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Review Article

Exploring the use and impact of artificial intelligence in higher education in Africa

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Artificial intelligence is transforming higher education, but its adoption in developing countries has been overlooked. This study analysed this gap through a comprehensive systematic literature review, analysing AI's use and impact in higher education. A total of 1,521 articles were identified through databases such as Scopus, Web of Science, EBSCOhost, and Google Scholar, with 63 selected for review. The findings indicate that AI is used in various higher education applications, including tutoring, administrative tasks, instruction, curriculum development, and facilitating new skills acquisition. Many benefits were derived from its use, such as multitasking, ease of workloads, and customised learning. However, challenges exist, including abuse by learners, resource limitations, skill gaps, data security concerns, and ethical issues. This study provides a unique conceptual analysis of AI's impact on higher education institutions, focusing on developing nations. Surprisingly, few explicit studies exist on AI adoption in higher education in these countries. The findings will inform policymakers, educators, and stakeholders about AI's potential to reshape higher education in developing countries, guiding strategic efforts to harness benefits while mitigating risks.

Keywords: Chatbots, generative artificial intelligence, higher education, intelligent tutoring system, virtual assistants

1. Introduction

AI has been a topic of growing interest and investigation in various fields, including higher education (Slimi, 2023). The domain of education stands at the precipice of an epochal transformation, with AI serving as the fulcrum and ChatGPT emerging as a quintessential manifestation of this evolutionary tide (Yu, 2024). This breakthrough in AI technology seems to be transforming current educational norms, leading to debates (Grassini, 2023). The incursion of ChatGPT into academia transcends a mere augmentation of the existing compendium of educational technologies; it signifies a reimagining of pedagogical engagement (Yu, 2024). As a result, several educational institutions are investigating ways of integrating this AI approach as part of their educational system, identifying its ability to revolutionise traditional pedagogical techniques, improve student interaction, as well as create specific learning environments (Hasanein & Sobaih, 2023). The incorporation of AI into education has heralded a transformative era in the way students learn and faculties teach (Hasanein & Sobaih, 2023; Yasmin & Mazhar, 2023).

Since its 2022 launch, AI chatbots like ChatGPT have sparked concerns in education (Dempere et al., 2023). AI encompasses technologies like Machine Learning [ML], Deep Learning [DL], Natural Language Processing [NLP], and Generative AI [GenAI], which simulate human cognitive abilities (Baker & Smith, 2019; Sousa et al., 2021). The recent emergence of ChatGPT, a GenAI tool, has transformed the technological landscape, generating human-like responses and enhancing educational possibilities (Dempere et al., 2023). The introduction of generative AI, such as ChatGPT, has posed both opportunities and challenges to the traditional model of education (Chiu, 2023). While these tools offer potential for personalized learning, tutoring support, and

increased access to knowledge, they also raise serious concerns regarding academic integrity. Many educators are increasingly uneasy about the potential for academic dishonesty facilitated by AI-driven chatbots (Dempere et al., 2023). For instance, ChatGPT can generate coherent and grammatically accurate essays, answer exam questions, and complete assignments with minimal human input, making it difficult to detect plagiarism using conventional tools (Cotton et al., 2023). Recent studies indicate that a significant number of students have already experimented with AI tools in academic work, often without clear understanding of ethical implications. This has prompted universities to reconsider their assessment strategies and academic integrity policies. According to Garcia-Lopez and Trujillo-Linan (2025), while generative AI can enhance educational experiences when used responsibly, its misuse poses a direct threat to fairness, learning outcomes, and the authenticity of student work.

Despite these concerns, the advanced features offered by GenAI present compelling opportunities for educators to enhance pedagogical practices, particularly in areas such as adaptive instruction, automated feedback, and learner engagement. The advanced features offered by ChatGPT present compelling opportunities for educators to enhance pedagogical practices (Grassini, 2023). As a result, scholars and academics have become acutely aware of the pressing need to thoroughly investigate the influence of these technologies and their subsequent consequences for education (Tayan et al., 2024). These AI models' impact, especially ChatGPT's remarkable possibilities of use in the education sector, has led to a mix of emotions among educators (Grassini, 2023). There is a limited, but growing, body of research concerning the key benefits, opportunities and challenges of ChatGPT use in higher education (Rasul et al., 2023). AI applications in education are on the rise and have received a lot of attention in the last couple of years (Zawacki-Richter et al., 2019). UNESCO has also published a report attempting to discuss the main challenges and the emerging ethical implications of AI in higher education (Grassini, 2023).

While Chiu (2023) noted that research into GenAI applications in higher education is ongoing, Coeckelbergh (2022) observed that Africa is often overlooked in the academic discourse. It is therefore essential to amplify the voices of developing nations within ongoing debates about AI integration, particularly from an African perspective. Although the continent actively develops and applies AI across sectors—including social media, business, healthcare, agriculture, and education—Africa remains largely invisible in global technology discourse (Coeckelbergh, 2022; Yilma, 2025). For instance, Western-generated "maps" of AI research and innovation seldom include African contributions, perpetuating an epistemic imbalance that mirrors broader patterns of knowledge inequality (Coeckelbergh, 2022). Consequently, explicit studies on AI adoption in African higher education settings are scarce. This gap is increasingly acknowledged in the literature, with recent reviews noting a lack of robust data, infrastructural support, and strategic frameworks tailored to national contexts across the continent.

