

Impact of AI Technologies on Teaching, Learning, and Research in Higher Education

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Abstract

The higher education sector is experiencing a rapid influx of artificial intelligence, which is resulting in significant improvements in administrative processes, efficacious instruction, and personalized learning. This paper investigates the potential of Artificial Intelligence (AI) technologies, including adaptive learning platforms, to personalize learning experiences for students, automate repetitive duties, and provide educators with valuable insights. The discussion centers on the ways in which artificial intelligence technologies are being utilized to customize learning, automate administrative activities, and improve decision-making that is driven by data. Through data analytics, artificial intelligence has delivered real-time insights, dramatically improved tailored learning experiences, and automated administrative procedures such as scheduling and grading. Despite this, there are still significant problems to be solved, such as algorithmic bias and data privacy. AI in education has the potential to improve student learning outcomes, increase instructional effectiveness, and allocate resources more efficiently. To optimize the advantages of AI, educators and students must develop digital literacy and ethical concerns. In order to investigate the practical applications of AI in a variety of educational environments, future research should involve more extensive, quantitative studies.

Keywords: Artificial intelligence, AI technologies, Higher education, Technology enhanced learning, Ethical and practical challenges

Introduction

Artificial Intelligence (AI) has smoothly fitted into our everyday lives. In 2016, Barack Obama mentioned that the line between man and AI is blurring since AI technologies were being created to improve and complement the ability of man. Doing fundamental research will

enable strategies concerning the effective interaction and collaboration with artificial intelligence systems to be built (Popenici & Kerr, 2017). Many universities are leveraging the newest technologies in enhancing student experiences while emphasising safety, gaining efficiency, and adapting to dynamic changes amidst the COVID-19 outbreak. AIED now carte du jour exercises a great deal of control over the learning and teaching environments in higher education settings. AI in higher education refers to a very knowledgeable information system in a way that it can perceive its environment and react intelligently.

There are so many myths that come into play about how to accurately assess the skills of teaching specialist; as remote learning methods become more mainstream, there will be even more discussion about how AI may assist these specialists. More time will be devoted to the curriculum content and in-depth interaction by instructors, while administrative duties will be performed by AI systems, which will greatly benefit both the teachers and the students. The need for a system that can assist in diagnosis and predict critical factors is urgent; therefore, it is predicted to help in the effective diagnosis and forecasting of the type of treatment that each individual patient would require (Baker & Smith, 1970).

In addition, having a prognostic system that can tell the degree of infection in different persons would have helped stabilize healthcare systems, decreasing chances of medical facilities being overcrowded and finding solutions to any supply shortages before they happen. Our lives depend heavily on education. The process of learning through information and skill development goes intrinsically with education. Education refines a human mind's ability to distinguish and discriminate between truth and falsehood. In the future, teaching will be characterised by intelligent machines having computing power and sophisticated tools. This creates new possibilities for teaching and learning within the sphere of education and can totally change the structure and management of institutions of higher learning (Verma, & Tomar, 2020). These days, the cost of education has become unnecessarily exorbitant for low-income parents to admit their extraordinarily bright children in the schools of their choice. Education enables people to understand the actual values of social and cultural behaviour and to develop as morally pure members in society (Sethi, Chauhan & Jaiswal, 2021).

Traditional methods of teaching, learning, and research are being transformed by artificial intelligence which is becoming an increasingly important component of higher education. Personalized learning experiences, optimal administrative tasks, and improved student engagement are being enhanced by AI technologies, including adaptive learning platforms, intelligent tutoring systems, and advanced data analytics. The capacity of AI to efficiently process large volumes of data enables educators to identify at-risk students early and provide opportune interventions. Nevertheless, the incorporation of AI in higher education also presents challenges, such as the necessity of digital literacy among faculty and students, algorithmic bias, and data privacy. It is imperative to guarantee that AI is implemented in a manner that is both ethical and equitable in order to optimize its advantages and mitigate potential risks.

