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Proliferation of Artificial Intelligence Tools: Adaptation Strategies in the Higher Education Sector

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Abstract: *The growing popularity of Artificial Intelligence (AI) tools in various fields has prompted great interest in the possible applications that these tools may have in higher education. This study investigates the consequences of using AI technologies in higher education, mainly focusing on developing countries as the primary research setting. It explained the benefits, difficulties, and ethical issues that are linked with using AI technologies in educational practices such as teaching, learning, and research. The paper illustrates the advantages of adopting AI tools by drawing on a complete analysis of the existing literature to highlight these benefits. These benefits include improved educational experiences, chances for individualised learning, and possible improvements in administrative duties. In addition to this, it gives information on possible issues, such as concerns around biases, hazards to human contact and critical thinking, and the influence on creative thinking in educational settings. This work suggests techniques for integrating AI technologies into higher education to successfully harness the advantages these tools provide while retaining fundamental educational standard. These solutions include training and upskilled educators to exploit artificial intelligence (AI) technologies, encouraging cooperation between academics, business, and government, and establishing a balanced approach to analysing the merits and downsides of the technology. The paper strongly emphasises the significance of considering the specific circumstances of developing nations, addressing the scarcity of resources, and encouraging fair access to AI technologies.*

Keywords: AI tools, Higher education, Technology integration, Developing countries, educational outcomes, Ethical considerations, Stakeholder collaboration

1.0. Introduction

In the higher education sectors of developing nations, AI technologies are becoming more common (Alordiah et al., 2023a; Zawacki-Richter et al., 2019). Tools based on AI have the likelihood to overcome educational challenges such as a shortage of available resources, overcrowded classrooms, and not enough numbers of skilled instructors (Pierce & Cleary, 2014). Nevertheless, some difficulties are unique to developing nations and need to be addressed. In order to make successful use of artificial intelligence technologies in the higher education sectors of developing nations, efforts should be made to strengthen technical infrastructure, extend internet connections, and guarantee that cheap access to equipment is available (Asad, 2021). Since AI tools in the

higher education segment in emerging nations are of the extreme significance because they are able to rise access to quality education, advance the usefulness and efficiency of teaching and learning process, and contribute to data-driven decision-making. Using AI tools in developing nations can have positive and negative effects, such as aggravating existing inequalities and failing to align with local cultural, social, and linguistic contexts. However, there is also the potential for these tools to have positive consequences (del Cerro Velázquez & Morales Méndez, 2018; Adejo & Connolly, 2017). This study looks into whether integrating AI technology into higher education in underdeveloped countries should be accepted or rejected. The research aims to shed insight on the potential benefits, challenges, and moral concerns of using such technology in underdeveloped countries. The research also intends to help underdeveloped countries adapt to the increasing prevalence of AI technology in academic settings. This work adds to the academic conversation and educates policymakers, and educators in developing countries on the outcomes and methods of using AI technology into higher education. This will be accomplished by looking into the topic. The key ideas presented in this work are illustrated in Figure 1.