Recent scholarly work has systematically examined the implications of generative artificial intelligence in higher education, addressing its pedagogical opportunities, challenges, ethical dilemmas and institutional readiness. For example, Chiu et al. (2022) conducted a scoping review focusing on how generative AI reshaping higher education. Reviewing 92 articles across four educational domains (learning, teaching, assessment, administration), they highlighted the potential of generative AI to foster self-regulated learning, personalized feedback, and adaptive assessment mechanisms. However, they also raised concerns regarding hallucinated outputs, academic integrity breaches, and over-dependence on algorithmic support. The authors stress that effective AI integration requires strategic investment in educator professional development, updated pedagogical designs, and maintaining a balance between AI-driven efficiency and critical human oversight. Similarly, Bobula (2024) offers a comprehensive review of large language models [LLMs] drawing from literature. The study identifies both advantages—like improved productivity and writing assistance—and concerns, including academic integrity risks, model bias, privacy, and the spread of misinformation. Bobula (2024) recommends that institutions adopt LLMs responsibly by updating assessment guidelines, developing clear policies for both staff and students, scaffolding AI skill development throughout curricula, and allocating institutional

resources for staff training and support. Cui and Alias (2024) also conducted a PRISMA-based systematic literature review of AI applications in higher education from 2020 to 2024. They found that AI enhances student efficiency and administrative processes, yet excessive reliance undermines learner autonomy and critical thinking. They recommend that educational stakeholders adopt data-informed yet human-centered approaches to preserve educational quality. Castillo-Martínez et al. (2024) systematically reviewed AI use in university-level scientific research. Their findings include that AI tools like ChatGPT support scientific writing and productivity, but raise concerns about methodological rigor and ethical oversight. They argue for a balanced posture, urging researchers to maintain critical engagement with AI-generated outputs. Bond et al. (2024) performed a large-scale tertiary review synthesizing 66 secondary studies on AI in higher education. They found that adaptive systems and personalization dominate the field, yet ethical and methodological rigor remain insufficiently addressed. They call for interdisciplinary collaboration, transparent research practices, and stronger ethical governance frameworks in AI researches in higher educations. Moreover, Vieriu and Petrea (2025) investigated AI's impact on students' academic development via surveys and thematic analysis. They reported that AI tools enhance personalized learning and engagement but flagged concerns over overreliance, reduced critical thinking, and data privacy. They recommend structured frameworks and equitable access to AI, ensuring it complements rather than substitutes learning.

Despite the valuable insights offered by these studies, there remains a notable gap in the literature regarding the adoption and integration of AI in developing country contexts, particularly within Africa. These regions are often marked by limited economic growth and insufficient technological and social infrastructure, especially in the domain of information and communication technologies, which can significantly shape the trajectory of AI implementation (Gutierrez et al., 2017). Consequently, a deeper investigation into AI adoption from the perspective of developing nations is both necessary and urgent to ensure more equitable and contextually relevant technological advancement in global education systems. This gap highlights the need for research that considers the unique socio-economic and cultural contexts of African nations, which may influence the adoption and implementation of AI technologies differently than in developed countries. Addressing this oversight could provide valuable insights into how AI can be effectively integrated into educational and professional practices in Africa. This study aims to systematically review and synthesize existing literature on the application of artificial intelligence in higher education within developing countries in Africa, with the goal of identifying key areas of implementation, evaluating the associated benefits, and uncovering the primary challenges encountered in the process. Hence the following research questions guided the review:

RQ 1) How can AI be applied in higher education within developing countries in Africa?

RQ 2) What are the benefits of implementing AI in higher education in developing countries in Africa?

RQ 3) What challenges are faced when using AI in higher education in developing countries in Africa?

2. Methodology

The PRISMA-ScR checklist (Tricco et al., 2018) provided the framework for this systematic review, ensuring both transparency and methodological rigour. The research utilised a systematic review to investigate the use and impact of AI in higher education.

2.1. Search Strategy

This systematic review undertook an examination of the scope and nature of how higher education institutions were using AI. Four academic databases namely Scopus, Web of Science, EBSCOhost, and Google Scholar, were selected to retrieve journal articles. The search strategy was done to get a comprehensive and representative sample of the available literature on the impact of AI in higher education. The search of these databases was conducted from January to March 2024. The search string that was used for this study was:*(Artificial intelligence OR Generative AI OR Chatbots OR*

Intelligent tutoring systems OR AI enabled educational technology OR Virtual assistants AND Application AND Challenges AND Benefits AND Higher education OR Institutions of higher learning OR Academic institutions). The keyword system was used to have a focused and relevant search for literature on AI use in higher education.