Rapid development and adoption of artificial intelligence in higher education offer great potential for personalization and efficiency of learning, teaching efficacy, and administrative effectiveness. In this light, of course, there are critical problems that need to be effectively and equitably integrated. AI stands as having potential in the transformation of student learning practices through adaptive platforms learning, automated administrative functions, and data-perceptive analytics. Yet at the same time, AI raises issues of correlational bias, privacy of data, and digital literacy on the part of both faculty and students. If such issues are not responsibly handled, the promise of AI in higher education would not lead to its full benefits and might even increase further disparities or of ethical concern. This study focuses on the duality of AI: the transformational potential and inherent problems associated with AI integration into higher education. Taking a balanced and levelled approach, therefore, this study offers some ways to maximize AI uses for relatively better outcomes while ensuring moral standards and augmenting digital literacy.

Literature Review

A literature review is literature collected for a given study, and through the analysis of existing research and scholarly work, it provides a critical analysis by identifying the gap and hence forming a ground for new directions of the research. It seeks to establish the context and significance of a study within the broader discipline.

Regarding AI, Samman, et.al. (2024) investigated that artificial intelligence can be implemented within higher education massively and had a great potential for improving teaching, learning, and organizational processes. Meta-analysis of the different studies carried out in the last ten years towards investigating impacts, trends, and challenges of using AI in higher education. The investigation identified that AI had a positive effect on validated learning experiences, operational efficiency, and data-driven decision making. At the same time, however, burning ethical issues related to data processing, development of algorithms, and the correct use of Artificial Intelligence, were still under vigorous debate. The research study has further provided suggestions on policy development in future implementation, advocacy for research in how to establish artificial intelligence among the teachers, teaching, and learning, ethical standards in the profession, and continued investment in studies.

Giray (2024) investigated, broke down and disputed a portion of the prominent untruths recorded over AI in instruction. The study disclosed and explained 10 standard misconceptions about artificial intelligence related to the domain of education. The research provided a possibility of short answers assigned to refute each fallacy and set forth the fact associated with the fallacy, along with authentic sources of numbers. Artificial intelligence was proving unsatisfactory in replacing the educators since it lacked an essential human quality, a necessity of effectively promoting enjoyable learning. Therefore, technology could only supplement other than replacing the educators. A physical classroom is vital to encourage a student's engagement, a necessity that artificial intelligence cannot offer in totality. This demystifies that artificial

intelligence can replace all aspects of the traditional classes. Although AI showed excellent performance in some tasks, it lacked the human cognitive aspects such as understanding and creativity. This leads to the question for the case where it is said that AI exceeds human level. This assured that its effects fell in place with the beneficial educational goal and that helped in the gradual development of society. Artificial intelligence (AI) can offer every man teaching that is personal, impartial, and judgment-free.

The study by Zouhaier (2023) reviewed the influence of AI in higher education on teaching and learning processes, testing methods, consideration of ethical issues, necessary competencies, and estimation of potential jobs. The study researched the influence of AI on the educational process, analysed the effects of AI on evaluation and grading, and also predicted consequences for the future career trajectories of graduates. The approach to the research is qualitative, and a scale was issued to the population around higher education. The results of the study showed that AI was of help in shaping higher education forecasting. Furthermore, the results pointed out that AI was of great benefit and was less troubled by the automation in acquiring a new set of skills that would help graduates in facilitating their challenges in the future career. More so, the study pointed out the significance of AI ethical consideration. The higher education institution was seen to need to incorporate artificial intelligence more deeply into its curricula to prepare its graduates adequately for the job market in a future that is fast approaching. AI was identified as a possible disruptive force in education by customizing teaching methods to fit each individual student, providing instant feedback, and taking over some of the administrative duties by automation. Moreover, it was acknowledged that through AI, the process of examining the assessment could have been optimized for educators to focus more on the curriculum's development and quality delivery offering excellent education. The results noted that the learning process was improved through AI to access acquisition of new knowledge and skills.