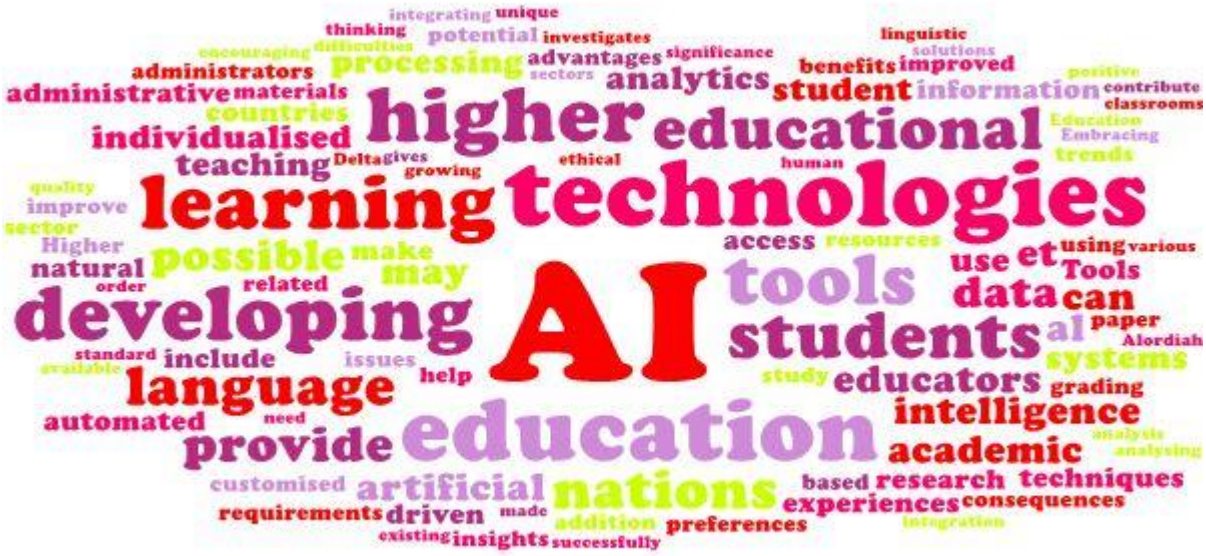

Figure 1: Main concepts discussed in this paper (Researcher, 2023)

2.0. Concept of AI tools

AI tools are computer programs or systems that execute activity linked to education, instruction, research, and administrative duties in higher education by utilizing artificial intelligence techniques, such as machine learning, natural language processing, and data analytics (Pikhart, 2020; Rienties et al., 2020). Deep learning, natural language processing, and data analytics are some of these methods. Others include natural language processing and natural language production. These technologies intend to improve human skills, provide students with more customised educational experiences, and make educational institutions more efficient overall in their day-to-day operations (Gordes & McCombe Waller, 2019).

Students can engage in more customised learning via these platforms, which are driven by AI and adjust material and teaching techniques to suit the preferences and requirements of individual students. AI tools promote students' academic success by providing interactive and individualised advice, feedback, and evaluations. This helps students make progress in their studies. As virtual advisors or information providers for pupils, artificial intelligence chatbots or voice-based assistants are increasingly being used (Buerck, 2014). These assistants can respond to queries on various academic topics, including inquiries about course materials, enrollment procedures, campus services, and other academic matters. They provide prompt replies and help, which contributes to improved accessibility and productivity. The grading and evaluation of student assignments, quizzes, and examinations can now be fully automated with the application of AI algorithms. These systems examine the replies provided by the students, evaluate them based on the criteria that have been established, and then provide either scores or feedback (Pikhart, 2020). Educators benefit from the time savings afforded by automated grading systems, which enables them to devote more attention to teaching and advising students. Artificial intelligence models and data analytics approaches are applied to analyse massive volumes of student data, such as prior academic achievement, demographic information, and behavioural trends. Predictive analytics aims to discover patterns and trends to create insights about the development of students, possible obstacles, and the need for intervention (del Cerro Velázquez & Morales Méndez, 2018). Improved student results may be attributed, in part, to the focused assistance and individualised interventions that institutions are able to deliver as a result of this information. In order to give students individualised material suggestions, AI algorithms investigate student preferences, performance statistics, and learning patterns. Depending on the individual's requirements, these systems provide recommendations for useful learning resources, such as texts or multimedia materials. This makes for more self-directed and personalised learning experiences. Tools for processing language and translating it also exist. Language learning and translation are both aided by technologies that are enabled by AI's language processing capabilities. AI tools provide automated language assessments, voice recognition, evaluations of language competency, and translation services, all of which are geared toward supporting students in the process of acquiring new languages and communicating effectively across linguistic boundaries (Ranalli et al., 2016).

2.1. Embracing AI Tools in Higher Education

The employment of AI technology in higher education has the potential to totally change how administrative, research, teaching, and learning functions are carried out. Students' individual requirements and learning preferences may be catered to using AI technologies that provide personalised and flexible learning experiences. These tools might raise students' involvement and motivation in the classroom, as well as their overall academic performance. This is a welcome improvement for many developing countries that are currently faced with sub-standard educational system (Alordiah et al., 2023b). The grading of assignments, the creation of reports, and other administrative responsibilities may all be automated with the help of AI technologies. This automation frees up valuable time for educators and administrators, which enables them to focus on higher-value activities such as providing individualised instruction, mentoring, and engaging in research (Su & Yang, 2022). Because of this automation, educators and administrators can now focus on these higher-value activities. Reaching students in rural or impoverished regions of the country is one way that AI technologies may contribute to closing the education gap. Access to high-quality educational materials is made possible through online platforms, virtual classrooms, and mobile learning apps that are driven by artificial intelligence (AI) (Tan et al., 2021; Abuhmaid,

