting accordingly to fulfill its objectives.

Adaptive: Despite AI can interpret data and acting appropriately to fulfil its assigned tasks. AI has the capacity to take in new knowledge and modify its behaviour to make the most of it.

Independent: Most AI's choices can be completed without human involvement.

Role of Artificial Intelligence in higher education

Through the automation of processes, personalization of learning environments, and data analysis to enhance overall efficiency, artificial intelligence (AI) significantly contributes to increased administrative efficiency in higher education. Educational establishments may save money and time because of these developments. By providing individualized learning experiences and modifying curricula to increase student engagement, artificial intelligence (AI) has the potential to completely transform the educational landscape. Because of this, AI will be a potent instrument in determining the direction of education in the future. Figure 2 depicts the application of AI key areas in higher education.



Figure 2: Applications of AI in Higher Education

Using individualized learning to transform education:

Through the automation of processes, personalization of learning environments, and data analysis to enhance overall efficiency, artificial intelligence (AI) significantly contributes to increased administrative efficiency in higher education. These developments could save educational institutions money and time.

AI can assist teachers with individualized learning and educational support by analysing data on behaviour and performance, identifying possible problem areas, and providing customized recommendations for improvement. Adaptive learning systems, which adjust the level of difficulty of assignments and assessments based on the individual requirements and skills of each student, are developed using artificial intelligence (AI) tools. This makes it possible for teachers to precisely evaluate each student's learning accomplishments and develops a personalized learning environment. By ensuring that students are challenged but not overburdened, this can boost their engagement and motivation. (Baars M et al.,2022).

Like this, AI aids in the creation of individualized literacy programs that consider each student's literacy style, interests, and objects. This keeps students motivated and involved, improving academic outcomes. (Mbakwe AB et al., 2023; Paranjape K et al., 2019). Furthermore, because education research is growing, artificial intelligence (AI) can stay current with the best and most efficient reading and tutoring techniques. Therefore, for the best literacy and accomplishment, students might employ a supported and practical technique. AI eventually has the potential to completely change the way that education provides verified literacy and support, solving problems for every college student.

Also, the lack of qualified preceptors and the need for hourly labour to provide enough instructional support usually pose challenges to traditional training. For example, GPT-4 overcomes these challenges by providing accurate responses and thorough explanations right away (Paranjape K et al., 2019 and Grunhut J et al., 2021). NLP-powered chatbots can quickly respond to basic inquiries about themes or topics, increasing accessibility to abecedarian knowledge (Libbrecht P. et al., 2020 and Ashwini S. et al., 2022). However, it's critical to find a balance between the application of AI and human involvement in the learning process. While AI can help kids, human interaction is always important and should never be ignored (Vasileva O. et al., 2019).

Think about the significant effects that empathy and healthy emotional behaviour have on students. execution. Therefore, when using AI in the classroom, the ideal level of human interaction needs to be identified and included in the lesson design. Teachers can increase retention rates and overall academic success by carefully integrating technologies like chatbots into classroom environments. This helps students feel connected and at home.

Education in general as well as higher education are predicted to be significantly impacted by AI technology. Customized instruction based on each student's requirements, preferences, and interests may soon become the norm. To fully benefit from this paradigm, change in education, teachers need to be open to experimenting with new ideas and accepting of technology as a necessary instrument for advancement.

Using artificial intelligence to transform the grading environment

In recent years, there has been a substantial increase in research on the automation of assessment and grading using AI and NLP techniques. Several research have looked into the ways in which these technologies can improve the uniformity, accuracy, and efficiency of grading procedures. One technique, automatic essay grading (AEG), evaluates written answers to open-ended questions using machine learning algorithms. Build AEG models, researchers have included elements including grammar, syntax, lexicon, and coherence.

These models can be used in conjunction with NLP techniques such as discourse analysis and semantic analysis to determine a student's level of understanding of a subject.

Another application of AI and NLP in education is automated short answer grading (ASAG), in which students submit brief answers that are evaluated by machine learning algorithms. For ASAG problems, deep learning techniques have been used because deep learning techniques can learn complicated data representations, they have been applied to ASAG challenges.