O'Dea, et.al. (2023) attempted to fill the vacuum based on the question: In reality did artificial intelligence transform the ways and means implemented for higher education? It was contended that existing AI technologies had not achieved much in higher education teaching according to the technological pedagogical content knowledge and Unified Theory of Acceptance and Use of Technology (TPACK and UTAUT) framework. The key factor in this regard was the absence of reliable evidence related to the ability of AI technology and apps to influence learners positively, and also the effectiveness of potential improvements in instruction by the educators. Moreover, in relation to AI, the exact educational benefits were not clearly delineated.

Singh (2023) studied that the general objective of this broadside was to explore the present challenges that the exercise of implementing artificial intelligence is posing to the higher education sector at the national, institutional, and personal levels. AI not only impacted instruction strategies, but also revolutionized administrative procedures in higher education

institutions. Chatbots made operations of common inquiries from students automated and advanced the speed and responsiveness of administration. AI enabled predictive analytics to better admissions, strategic planning for retaining the students, and allocation of resources to make the backbone of depots of universities and colleges strong in their operation.

Duran (2022) had looked at a number of instructional technologies and their related improvements at the university level. The chapter began by addressing key learning technology strategies that are currently being implemented in elementary and secondary schools in the U.S. The study also noted that the higher education institutions must utilize AI with caution and intentionality. And since then, opportunities for effectiveness, innovation, and personalization remain infinite as the higher education institutions are moved through a time when the student is their centre. These include: classroom technologies, blended learning, online learning, and massive open online courses (MOOCs). Following, she discussed the integration of technology into the professional development of teachers. The topic was about technological advancement in the higher education setting, focusing on some areas like Artificial intelligence, Adaptive learning, Learning Analytics, Learning Design, Extended Reality, and open education resources. Later on, the chapter treated current trends and evolution in higher education and its influences on technological initiatives.

Singh, et. al. (2022) studied that AI empowered learners to learn on their own at their own convenience and place. AI solutions facilitated the optimization to furnish feedback in a timely manner on projects, tests, and other assessments. Through this feedback, the system acted as a supplemental instructional tool to improve student performance. The research examined the effects of AI on the teaching and learning processes in higher education. What the review focused on was the effect of new technology that would be brought to student learning and the educational institutions. Underlaid with the fact that at the universities new technologies are adopted, and developed, we might even stand on the threshold until projecting higher education of the future societal landscape where artificial intelligence pervasively provides its benefits. The benefits offered by these technologies would lie in management, student support, instruction, and education.

Algabri, et al. (2021) discussed developments in AI in terms of how it impacts education, from higher education to alternative learning environments. The study explores the effect of emerging technologies, including virtual and augmented reality, on the learning processes of students and the advancement of educational institutions in general. The study looks at AI recent advancements and its potential impact in the process of learning, teaching, and education. The website offered academic assignments, scientific research, and novel projects underpinned by the most recent breakthroughs in artificial intelligence. The fundamental issue was the investigation of potential utilities and pitfalls arising out of the use of artificial intelligence in higher education. Artificial intelligence use in the education sector has increased exponentially, though full-fledged application remains to be seen. Though AI had so

much potential in improving teaching, learning, the development of its practices with time, worsened every related issue, and prompted ethical re-evaluations. Digital technology was now a part of human life. At this time information got transmitted in many ways, people were made to interact in so many ways, and the perception changed. It had already taken roots in all proper facets of life, including the education sector.

Materials and Method

This research used a survey approach to gather data on the utilization and perspectives of generative artificial intelligence in the educational context, namely from students and professors at CSIT in Education and MBS, Far Western University. The main method of collecting data is using a closed-ended online questionnaire. This study focuses on the integration of artificial intelligence technologies, primarily ChatGPT, into the higher education setting. This study examines the possible hazards linked to these technologies and evaluates their influence on the practices of teaching, learning, and research. Participants were recruited using mass email invites, using a convenience sample method that selected respondents based on their availability and desire to participate. The final sample included 100 students pursuing undergraduate and postgraduate degrees out of 700 population size, as well as professors from several fields. The survey data underwent descriptive analysis, while the replies from the open-ended questions were evaluated using a procedure known as theme analysis.