2020). This is true regardless of the user's location or the physical restrictions they face. Analysing student performance, locating trends, and developing useful insights are all possible with the help of AI systems that employ data analytics. This method, which is driven by data, gives educators and administrators the ability to make educated choices regarding the design of curricula, instructional practices, and interventions for student assistance. Tools based on AI have the potential to act as helpful resources and support systems for instructors. Intelligent tutoring systems, virtual assistants, and chatbots can give support, advice, and access to educational materials in real time (Snelson et al., 2017). This enhances the capacity of educators and makes it easier for them to continue their professional growth. Higher education institutions that embrace artificial intelligence technologies are more likely to remain at the forefront of technological breakthroughs.

2.2. Case studies and examples of successful AI tool implementations in higher education

Georgia Institute of Technology (Georgia Tech)

In the online artificial intelligence class that Georgia Tech offer, students have access to a virtual teaching assistant powered by AI and given the name "Jill Watson." (Haiguang et al., 2020; Goel & Polepeddi, 2018). Jill Watson was developed to engage in conversation with students, give assistance, and respond to their queries. Students were originally unaware that Jill Watson was an artificial intelligence, and the system attained an accuracy rate of 97% in replying to enquiries made by students. Because of the effectiveness of this implementation, it was possible to demonstrate the potential of AI technologies to improve student engagement and assistance (Vanichvasin, 2022).

Carnegie Mellon University

Carnegie Mellon University developed an AI "LearnSphere" system that analyses large-scale educational data to improve learning outcomes (Rosé et al., 2019). LearnSphere gathers and analyses data from various sources, including student performance, assessments, and learning resources. This AI tool provides valuable insights for instructors to optimise curriculum design, identify effective teaching strategies, and enhance student engagement (Paquette et al., 2018; Holstein, 2019).

Stanford University

Stanford University implemented an AI tool called "Ariadne" to enhance the learning experience in their medical education program (Arieno et al., 2019). Ariadne uses natural language processing and machine learning techniques to analyse medical case reports and provide personalised student recommendations based on their learning goals. This AI tool has demonstrated the ability to support medical students in developing critical thinking skills and making accurate diagnoses.

2.3. Resisting AI Tools in Higher Education

There is a possibility that certain educational institutions and people may maintain the viewpoint that AI tool integration in higher education should be resisted (Cukurova et al., 2019). Although many potential advantages may be gained by using AI technologies, there are also legitimate concerns and grounds for resistance. Ethical concerns may be behind educators' reluctance to use AI technologies in the classroom. Some people believe that putting too much stock in artificial intelligence might remove the human aspect from the classroom, which would lessen the significance of one-on-one communication, mentoring, and the development of social and emotional competencies (Sætra, 2020; Spector & Ma, 2019). There is concern that the use of AI technologies might result in the loss of jobs or the undervaluation of specific tasks within the educational system (Gibbs & Bazylik, 2022; Holm & Lorenz, 2021). It may be possible, for

instance, for automated grading systems to replace the requirement for human graders. Because of this worry, issues have been raised concerning the effect on teachers, teaching assistants, and other educational support employees. Tools that employ AI depend on algorithms, which might perpetuate any biases present in the data used to train them. When AI is employed for jobs such as making admissions choices or evaluating students, concerns emerge over fairness, accuracy, and the possibility of prejudice (Barabas, 2019). The lack of transparency in AI systems contributes to the general mistrust surrounding the deployment of these systems. Concerns about uneven access and the worsening of educational inequality may be at the root of some individuals' reluctance to embrace AI-powered products. Implementation difficulties in developing nations or resource-constrained places might restrict access to AI technologies, extending the digital gap and producing an imbalance in educational possibilities (Makarova & Makarova, 2018). The implementation of AI techniques requires the collection and examination of substantial volumes of data pertaining to students. Concerns concerning privacy have been raised over the gathering, storing, and upkeep of sensitive data. Data breaches, hackers, and improper usage of student information are major sources of concern. Some people believe that overreliance on AI technologies might result in students losing their ability to think critically and their independence. They are concerned that students would learn to rely excessively on AI for problem-solving, information retrieval, and decision-making, which may inhibit their capacity for imaginative and analytical thought (Bedel & Özdemir, 2021). The implementation of AI tools may be very resource-intensive, requiring significant expenditures in infrastructure, training, and continuing maintenance. Their maintenance must also be performed continuously. There is a possibility that opposition could surface owing to worries about the financial load that will be incurred as a result of adopting and integrating AI technologies into already existing educational systems.