Nevertheless, getting good training data for ASAG is still difficult.

There could be several advantages to using these technologies for grading and assessment. First off, in comparison to manual grading, it can save teachers a great deal of time and work. Second, AI grading can be less biased and subjective than human grading since it is more methodical. Third, AI grading is quicker than manual grading, which can assist teachers in giving students feedback more rapidly and freeing up more time for other crucial activities consistent, and unaffected by fatigue. Fourth, AI can analyse student performance data to reveal areas in which students may be failing or succeeding. This can assist teachers in determining which areas require modification in their teaching strategies or where pupils may require more support. Finally, by utilizing AI, teachers can create unique grading standards and rubrics that suit their unique requirements and pedagogical approaches, accurately reflecting the lesson's objectives and offering a true evaluation of students' accomplishments. As beneficial as AI and NLP are, there are certain drawbacks as well. One significant worry is that rather than participating in real-world learning, students would utilize these models to provide answers for homework or exams. This may cause a situation where students are just using the system to their advantage rather than really understanding or mastering the subject matter. Accordingly, even though those technologies have a lot of promise to help with teaching and learning, their use needs to be carefully controlled and complemented by techniques that promote critical thinking and true comprehension. Creating an educational atmosphere that respects academic integrity and discourages the improper use of these technology is also essential (Alqahtani et al.,2023).

Fostering psychological well-being to ensure future resilience

The rising number of students experiencing mental health problems has made it necessary to investigate creative ways to help and lessen their psychological suffering (Auerbach RP et al., 2016). One such innovative technology is the use of NLP models to provide students with mental health support (Sureshkumar M et al., 2022). GPT-4 and related AI models can help with mental health support by providing students in emotional distress with easily accessible and timely help. These AI models can converse with students in an understanding and cogent manner, giving them a secure and accepting space to share their worries and feelings.

NLP and AI technologies have a lot of potential to improve students' mental health, but we also need to be aware of their drawbacks and moral dilemmas. The fact that these technologies cannot replace in-person communication or professional medical advice is a major limitation. Because mental health problems are complex, individualized treatment plans that include each patient's particular needs and circumstances are necessary. Therefore, even though AI-driven treatments might provide counselling and emotional support, they are intended to be complementary instruments that improve current healthcare offerings rather than a substitute for human-based therapy.

Enhancing the curriculum to better prepare students for the workforce

An AI curriculum generator is a clever piece of technology that assists educators in creating comprehensive lesson plans by utilizing artificial intelligence. It can understand curriculum standards, analysing educational data, and creating a personalized learning path for each student.

While addressing stakeholders' worries about keeping up with evolving pedagogical techniques and the shifting labour market, AI can help achieve program-specific goals.

This can be achieved through streamlining course design, creating descriptions, establishing learning objectives, and developing evaluation procedures. (Aljohani N et al.,2022)

“Artificial intelligence technologies hold the potential to facilitate curriculum development and simultaneously align it with job market needs “(Almaleh A et al.,). In terms of guiding students toward rewarding career options, AI-driven career advising, and job selection can assist students in discovering their talents, interests, and aptitudes. AI technologies can help with career decision-making and provide individualized support by offering specialized guidance on possible career routes based on a person's particular abilities, preferences, and objectives (Gati I et al.,2021 and Westman S et al., 2021).

However, while depending on AI for curriculum development and career counselling, there are a few things to keep in mind. Artificial intelligence systems might not have the human element needed to understand the feelings and particular situations of each pupil. (Online Journal March 30, 2023). Finally, a dependence on AI tools too much may hinder the development of critical thinking abilities since students may become unduly reliant on the guidance provided by AI rather than developing their ability to make thoughtful judgments on their own. (Academy B, and Kouzov O 2019). Figure 3 shows the benefits of AI in higher education.