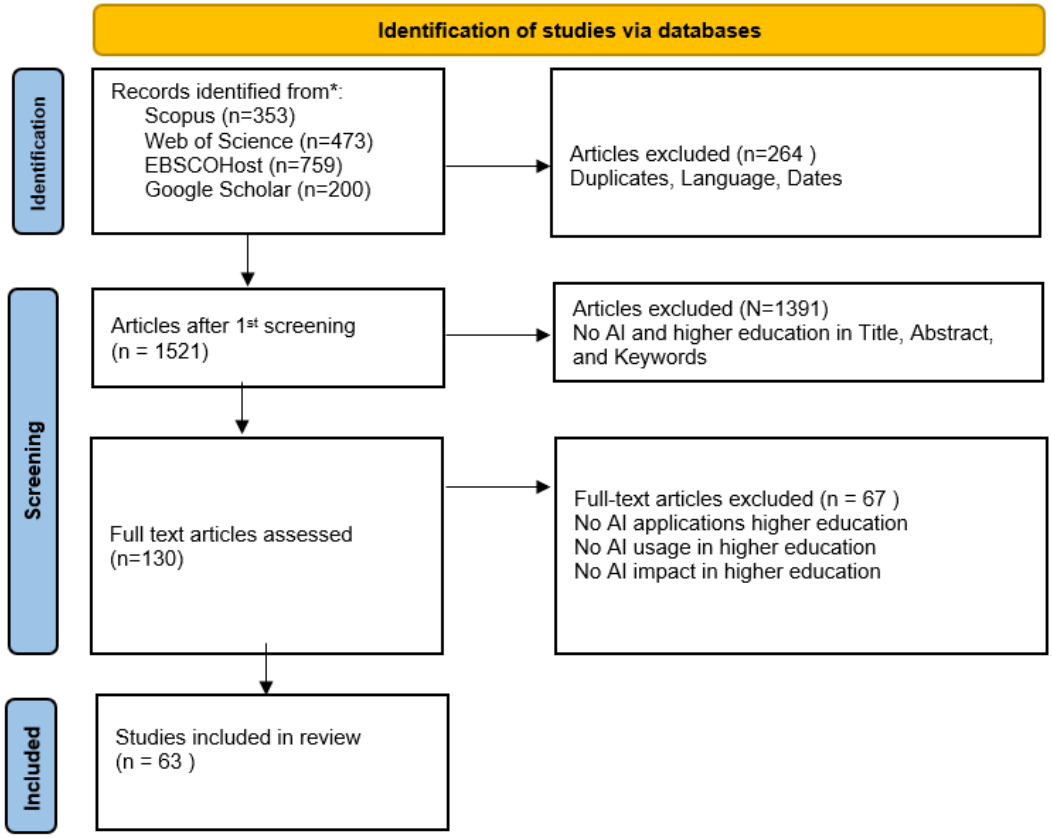
2.2. Eligibility process

To be included in the study, the study design employed in the article was looked at where empirical research employing quantitative, qualitative, or mixed methods were considered. Those that were descriptive, opinion pieces, editorials, commentaries, and non-peer reviewed publications were excluded from the study.

2.3. Selection Process

The search strategies resulted in a total of 1521 peer-reviewed articles that were screened to reduce duplicates and eliminate articles that did not focus on the use of AI in higher education. The inclusion criteria specified that articles must discuss AI in higher education, including its benefits and challenges, in English and published journals. Only articles published between 2018 and 2024 were considered. After the initial abstract and title screening, a total of 130 articles were included for full-text screening, leaving 63 papers, as shown in Figure 1. Three researchers did the screening separately and came together to agree on the articles to be included in the study. The inter-rater reliability (IRR) assessment, using percentage agreement and kappa statistic (κ), demonstrated a high level of agreement (80% agreement, $\kappa = 0.68$), providing robust evidence of the selection process's validity and reliability.

Figure 1
PRISMA flowchart diagram for AI use and impact in higher education



2.4. Data Charting Process

The researchers conducted a comprehensive examination and synthesis of each paper to identify recurring themes and patterns guided by the research objectives. A data extraction form was developed, and Zotero reference management system was used to ensure accurate citation and efficient management of references. The form extracted the study characteristics, use of AI in higher education, and impact of AI in higher education. Figure 1 illustrates these processes. Once data extraction was complete, a thematic analysis approach was employed to analyse the included studies. This included iterative reading and re-reading of the extracted data to identify recurring ideas, patterns, and themes that aligned with the study's objectives. The process was guided by Braun and Clarke's (2006) six phase framework for thematic analysis which includes familiarisation with the data, generation of initial codes, searching for themes, reviewing themes, and producing the report. The initial codes were generated manually and grouped into broader conceptual categories. After initial coding, the researchers collaboratively grouped similar codes to form broader categories. Through discussion and consensus, overarching themes were identified that corresponded to the study's guiding objectives. The themes were organised around the three main areas of inquiry, that is, application of AI in higher education, benefits of AI use, and challenges associated with its implementation in African higher education institutions. The thematic categories were redefined through repeated review of the coded data. Triangulation was achieved through cross-validation among the research team to ensure reliability and consistency of the themes. Any discrepancies in interpretation were resolved through discussion. The finalised themes formed the basis of the synthesis presented in the finding section and are supported by evidence from multiple sources.

3. Findings

The presentation of results aligns with the study's objectives, which concentrated on the application, benefits, and challenges of AI in higher education, particularly with a focus on Africa.

3.1. Application of AI in Higher Education

Numerous authors have contributed to the study of AI application to higher education. Table 1 summarises the key themes and the authors associated with each theme regarding the application of AI in higher education.