The study's primary data were gathered using a qualitative survey method. In the process of collecting data, the instructors and students at CSIT in Education were given closed-ended online questionnaires. The convenience sampling procedure was implemented in the study, with participants being selected based on their availability and willingness to participate. In the final cohort, there were 100 students and professors from a variety of disciplines. In accordance with the questionnaire, we conduct surveys. The purpose of the study was to learn more about how artificial intelligence (AI) technologies ChatGPT in particular are used and perceived within the classroom.

Secondary data were obtained from a comprehensive review of existing literature and case studies on the integration of AI in higher education. They were acquired through a review of existing research especially from sources such as "Web of Science," "Scopus," "ERIC," and "Emerald," with some grey literature included. This included analysis of studies focusing on adaptive learning platforms, intelligent tutoring systems, and the impact of AI on administrative and instructional processes.

Results and Discussion

Using AI in higher education has produced a number of noteworthy results. By giving them personalized feedback and guidance, this has improved student engagement and learning results. Artificial intelligence (AI) has also automated a number of administrative duties, including scheduling and grading, increasing operational efficiency and freeing up teachers to

concentrate more on curriculum development and student engagement. Furthermore, the ability of AI to analyze data has given rise to real-time insights on student performance, allowing for the prompt intervention of children who are at risk. But putting AI into practice has also brought to light some serious issues, such as algorithmic prejudice and data privacy. To guarantee the proper application of AI technologies, these ethical concerns demand strict norms and the growth of digital literacy among educators and students.

The primary method of data collection was a close-ended online questionnaire that was delivered via mass email invitations. The convenience sampling procedure was implemented in the study, with participants being selected based on their availability and willingness to participate. In the final cohort, there were 100 students and professors from a variety of disciplines. In accordance with the questionnaire, I conducted the survey. The survey exhibited the following results which are presented using both figures and tables.

Figure 1

AI Technologies Enhancing Personalized Learning Experiences for Students

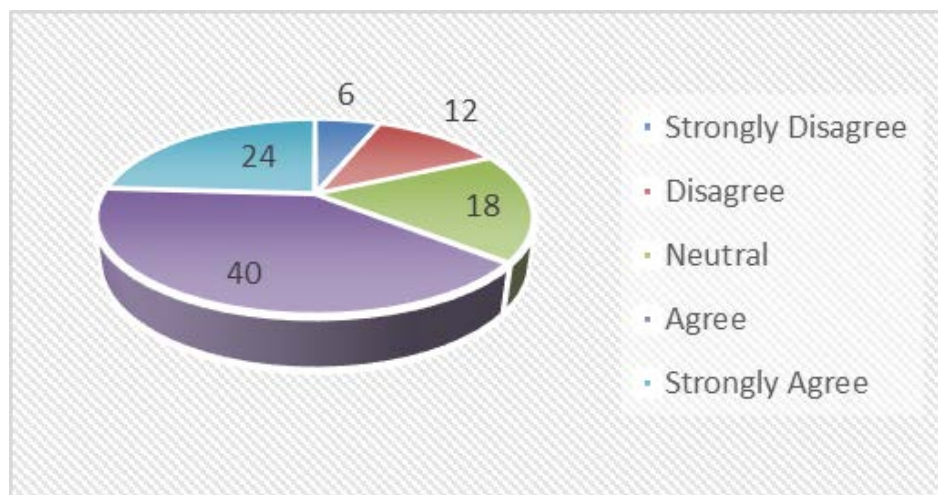
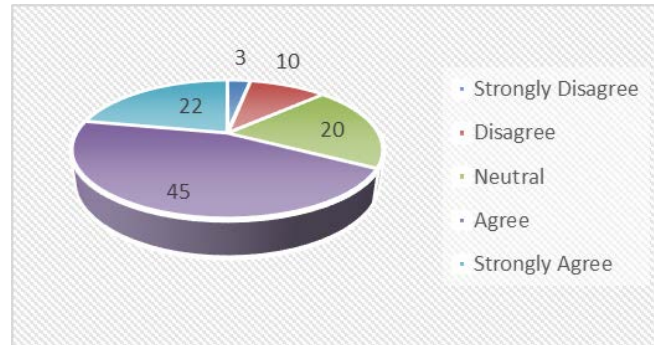