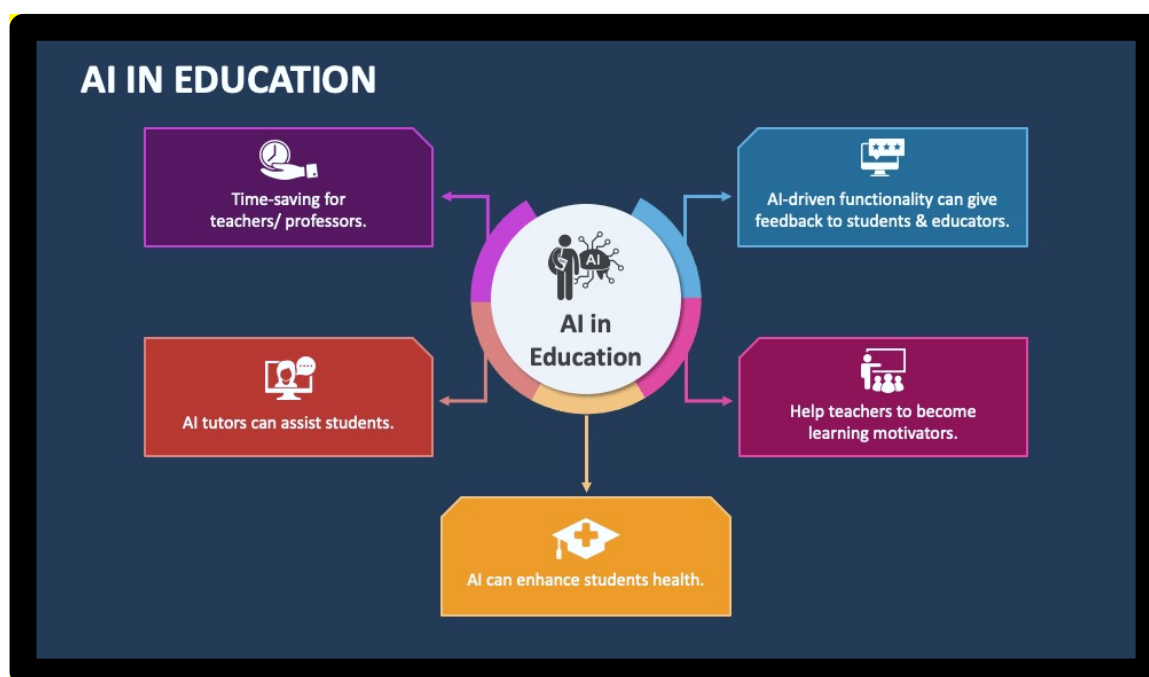


Figure 3: Benefits of Ai in Higher Education

Enabling the creation of text

OpenAI is the company that created the extensive language model known as ChatGPT. Because it was trained on a vast corpus of literature, it can generate human-like reactions to a range of

stimuli. It can be applied to several tasks, including conversation production, text summarization, and language translation.

The way scientific prose is written has changed because of ChatGPT, other AI models, and technological advancements in AI. Based on cues or input data, these models can generate excellent scientific texts after being trained on vast volumes of scientific data. To create scientific text, students can enter data such as study materials or notes. After that, the AI model evaluates and synthesizes the data to produce an accurate scientific writing that is logical and pertinent to the given data. As a result, students can save a significant amount of time and work as they won't need to read through study massive unnecessary notes or compose specific sections. Furthermore, because AI systems may employ complex natural language processing (NLP) techniques and are trained on enormous amounts of scientific data, they typically produce scientific articles of a high quality.

The generated content will probably be accurate and pertinent if there is enough data and sources, which makes it a priceless tool for students who want to create study materials. It might also be trained to adjust its writing to meet certain requirements, such being casual or formal, short or accurate. (Alqahtani, T et al.,2023).

Review of the Literature

Researchers are looking into the studies on the application of artificial intelligence in higher education because of the increased interest in AIED. Some researchers have focused on a particular subject domain by conducting systematic reviews.