AI has been increasingly applied in education for various purposes, including administrative automation, curriculum development, instruction, assessment, and student learning. Notably, research highlights four areas of AI applications: profiling and prediction, assessment and evaluation, adaptive systems and personalisation, and intelligent tutoring systems. Furthermore, AI software applications in education include personal tutors, intelligent support for collaborative learning, and intelligent virtual reality, as pointed out by Salas-Pilco and Yang (2022). Moreover, AI has been used to customise and personalise curriculum and content according to learners' needs, abilities, and capabilities, as found by Chen et al. (2020). In addition, AI tools can generate educational content, create lesson plans, and produce learning materials, potentially expanding the scope of educational content available to students and educators, as highlighted by Fischer et al. (2023) and İpek et al. (2023). As a result, the introduction of digital learning approaches has significantly transformed the landscape of higher education, according to Khoza and Mpungose (2022). Consequently, AI influences students' learning through learning management systems and curriculum design, as identified by Kuleto et al. (2023).

Additionally, AI is applied in developing new higher education strategies, as noted by Ilić et al. (2020), evaluating study programmes, and ensuring quality, as emphasised by Radic et al. (2020). Moreover, virtual assistant tools and adaptive learning systems offer immersive and engaging learning experiences, allowing students to discover complex theories and solutions in a more interactive and meaningful manner, as observed by Chaudhry et al. (2023), Khairy et al. (2020),

Table 1
Application of AI in higher education

Application	*Supporting Statements*	*Scholars*
Administration	AI has been applied in educational institutions for automation of administrative processes and tasks	Chen et al. (2020), Ilić et al. (2020), Radic´ et al. (2020), Kuleto et al. (2023)
Curriculum development and personalisation	AI improves students' learning through the customisation and personalisation of curriculum and content.	Chen et al. (2020), Salas-Pilco and Yang (2022), Fischer et al. (2023), Alharbi (2023)
assessment and evaluation	AI is applied in grading and assessment, enhancing the evaluation of study programmes.	Chen et al. (2020), Rahimi and Tafazoli (2022), Slimi (2023)
Intelligent tutoring systems	Intelligent tutoring systems offer immersive and engaging learning experiences	Salas-Pilco and Yang (2022), Chaudhry et al. (2023), Khairy et al. (2020), Khoza and Mpungose (2022), Huang et al. (2021)
Adaptive learning systems	AI systems support personalised learning for students and power adaptive assessments	Seo et al. (2021), Kuleto et al. (2023), Pradana et al. (2023), Chaudhry et al. (2023), Khairy et al. (2020), Talan (2021)
Innovative teaching methods	AI introduced innovative methodologies that teachers are employing to integrate into their instructional strategies.	Rahaman et al. (2023), Khoza and Mpungose (2022), Franzoni et al. (2020), Rahimi and Tafazoli (2022)
Smart campus development	AI-powered face recognition technology can be used for efficient book borrowing and returning in university libraries	Huang et al. (2021), Alharbi (2023)

Pradana et al. (2023), and Talan (2021). Furthermore, AI supports personalised learning, automates instructors' routine tasks, and powers adaptive assessments, according to Seo et al. (2021). In fact, AI can be used for efficient library management and identity verification, as suggested by Huang et al. (2021). AI also promotes multilingualism and linguistic inclusivity by dismantling language barriers, as pointed out by Alharbi (2023).

3.2. Benefits of Using AI in Higher Education

The integration of AI in higher education has sparked significant discourse, highlighting its multifaceted benefits (Stahl & Eke, 2024; Yu, 2024). AI enhances educational progression by automating tasks, supporting educators, and personalising learning experiences (Choi, 2020; Owoc et al., 2021). Table 2 summarises the benefits of using AI in higher education.

3.2.1. Advancing individualised and self-directed education

Findings from this systematic review indicate that AI facilitates personalised and self-directed learning in higher education (Hasanein & Sobaih, 2023; Ngoc et al., 2023; Xiao &Yi, 2020; Yu, 2024). Studies suggest AI enables tailored learning strategies, resources, and feedback, catering to diverse educational competencies (Chen et al., 2020; Yu, 2024). ChatGPT's conversational interface acts as a bespoke "learning consultant," mobilising students' self-initiative and discerning academic statuses and obstacles (Yu, 2024). The review reveals AI's capacity as shown in Table 3.

Table 2
Benefits of AI

Benefits	*Supporting Statements*	*Scholars*
Advancing individualised and self-directed education	AI's potential to offer bespoke pedagogical approaches, expediting learner-centric educational models	Yu (2024), Hasanein and Sobaih (2023), Ngoc et al. (2023), Xiao and Yi (2020), Chen et al. (2020)
Enhancing pedagogical efficacy and quality	AI produces comprehensive lesson plans, engaging presentations, and educational resources, empowering teachers to refine pedagogical strategies	Grassini (2023), Hasanein and Sobaih (2023), Yu (2024), Dempere et al. (2023), Jacob et al.,(2023), George and Wooden (2023)
Advancing pedagogical assessment and responsiveness	ChatGPT provides real-time pedagogical support, personalised learning pathways, and instantaneous feedback	Yu (2024), Slimi (2023), Hasanein and Sobaih, (2023), Rahiman and Kodikal (2023), Zeb et al. (2024), Grassini (2023), Nazari et al. (2021), Molin et al. (2020), Essien et al. (2020), Jani et al. (2020), Mirchi et al. (2020)
Reduced teacher workload	AI has decreased the burden of many teachers who don't have much free time	Huang et al. (2021), Ahmad et al. (2021), Chatterjee and Bhattacharjee, (2020), Grassini (2023)
Enhance academic research	ChatGPT can assist in data analysis and literature review generation, potentially streamlining the research process	George and Wooden (2023), de Jong and Bus (2023), İpek et al. (2023), DesRoches (2022), Dempere et al. (2023)
Provide practical experience	Virtual reality classrooms provide skills that can be learned in the absence of risk.	Chen et al. (2020), Ahmad et al. (2021)
Improving language skills	ChatGPT provides immediate grammar, vocabulary, and pronunciation checks	Malik et al. (2023), Hasanein and Sobaih (2023), Zeb et al. (2024), Pokrivcakova (2019), Chen et al. (2020), Hemachandran et al. (2022)
Asynchronous communication	AI language models offer a significant benefit in terms of asynchronous communication, which has been observed to enhance student cooperation and engagement.	Ahmad et al. (2021), Grassini (2023), Zeb et al. (2024), Li and Xing (2021)
Enhance education equity	AI technology can help break regional differences and reduce the inequality of educational resources.	Huang et al. (2021), Hao (2019), Qiu (2020)
Enhanced campus management	Face recognition, hearing and sensing technologies are applied in the construction of smart campuses	Huang et al. (2021), Liu et al. (2018), Afra and Alhajj (2020), Yu (2024)
Advancing educational digitisation through ChatGPT	AI ensures the enhanced dissemination of course content, from the development of the curriculum to the actual delivery of content	Yu (2024), Chen et al. (2020)
Fostering inclusivity in higher education	AI provides opportunities for people with disabilities, refugees, and isolated communities to access learning paths.	Hutson et al. (2023), Maphosa and Maphosa (2023), Aswin et al. (2023), Farrelly and Baker (2023)