2.3. Concerns and criticisms regarding the use of AI tools in academia

When examining the incorporation of AI technologies in higher education, it is essential to consider all of these points of view and participate in in-depth critical discourse. When it comes to making educated judgments on the use of AI technologies in the academic setting, it is vital to strike a balance between the possible advantages, ethical issues, equality concerns, and the preservation of key educational principles. Concerns about ethics and possible biases in connection with AI technologies AI tools have the potential to inherit biases inherent in the data used to train them, which might result in discriminatory results or the continuation of existing disparities (Packin & Lev-Aretz, 2018). The opaque nature of artificial intelligence's algorithms and decision-making processes raises questions about accountability, justice, and the capability to question or comprehend the findings provided by AI. The gathering, storage, and usage of student data by AI tools raises ethical issues around privacy, permission, and the possibility of misusing or accessing sensitive material without authorisation (Ohei & Brink, 2019). These concerns are prompted by the use of AI technologies. It is possible that an excessive dependence on AI technologies may lessen the significance of human connection, individual mentorship, and the development of social and emotional skills, all of which are essential components of education (Tanveer et al., 2020). Students may be less likely to participate in active learning, critical thinking, and autonomous problem-solving if they have access to artificial intelligence systems that supply ready-made answers and solutions. It is possible that the use of AI technologies may promote mainstream or popular beliefs, reducing one's exposure to a variety of viewpoints and perhaps stifling creativity and innovation. It has been argued that the employment of AI-powered proctoring technologies for remote examinations violates students' rights to privacy, causes technological problems, and

engages in unfair spying activities (Coghlan et al., 2021), hence increasing the existing bias experienced in the educational system (Alordiah, 2015). AI technologies to provide tailored learning experiences may have difficulty effectively assessing individual requirements, which might lead to suggestions that are not matched with needs and insufficient assistance. AI technologies have the potential to unintentionally exacerbate existing educational inequalities, as students who lack adequate digital literacy or restricted access to technology run the risk of falling farther behind their peers (Alordiah & Agbajor, 2014). Some educational institutions have come under fire for utilising facial recognition technology driven by artificial intelligence to track student attendance or identify people. Studies have shown biases in face recognition algorithms, which may result in incorrect identifications and disproportionately harm specific populations, such as persons of colour or those who do not adhere to traditional gender norms (Marcolin et al., 2021; Mukudi & Hills, 2019). Despite their intention to simplify the assessment process, automated grading systems based on artificial intelligence have come under fire for their failure to grade more complicated assignments effectively. These tools may have difficulty with subjective grading criteria, assessing creativity, and providing nuanced feedback, which can damage both the learning results for students and the integrity of assessments. Concerns have been expressed about fairness, transparency, and the potential for biased results by using artificial intelligence algorithms in admissions procedures and student assessments (Alordiah & Agbajor, 2014). There have been reports of instances of algorithmic prejudice and the reinforcement of pre-existing inequities, which highlights the hazards connected with depending only on AI technologies for making important choices. It may be difficult for AI tools to take individual differences in learning styles and contextual subtleties into account, which might result in uniform methods that ignore individual students' specific requirements and preferences (Munawar, 2022). Because of this constraint, the creation of individualised instructional tactics and the potential advantages of customised learning may be hampered. Concerns have been expressed about artificial intelligence technologies' effect on various employment responsibilities in the higher education sector. It's possible that the automation of certain functions, including administrative responsibilities or providing fundamental student assistance, might result in the loss of jobs or a devaluation of human connection and support in educational environments. A major cause for worry is the dwindling number of possibilities for personal interaction and guidance from others. The use of AI techniques necessitates collecting and examining vast volumes of data pertaining to students. This raises issues about data privacy, potential security breaches, and the appropriate use of personal information. The erosion of trust and the compromise of privacy rights may be caused when student data is improperly handled or unauthorised individuals access it.