A bibliometric investigation on the effects of AIED in HE was conducted by Hinojo-Lucena et al. in 2019. They looked at the scientific output of AIED HE publications that were indexed in the databases Scopus and Web of Science between 2007 and 2017. According to this survey, proceedings papers made up the bulk of published document categories.. The country with the most publications was the United States, and the research that were cited the most frequently dealt with the use of virtual tutoring to enhance learning.

Specifically, (Winkler Schwartz et al., 2019) searched for optimal methods for utilizing machine learning education. These works give particular attention to the application of AIED in HE, although they do not offer a comprehensive understanding of AI in HE. Taking a larger picture of AIED in HE.

(Ouyang et al.,2022) conducted a thorough analysis of AIED in online higher education and looked at the literature on the use of AI from 2011 to 2020. Based on the findings, resource selection, improving the learning experience, performance prediction, and autonomous evaluation are the four main goals of AI applications in online higher education.

According to (Chu et al.'s.,2022) analysis of the top 50 AI-related HE articles cited between 1996 and 2020, discussions of forecasts of students' learning status were most common. Much of the time, AI was used in engineering courses, and it was mostly used for prediction and profiling.

(Salas-Pilco and Yang's., 2022) research centred on the use of AI in higher education in Latin America. The results show that the five primary applications of AI in Latin American higher education are as follows: assistive technology, image analytics, predictive modelling, intelligent analytics, and autonomous content analysis. These studies do not offer a comprehensive analysis of AIED in HE, but they do offer insightful data for the online and Latin American settings. Research has been done to investigate higher education (HE).

In their analysis of the potential benefits and drawbacks of ChatGPT and other Natural Language Processing (NLP) technologies in research and academic publishing, (Dergaa et al., 2023) draw attention to the ethical issues raised by their use and consider how it might affect the validity and authenticity of academic works. They discovered that ChatGPT and other NLP technologies can improve academic writing and research efficacy. However, concerns about the effects on the academic work's authenticity and credibility were also voiced, emphasizing the importance of human intelligence and critical thinking in research.

In conclusion, Zawacki-Richter et al. (2019) (2019) inspected AIED in higher instruction from 2007 to 2018 and decided four essential employments for it: (1) profiling and expectation; (2) evaluation and assessment; (3) versatile frameworks and personalization; and (4) intelligent teaching systems. These authors stress how fast AI is advancing as well as how AIED is employed in HE, and they call for additional research in this area. It appears that no studies have been conducted over the last two years of AIED in higher education.

Purpose of the study

The goal of this work is to address calls from academics (Chu et al., 2022; Hinojo-Lucena et al., 2019; Zawacki-Richter et al., 2019) for more research on the advantages and difficulties of AIED in higher education. Since research on AIED HE concluded with studies looking only to 2020, this report offers the most recent analysis looking at research that will continue to the end of 2022.

This study's main inquiry is: What patterns exist in HE researches when it comes to the application of AIED? Contextual information is given in the first two questions, including the study locations and the fields in which artificial intelligence was applied. In order to present the primary conclusions of the third question, which concerns how higher education is used artificial intelligence.

- a. What is the location of the AIED study, and how has the pattern of publishing amount changed over time?
- b. What subjects and academic levels were the subjects of AIED study, and which departments did the early authors belong to?
- c. How is artificial intelligence being used in higher education, and who are the intended users of these technologies?

Conclusion

The introduction of chatbots and AI is like how the internet first gained attraction in the 1980s—it began modestly and then grew into our daily life. It is essential to adjust to these technologies while putting strong rules and guidelines in place to protect people from possible harm. In summary, there are potential, and obstacles associated with integrating AI and NLP in higher education that need to be carefully considered. Adopting artificial intelligence (AI) tools and cutting-edge learning strategies is essential for creating a flexible and adaptive environment as the landscape of education changes. Researchers, teachers, and students in a variety of fields can benefit from comprehensive support systems that are developed by a deliberate, balanced, and integrated combination of AI and human help. In order to ensure the responsible and successful adoption of AI technologies, it is possible to make the integration of AI into our daily life easier by offering necessary resources, hosting webinars on the subject of AI's effects on education and research and adding pertinent courses to the curriculum.

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