Table 3
AI Capacity

AI's Capacity	*Scholars*
Personalised curriculum and content adaptation	Grassini (2023), Chen et al. (2020)
Self-directed learning promotion	Hasanein and Sobaih (2023), Hemachandran et al. (2022), Xiao and Yi (2020)
Customised tutoring	İpek et al. (2023), Hemachandran et al. (2022)
Real-time feedback and evaluation	Owoc et al. (2021)

Notably, programmes like DeepTutor and AutoTutor foster customisation and personalised content (Chen et al., 2020). Yixue Squirrel AI's data-driven approach provides timely individualised feedback (Owoc et al., 2021). The majority of studies converge on AI's potential to offer bespoke pedagogical approaches, expediting learner-centric educational models (Yu, 2024; Zhai, 2023).

3.2.2. Enhancing pedagogical efficacy and quality

Scholars promote AI's efficacy in pedagogy, highlighting its potential to enhance teaching and learning experiences (Grassini, 2023; Hasanein & Sobaih, 2023; Yu, 2024). Furthermore, ChatGPT amplifies pedagogical efficacy, enabling faculty to focus on teaching strategies and innovation (Hasanein & Sobaih, 2023; Yu, 2024). In addition, AI produces comprehensive lesson plans and educational resources, thereby empowering teachers to refine their strategies (Grassini, 2023; Yu, 2024). Moreover, AI-facilitated instruments enhance instruction and administration by automating tasks and providing personalised feedback (Hasanein & Sobaih, 2023). AI-powered data management systems also analyse student and faculty performance, identifying areas for improvement (George & Wooden, 2023; Chen et al., 2020). Notably, ChatGPT supports assessment, freeing educators to focus on student interaction and individualised pedagogy (Yu, 2024). Studies have shown that AI can improve academic performance (Dempere et al., 2023; Essel et al., 2022) and enhance learning quality (Chen et al., 2020). Additionally, AI supports collaborative learning, simulation, and teacher training (Chen et al., 2020; Dempere et al., 2023; Jacob et al., 2023; Santos & Boticario, 2014). Moreover, AI technology can generate examination questions, automatically correct assignments, and provide image recognition for homework correction, reducing errors and workload (Huang et al., 2021).

3.2.3. Advancing pedagogical assessment and responsiveness

The integration of AI in education has the potential to transform pedagogical assessments, as scholars have noted (Grassini, 2023; Hasanein & Sobaih, 2023; Rahiman & Kodikal, 2023; Slimi, 2023; Yu, 2024; Zeb et al., 2024). One of the challenges in traditional education is the lack of sufficient feedback due to instructor workload and overcrowding (Molin et al., 2020; Nazari et al., 2021). However, AI tools like ChatGPT can provide real-time support, personalised learning, and feedback, thereby enriching education (Yu, 2024). ChatGPT can also streamline grading, manage workloads, and bolster assessment precision (Yu, 2024). Furthermore, AI-powered approaches can generate personalised assessments (Zeb et al., 2024), evaluate student performance, and provide customised learning (Rahiman & Kodikal, 2023). Additionally, AI can assist in grading, detect similarities, and provide feedback (Essien et al., 2020; Rahiman & Kodikal, 2023).

3.2.4. Reduced teacher workload

AI in education reduces the burden on teachers, allowing them to focus on humanistic care (Huang et al., 2021). The massification of students in higher education has increased teachers' workload, with much time spent on correcting homework and exams (Chatterjee & Bhattacharjee,

2020; Huang et al., 2021). AI-powered tools, such as intelligent tutor systems and educational robots, can help teachers with repetitive tasks, alleviating pressure and freeing them from heavy knowledge transfer (Huang et al., 2021). With AI handling routine tasks, teachers have more time and energy to communicate with students, focus on their moral and ability development, and cater to their overall physical and mental growth (Huang et al., 2021). Additionally, teachers can reflect, innovate, and devise new teaching techniques and activities, enhancing their teaching practices (Grassini, 2023).