2.4. Strategies for effectively integrating AI tools while preserving core educational values

Table 1: A model for the adoption of AI tools in higher education, specifically tailored for developing countries

Stage/Component	Indicators	Actions
Planning	Assess technological infrastructure and readiness	Conduct an analysis of the current state of the technical infrastructure in emerging nations and identify any areas that need to be upgraded or expanded.
	Identify goals and objectives for AI tool integration	Define specific goals and objectives that align with the requirements and concerns of developing nations, such as expanding access to high-quality education and eliminating educational inequalities.
	Establish a budget and seek funding opportunities	Investigate the availability of grants, financing options, and collaborations with foreign organisations to acquire the necessary financial resources for acquiring and implementing artificial intelligence technologies.
	Engage local stakeholders and foster partnerships	To ensure contextual relevance, ownership, and sustainability, incorporating AI technologies should include local educators, administrators, politicians, and community people.
	Address ethical considerations with cultural sensitivity	Understand the cultural and ethical framework of the developing nations, and create guidelines and regulations that respect the local values and conventions.
Implementation	Identify appropriate AI tools for resource-constrained environments	Investigate artificial intelligence (AI) techniques that are acceptable for the restricted technical infrastructure and connection issues in developing nations, as well as those that are cost-effective and scalable.
	Provide training and capacity building	Develop comprehensive training programs and capacity-building initiatives to equip educators with the necessary skills to effectively integrate AI tools in their teaching practices, considering the varying levels of digital literacy
	Pilot projects in specific contexts	Select specific educational institutions or regions to pilot the use of AI tools, considering the diversity of student populations, infrastructure limitations, and local needs
	Monitor impact and document best practices	Collect data and analyse the effect of integrating AI tools in settings of developing countries, recording successful practices and lessons learned so that they may be shared with other institutions and governments.

	Address technical challenges with innovative solutions	Explore offline or low-bandwidth AI tool options to encourage creativity and collaboration to overcome technical constraints such as restricted internet access, power outages, and compatibility concerns.
Scaling-Up	Replicate and scale successful AI tool implementations	Extend the usage of AI technologies based on the results of pilot projects to ensure that people from disadvantaged areas have equal access to educational opportunities.
	Foster regional and international collaborations	Facilitate cooperation between educational institutions, government agencies, non-governmental organisations (NGOs), and foreign partners to exchange resources, knowledge, and best practices for scalable, long-term growth.
	Advocate for policy support and investment	Engage local, national, and international policymakers to prioritise the incorporation of AI tools into educational settings, push for legislation that encourage the use of technology, and provide money for the construction of infrastructure.
	Promote open educational resources (OER)	Encourage the production and dissemination of open educational resourses that use AI capabilities to broaden access to educational content of a high standard and reduce reliance on costly proprietary resources.
Evaluation	Assess the impact on learning outcomes and social development	Conduct extensive assessments to quantify the effect that the integration of AI tools has had on learning results, student engagement, and social development indicators, such as the reduction of educational inequities.
	Incorporate local stakeholders' feedback	To guarantee that the integration of AI technologies satisfies local requirements and concerns, collecting information from teachers, students, parents, and community members is essential.
	Utilise evaluation findings for evidence-based decision-making	Utilise the assessment results to guide policy choices, resource allocation, and the future direction of artificial intelligence tool integration in situations specific to developing countries.
	Share findings and promote South-South cooperation	Promote South-South collaboration for the purpose of information sharing and capacity development, and disseminate the results of research, success stories, and best practices within developing nations.