Figure 1 illustrates the respondents' perspectives regarding the assertion that AI technologies improve personalized learning experiences for students, as indicated by the questionnaire survey. In the context of personalized learning, AI is perceived positively, as evidenced by the fact that a substantial majority, 40%, concur with the statement. Furthermore, 24% of respondents expressed a firm agreement, which serves to bolster the positive perception of AI's role in education. Nevertheless, there are conflicting emotions, as 18% of respondents are neutral, which implies a degree of ambivalence or uncertainty. In contrast, 12% of respondents disagree and 6% strongly disagree, indicating that a small number of respondents do not believe that AI substantially improves personalized learning experiences.

Figure 2

AI Technologies and Improvement of Student Engagement



Regarding the influence of AI technologies on student engagement, Figure 2 illustrates the distribution of opinions. The positive influence of AI is firmly supported by a substantial majority (45%), which suggests that it improves student engagement. Furthermore, 22% of respondents concur with this sentiment, resulting in a total of 67% favorable responses. However, only a small minority (13%) disagree or vehemently disagree, while 20% remain neutral. This indicates that AI technologies are primarily perceived as beneficial in enhancing student engagement.

Figure 3

AI technologies Improving Teaching Efficiency by Automating Administrative Tasks

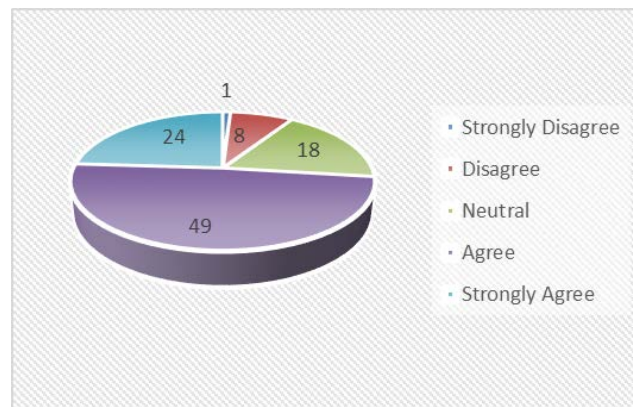


Figure 3 illustrates how teaching efficiency is thought to be enhanced by AI technology through the automation of administrative activities. A sizable majority (49%) strongly concur with this idea, demonstrating popular confidence in AI's ability to simplify administrative procedures. Additionally, 18% of respondents concur with the statement, indicating a broad consensus in support of AI's contribution to increased efficiency. Only a small minority (8%) disagree, indicating the generally favorable attitude on AI's potential to free up teachers' time for more impactful instructional tasks. A smaller majority (24%) stay indifferent, reflecting some degree of doubt or conflicting opinions.

Figure 4

AI Technologies Contribution to Enhancing Collaboration among Students in Educational Settings