3.2.5. Enhance academic research

The integration of AI tools in academic research has the potential to significantly improve efficiency and effectiveness. Scholars highlight AI's benefits in knowledge discovery, including automating tedious tasks, providing new insights, and enabling collaboration (George & Wooden, 2023; İpek et al., 2023). AI-powered tools like ChatGPT can assist in data analysis and literature review generation (İpek et al., 2023). By analysing vast amounts of data, AI can identify patterns, develop predictive models, and facilitate researcher collaboration. Additionally, AI-based tools can improve technical writing and verify cited claims (DesRoches, 2022).

3.2.6. Provide practical experience

Simulation technologies provide students with practical exposure and experiential learning, thereby improving learning quality (Chen et al., 2020). Moreover, virtual reality classrooms offer risk-free skill development, while AI systems conduct experiments in laboratories without human risk (Ahmad et al., 2021). Additionally, AI-created animations and virtual images in medicine help students learn human anatomy and organ functions more easily. For instance, practical experiences like flying an aeroplane require hands-on training, which AI's virtual environment can provide. Consequently, students gain valuable experience and skills in a safe and controlled environment, enhancing their learning outcomes.

3.2.7. Improving language skills

AI has revolutionised language learning with chatbots and virtual conversational partners, transforming language practice and refinement (Malik et al., 2023). Moreover, ChatGPT provides immediate grammar and vocabulary checks, making it a valuable tool (Hasanein & Sobaih, 2023). Additionally, GPT-3 supports language and critical thinking courses (Zeb et al., 2024). AI-powered writing assistants like Grammarly facilitate writing processes (Pokrivcakova, 2019). Furthermore, AI promotes honesty and academic integrity through tools like TurnItIn (Chen et al., 2020). Consequently, AI customises lectures to individual language requirements, bridging cultural gaps and facilitating global understanding (Hemachandran et al., 2022; Malik et al., 2023).

3.2.8. Asynchronous communication

AI plays multiple roles in education, improving communication between teachers and students (Ahmad et al., 2021). ChatGPT facilitates interactive communication, enabling more engaging classroom activities (Grassini, 2023). AI language models enhance student cooperation and engagement through asynchronous communication (Zeb et al., 2024). This model allows students to interact and discuss topics without simultaneous presence (Li & Xing, 2021). Furthermore, chat APIs enable student groups to collaborate on assignments and projects (Zeb et al., 2024). Additionally, chat APIs facilitate remote learning, benefiting students with mental or physical health concerns (Zeb et al., 2024). Through AI, learning becomes more inclusive and flexible.

3.2.9. Enhance education equity

AI technology promotes education equity by bridging regional differences and reducing inequality in educational resources (Huang et al., 2021; Qiu, 2020). By integrating the Internet and AI, remote personalised teaching can be provided, enabling one teacher to teach students in multiple areas (Hao, 2019). This facilitates resource sharing of high-quality teachers, allowing students in remote

areas to interact and learn with outstanding educators (Huang et al., 2021). Through online and offline mixed teaching methods, teaching levels can be improved, and teacher professional development can be enhanced in areas with insufficient resources.

3.2.10. Enhanced campus management

AI plays a vital role in campus management and services, leveraging technologies like face recognition, hearing, and sensing to create smart campuses (Huang et al., 2021). By forming a human-machine collaborative decision-making model, AI helps managers identify problems, allocate resources efficiently, and enhance campus safety (Huang et al., 2021; Liu et al., 2018). Face recognition technology secures sensitive areas like dormitories and libraries by authenticating identities and preventing unauthorised access (Afra & Alhajj, 2020). Additionally, ChatGPT automates textual operations, such as composing communiques and policy documents, increasing administrative efficiency and precision (Yu, 2024).

3.2.11. Advancing educational digitisation through ChatGPT

ChatGPT's integration into education marks a new era in managing, distributing, and enhancing educational resources (Yu, 2024). AI improves the dissemination of course content, particularly in online learning platforms, and aids in selecting digital tools and materials (Chen et al., 2020). By promoting technology integration, ChatGPT extends education beyond traditional classrooms, democratising access to high-quality resources regardless of geographical barriers (Yu, 2024). According to Yin (2024) this aligns with Education 4.0 goals, emphasising personalised and democratised learning experiences through technology, and potentially reaching a wider audience.

3.2.12. Fostering inclusivity in higher education

Research highlights AI's crucial role in fostering inclusivity in higher education (Hutson et al., 2023; Maphosa & Maphosa, 2023). AI improves learning opportunities, ensures equitable access, and provides opportunities for people with disabilities, refugees, and isolated communities (Tan, 2020). By personalising learning experiences, automating administrative tasks, and delivering real-time feedback, AI revolutionises education and bridges gaps (Kamalov et al., 2023). Additionally, AI-powered technologies like holograms, robotics, and online assistive tools facilitate access to education for students with special needs, enabling remote attendance and reading resource accessibility (World Health Organization [WHO], 2020).

3.3. The challenges of using AI in higher education

George and Wooden (2023) identify potential pitfalls of AI in higher education, including bias, privacy breaches, safety concerns, and unethical data gathering. Chiu et al. (2023) emphasises considering four educational domains: learning, teaching, assessment, and accessibility. Reviewing AI challenges within these domains is crucial to understanding its implications in higher education.