Source: Researcher

This model considers the difficulties and possibilities that developing nations experience when attempting to use AI technologies in higher education. It emphasizes the significance of context. Integrating AI tools into higher education while preserving core educational values requires a thoughtful and strategic approach (Kuzminska & Morze; Dankbaar & de Jang, 2014). Strategies to effectively navigate this process include defining educational goals, engaging stakeholders, developing ethical frameworks and guidelines, providing training and professional development opportunities, fostering critical thinking and creativity, investing in the necessary technological infrastructure, continuously evaluating the impact and effectiveness of AI tool integration, and balancing AI and human interaction. These strategies ensure a broader perspective and promote ownership and acceptance of AI tools. Training and upskilling educators to leverage AI tools in their teaching practices is essential for successful integration (Ohei & Brink, 2019). Strategies to effectively train and support educators include a needs assessment, professional development programs, collaborative learning communities, tailored training modules, ongoing support, coaching, showcasing successful implementations, and encouraging experimentation and reflection. Needs assessments should identify the specific AI tools and skills that educators require for their teaching practices and provide hands-on training, practical examples, and opportunities to experiment with AI tools (Ohei & Brink, 2019). Professional development programs should provide educators with hands-on training, practical examples, and opportunities to experiment with AI tools (Akhtyamova, 2021). Collaborative learning communities should foster forums, online platforms, or interest groups where educators can discuss, ask questions, and exchange ideas. Tailored training modules should cater to different levels of expertise and specific subject areas. Ongoing support and coaching should provide guidance, answer questions, and offer personalised support. Collaboration between academia, industry, and policymakers is essential to shaping responsible AI tool adoption in higher education. This can be done through partnerships, alliances, and ethical guidelines and standards. These partnerships can bring together expertise from different domains and facilitate dialogue on responsible AI tool adoption. Policymakers can play a crucial role in formulating policies promoting ethical and responsible AI use (Ouchchy et al., 2020). Research and development, knowledge exchange and training programs, regulatory frameworks, piloting and evaluation, public engagement and awareness, and continuous monitoring and evaluation are all important steps to promote responsible AI tool adoption in higher education. Policymakers can support funding initiatives for research that focuses on ethical AI, bias mitigation, and the impact of AI tools on teaching and learning outcomes.

3.0. Conclusion

This paper has explored the topic of AI tools in the higher education sector and their implications for institutions. The increasing prevalence of AI tools in various domains has significantly changed higher education. Institutions need to decide whether or not they should change to reflect this development. It has been emphasized how crucial it is to address the effects of AI technologies on the higher education industry, especially in developing nation. It is crucial to assess both the benefits and potential challenges associated with their use. Advantages of integrating AI tools into teaching and learning processes have been identified, including enhanced educational experiences, personalised learning opportunities, and potential improvements in administrative tasks and institutional efficiency. Case studies and examples have highlighted successful implementations of AI tools in higher education.

On the other hand, concerns and criticisms regarding the use of AI tools in academia have been discussed, such as ethical considerations, potential biases, and risks to human interaction, critical thinking, and creativity. The need for developing a balanced approach to AI tool integration has been emphasised. This involves evaluating the advantages and disadvantages, preserving core educational values, and addressing ethical considerations while ensuring that AI tools are effectively leveraged to enhance teaching and learning. Strategies for effectively integrating AI tools while preserving core educational values have been outlined, including clearly defining educational goals, engaging stakeholders, establishing ethical frameworks, providing training and support to educators, and fostering a balance between AI and human interaction. Lastly, the collaboration between academia, industry, and policymakers has been highlighted as crucial for shaping responsible AI tool adoption. This collaboration can involve partnerships, ethical guideline development, research and development initiatives, regulatory frameworks, public engagement, and continuous monitoring and evaluation.

Call for further research and exploration of the evolving role of AI tools in education

AI tools' rapid development and integration in education present an exciting and evolving landscape that calls for further research and exploration. As technology continues to advance and new AI applications emerge, several areas warrant deeper investigation:

1. Conduct research to examine the pedagogical impact of AI tools on teaching, learning and research outcomes. Also, investigate how AI tools can enhance student engagement, promote personalised learning, and support the development of critical thinking and problem-solving skills.
2. Investigate potential biases, fairness, transparency issues, and ethical decision-making frameworks for educators, reearchers, and institutions utilising AI tools.
3. Investigate the impact of AI tools on the student experience, particularly in terms of accessibility, inclusivity, and equity. Can AI tools address educational disparities and provide equal learning opportunities for diverse student populations.
4. Question the roles of educators as facilitators and the extent to which AI tools complement or replace traditional instructional methods.
5. Explore how professional development programs can best support educators in harnessing the full potential of AI tools in their teaching practices.
6. Discover how AI tools can streamline administrative tasks, improve efficiency, and enhance decision-making processes.
7. Examine best practices for data governance, privacy protection, and the responsible use of student data in the context of AI tools.
8. Assess the long-term effects of AI tool integration on students' academic and professional trajectories. There is the need to investigate the transferability of skills acquired through AI-enabled learning experiences to real-world contexts and the impact on graduates' employability.
9. Find out how AI tools are transforming specific disciplinary fields in education.
10. Investigate policy frameworks that foster responsible AI tool adoption, address potential risks, and promote equitable access to AI-enabled educational opportunities.

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