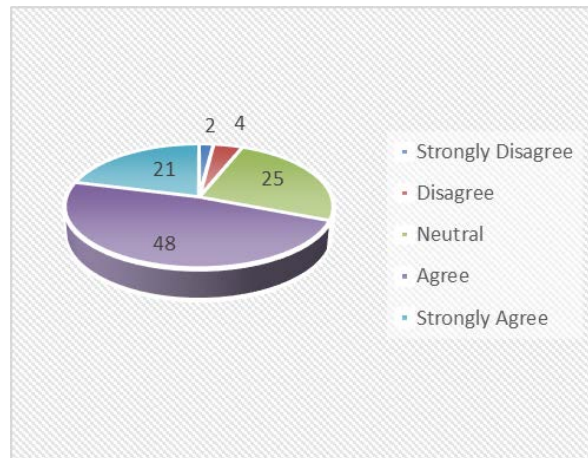
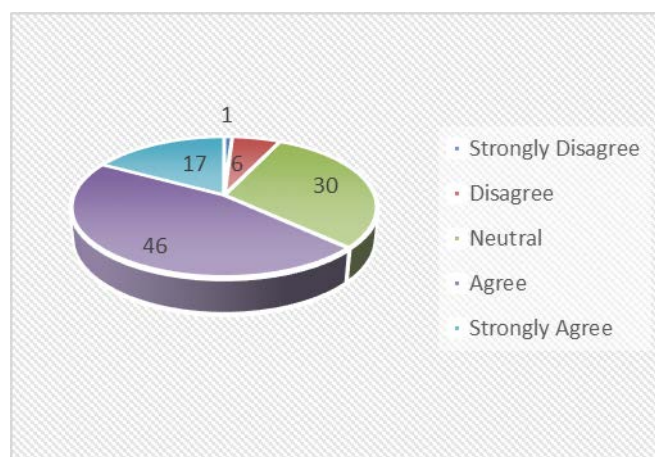


Figure 4 depicts the range of perspectives on how AI technology can improve student collaboration in learning environments. This statement is highly agreed with by a sizable majority (48%) of respondents, indicating broad optimism regarding AI's potential to promote collaborative learning. Significantly more (25%) concur, underscoring the importance of having a positive viewpoint. A very small minority (4%) disagrees, expressing possible misgivings or concerns regarding AI's role in collaboration, while a smaller fraction (21%) stays indifferent, indicating a need for greater investigation and evidence.

Figure 5

Higher Education Institutions and Their Effective Adoption and Integration of AI Technologies



The statement that higher education institutions should successfully incorporate and integrate AI technology is one that a considerable majority of respondents (46%) agreed with, as seen in Figure 5. This implies a very favorable opinion on the application of AI in this situation. Moreover, 30% of participants exhibit neutrality, signifying a degree of ambiguity or a waiting-and-see attitude. Just 17% of respondents disagree, which may indicate some misgivings or anxieties regarding AI inclusion. The remaining 6% and 1%, which reflect more extreme opinions, strongly disagree and strongly agree, respectively.

Figure 6

AI Technologies Contribution to Improving Overall Student Learning Outcomes

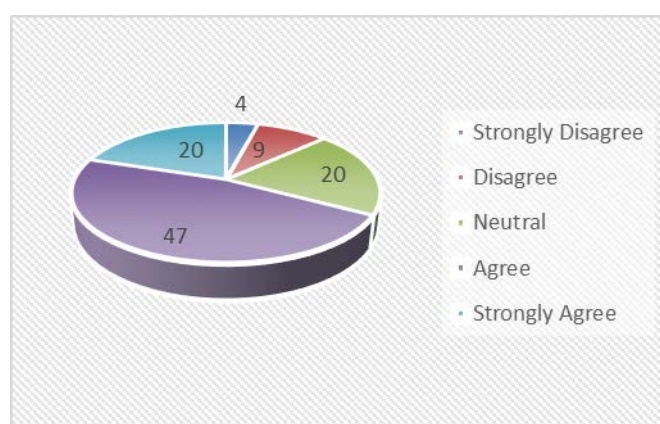


Figure 6 illustrates the range of viewpoints on how AI technologies affect the educational outcomes of students. A sizeable percentage of respondents (20%) are neutral, despite the fact that a sizable portion (47%) concur that AI helps to improve overall student learning. This remark is disagreed with by a smaller group (20%) and strongly disagreed by a very small percentage (9%). This demonstrates a diversity of viewpoints on the subject, with a sizeable segment of the community acknowledging the potential advantages of artificial intelligence in education.

Findings

Personalized Learning: AI technologies such as ChatGPT will significantly develop customized learning possibilities, which enable every learner to obtain learning material and appropriately pace instruction according to requirements. All these modifications will encourage a much more immersive and efficient learning environment.

Teaching Efficiency: AI automates quite a number of the administrative procedures, hence improving teaching efficiency. Teachers could work on curriculum development and teaching excellent education rather than being burdened by mundane administration works.