3.3.1. AI challenges in learning

Seven major challenges within the learning domain were identified in the review literature from scholars. Table 4 shows the challenges that AI poses in higher education.

Inadequate supportive learning resources. In the AI era, learning is expected to be student-centric, with personalised learning plans and collaborative group learning enabled by intelligent teaching systems (Huang et al., 2021). However, AI-driven personalised learning faces challenges, including limited suitable learning resources and uniformity in teaching methods (Chiu et al., 2023; Kong et al., 2021). Students are also hesitant to use AI due to difficulties in handling complex topics and limited customisation options (Malik et al., 2023). To effectively integrate AI in

Table 4
Challenges in Learning

Challenges	*Supporting Statements*	*Scholars*
Inadequate supportive learning resources	AI still experimental, lacking suitable learning resources.	Kong et al. (2021), Yang and Shulruf, (2019), Munawar et al. (2018), Chiu et al. (2023), Huang et al. (2021)
Academic dishonesty	ChatGPT's ability to generate high-quality text tempts students to use it as a shortcut, fostering academic dishonesty and undermining integrity	Chan (2023), Grassini (2023), Libert (2023), Dehouche (2021), Zeb et al. (2024) and Hasanein and Sobaih (2023), Basic et al. (2023)
Limiting social interactions	Substituting human interaction with AI in education can lead to reduced engagement and learning outcomes	Sun and Hoelscher (2023), Hemachandran et al. (2022), Bhatnagar (2020), Dempere et al. (2023), Baidoo-Anu and Owusu (2023), Yasmin and Mazhar (2023), Hasanein and Sobaih (2023)
Increasing digital divide	AI exacerbates inequality in the educational setting through a concept known as the digital divide	Lutz (2019), Chiu (2023), Dakakni and Safa (2023), Huang et al. (2021), Okolo et al. (2023), Font de la Valle and Araya (2023)
Questionable quality	ChatGPT may produce incorrect or fabricated information, posing challenges for students	Sun and Hoelscher (2023), Hasanein and Sobaih (2023), Malik et al. (2023), Grassini (2023)
Unfair advantage	Students with ChatGPT access might unfairly outperform peers without access to such "AI-based learning tools like smart laboratories and tutors,	Grassini (2023), Zeb et al. (2024)
Over-dependence on AI	Generative AI (GenAI) has raised concerns about its impact on core skill development, such as problem solving and critical thinking skills	Hasanein and Sobaih, (2023), Civil (2023), Warschauer et al., (2023), Dickey et al. (2023), Yu (2024), Hasanein & Sobaih (2023)

education, addressing these challenges is crucial, and students must develop autonomous learning skills to thrive in this evolving learning environment (Huang et al., 2021).

Academic dishonesty. The widespread use of AI writing tools like ChatGPT has raised concerns about student plagiarism in educational institutions (Grassini, 2023). ChatGPT's ability to generate high-quality text tempts students to use it as a shortcut, fostering academic dishonesty and undermining integrity (Grassini, 2023; Zeb et al., 2024). This can lead to plagiarism, copyright infringements, and compromised originality (Hasanein & Sobaih, 2023). Many teachers worry about ChatGPT's impact on plagiarism, with some universities taking strict measures, including declaring its use in assignments as academic misconduct (Chan, 2023).

Limiting social interactions. Overreliance on ChatGPT may diminish social interactions among students and faculty, impacting their learning journey (Hasanein & Sobaih, 2023). Excessive use of AI for learning can limit face-to-face interactions, hindering social skills development and emotional connections with tutors (Hemachandran et al., 2022; Huang et al., 2021). Machines lack non-verbal cues and emotional understanding, potentially leaving students without the support they need (Bhatnagar, 2020). This can lead to reduced engagement, learning outcomes, and emotional intelligence, ultimately affecting students' personal and professional lives (Dempere et al., 2023; Yasmin & Mazhar, 2023). Hemachandran et al. (2022) exemplify this by illustrating how a human tutor not only imparts knowledge but also nurtures ethics, critical thinking, and emotional well-being, aspects that AI systems may lack:

> A human tutor would explain the concept of bomb creation, but he would limit the scope of the explanation, also try to develop ethics and intelligence to discriminate between good and bad in the students, he will always try to help them with their negative feelings. We cannot expect the same from artificially intelligent systems because they lack emotions, and they would not even try to go further to help individuals, and with the virtual connection, there would be no limit to the information that an individual can access without knowing his intentions.

Sun and Hoelscher (2023) highlight ChatGPT's deficiency in offering personal insights derived from experiences or emotions.

Increasing digital divide. AI exacerbates inequality in education through the digital divide, creating gaps between students with and without access to technology (Lutz, 2019; Van Dijk, 2006). This issue is particularly significant in Africa, where internet affordability is a barrier (Okolo et al., 2023). AI-enhanced technologies can lead to disparities in learning outcomes and opportunities, creating an unfair advantage (Choi et al., 2023; Font de la Valle & Araya, 2023). The digital divide also affects digital skills acquisition and application, with AI requiring new skills like prompt skills, digital literacy, and ethical knowledge (Chiu, 2023; Dakakni & Safa, 2023).