Student Engagement: AI-based solutions have been found to enhance engagement among students to a large extent. Such technologies help in developing acute sophisticated and problem-solving skills by interactive, adaptive learning experiences that engage students in their education.

Ethical Considerations: There are a lot of ethical questions surrounding the deployment of AI in higher education, like those dealing with the protection of privacy data and algorithm bias. The research highlights the setting of ethical standards and legislative rulings to govern AI applications in the educational setting that would ensure fairness and protect student data.

AI enhances operational efficiency by allowing data-driven institutional decision-making processes to increase strategies and operational effectiveness. Artificial intelligence could be used to analyse vast datasets in order to give useful insights into institutional performance, student engagement, and curricular effectiveness. This implies a more efficient use of resources and better strategic planning.

Discussion

The study demonstrates how artificial intelligence (AI) technologies, like intelligent tutoring programs and adaptive learning platforms, improve individualized learning, streamline administrative processes, and give instructors insightful information. With the help of these technologies, teachers may concentrate more on instructing and developing curricula while also facilitating personalized learning experiences for each student.

There are important ethical considerations associated with the use of AI in higher education, such as algorithmic bias and data privacy. The study emphasizes how crucial it is for educators and learners to become digitally literate in order to fully take advantage of AI's advantages while overcoming these obstacles. The study highlights the necessity of stringent ethical standards to guarantee the responsible and equitable application of AI. It also proposes that in order for educational institutions to develop ethical standards and promote digital literacy, future study should incorporate larger quantitative studies to explore real-world uses of AI in a variety of educational settings.

Challenges of AI in Higher Education

- **Faculty and Staff Preparedness:** Successful AI integration requires extensive training and support.
- **Fairness and Accessibility:** Ensuring unbiased and inclusive AI applications is crucial.
- **Technological Barriers:** Integrating AI with existing systems can be complex and costly.
- **Ethical and Legal Considerations:** Addressing data privacy and security issues is essential for ethical AI use.

Conclusion

The study emphasizes how AI has the ability to revolutionize education. By tailoring educational materials and pacing to each student's needs, artificial intelligence (AI) technologies, like adaptive learning platforms and AI-driven data analytics, have the potential to completely transform customized learning. This creates a learning environment that is more effective and immersive. AI also increases the effectiveness of education by automating administrative duties, freeing up teachers to focus more on developing curricula and providing high-quality instruction. Additionally, through dynamic and adaptable learning environments that foster higher-order thinking and problem-solving abilities, AI-powered technologies dramatically increase student engagement. Algorithmic prejudice and data privacy protection are two ethical issues that are brought up by the use of AI in higher education. Strict moral norms and legal requirements must be established in order to secure student data and guarantee equity in the application of AI. AI also improves operational efficiency by facilitating data-driven decision-making processes that improve resource allocation and institutional initiatives. AI is capable of analyzing massive datasets to offer insightful information about curriculum efficacy, student engagement, and institutional performance. This information is useful for strategic planning and well-informed decision-making.

The integration of AI in higher education faces substantial obstacles. To effectively utilize AI technologies, faculty and staff require extensive training and support. To prevent bias and exclusion in AI applications, it is essential to ensure fairness and accessibility. It is also difficult to integrate AI with existing systems due to technological barriers, such as the complexity and cost. In order to ensure the ethical use of AI in education, it is imperative to address ethical and legal considerations, particularly those related to data privacy and security. The future research should concentrate on the following: the collection of quantitative data, the expansion of sample sizes, and the examination of real-world contexts in which AI is effectively implemented in education. Prioritizing these areas will allow higher education institutions to more effectively prepare for AI integration, thereby maximizing its potential to establish innovative and student-centered learning environments. In order to capitalize on the transformative potential of AI and resolve the associated obstacles, it is essential to comprehend its influence on educational pedagogies, student outcomes, and institutional practices. An inclusive, personalized, and productive educational experience that equips learners for a swiftly changing global economy can be achieved through AI-powered learning environments.

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