Questionable quality. The integration of ChatGPT in education raises concerns about its precision and dependability, as it may produce inaccuracies and lack objectivity due to its training on raw data (Grassini, 2023). ChatGPT's responses can vary in quality, potentially impacting learning outcomes, and may produce incorrect or fabricated information (Hasanein & Sobaih, 2023). Many students are hesitant to use AI due to misinformation and inaccuracies, with limitations including biases, fabricated references, and limited access to up-to-date information (Malik et al., 2023; Sun & Hoelscher, 2023).

Unfair advantage. The misuse of ChatGPT can create an unjust academic environment, where students with access to AI tools unfairly outperform peers without access (Grassini, 2023; Zeb et al., 2024). This can lead to disparities in assessment, potentially distorting grades and academic acknowledgments, and devaluing the importance of diligence and personal effort (Grassini, 2023). Students leveraging ChatGPT may gain an inequitable edge, undermining the fairness and validity of academic evaluations.

Over-dependence on AI. The rise of Generative AI in education raises concerns about its impact on core skill development, such as problem-solving and critical thinking (Dickey et al., 2023;

Hasanein & Sobaih, 2023). Over-reliance on AI tools like ChatGPT may hinder students' independent cognitive and creative faculties, potentially leading to a "Junior-Year Wall" where students struggle in advanced courses (Dickey et al., 2023; Yu, 2024). This dependence could also result in a devaluation of knowledge acquisition, diminished classroom engagement, and a loss of critical thinking, writing, and problem-solving skills essential for lifelong learning (Civil, 2023; Hasanein & Sobaih, 2023; Warschauer et al., 2023).

3.3.2. AI challenges in assessment

Four themes were discovered under challenges in assessment were discovered. Table 5 captures the challenges in assessment.

Table 5
AI challenges in assessment

Challenges in assessment	*Supporting statements*	*Scholars*
Limitations of Automated Grading	The majority of automated grading and marking is currently limited to certain disciplines	Sun (2021), Chiu (2023)
Distinguishing Student Work from AI	Academic staff may find it challenging to differentiate between a student's original work and the chatbot's response	Zeb et al., (2024), Chiu (2023), Grassini (2023)
Gauging True Understanding	When students utilise AI tools, it can become complex for teachers to gauge the students' genuine grasp and competence	Grassini (2023)
Challenges in Data Interpretation	If a student provides an incorrect answer, a machine will register it as wrong. However, if a teacher poses the same question differently and the student answers correctly, the machine might miss this discrepancy.	Yasmin and Mazhar (2023)

The integration of AI in education raises concerns about accurately assessing student performance (Grassini, 2023). AI grading systems can provide quicker and more precise feedback, but their application is still limited to certain disciplines (Kumar & Boulanger, 2020). Educators may struggle to differentiate between student-created work and AI-generated responses, affecting the evaluation of students' true comprehension levels (Cotton et al., 2023). This can obscure learning gaps, making it challenging for teachers to provide tailored feedback and create necessary intervention strategies (Grassini, 2023). Furthermore, AI assessment tools may miss nuances in student understanding, such as when a student answers correctly when a question is posed differently (Yasmin & Mazhar, 2023). As a result, the educational process may become less efficient, compromising the fundamental goal of teaching and learning (Grassini, 2023).

3.3.3. AI challenges in teaching

The integration of ChatGPT into pedagogical frameworks has sparked a complex discussion about its impact on conventional educational methodologies (Yu, 2024). Concerns include the potential dilution of core knowledge and subversion of traditional teaching techniques (Yu, 2024). While AI can assist teachers in selecting subject matter and instructional strategies, inadequate evaluation techniques and limited trust in AI technology pose challenges (Chiu, 2023). AI can facilitate tasks such as uploading and distributing learning materials, but teachers' faith in its capabilities remains a concern (Chiu, 2023).

Lack of connection between AI technologies and their use in teaching. A review by Chiu et al. (2023) indicates that teachers may not have a sufficient understanding of the technologies to apply them effectively. Teachers are sometimes unable to interpret the information provided by learning

analytics, lack an understanding of the affordances of AI technologies for education, and are uncertain on the pedagogical implications of using AI for teaching students.

Insufficient knowledge of AI technologies among teachers. Chiu et al. (2023) claims that most teachers lack an understanding of how AI technologies work (e.g., the principles or algorithms for recommending resources), and they have therefore been teaching with a black box. Wang et al. (2020) make the point that teachers' lack of knowledge of the systems can lead to weak self-efficacy. There is a need to give more time and space to lecturers for development and change. So, that they don't consider the technology as a burden but as a tool for improvement (Bhatnagar, 2020).

3.3.4. Ethical challenges

The use of AI in education also raises ethical considerations, prompting interdisciplinary discussions on the responsible and ethical use of AI technologies (İpek et al., 2023). Ethical concerns include fairness, inclusivity, diversity, an absence of bias, reliability, accountability, transparency and clear liability, as well as clear privacy and data protection processes and security (Ernest, 2019). Table 6 shows the ethical challenges as discussed by various scholars.

Table 6
Ethical challenges

Ethical challenges	*Supporting statements*	*Scholars*
Potential bias	ChatGPT has the potential to generate responses that inadvertently reflect prejudices	Hasanein and Sobaih (2023), Dempere et al. (2023), University of Buckingham Interim Report (2021), Galindo-Domínguez et al. (2023)
Security	Underground hacking communities utilise Open AI to create malicious tools, potentially adopted by skilled threat actors	Dempere et al. (2023), Krishna (2024), Dakakni and Safa (2023), Bushwick and Mukerjee (2022), Bates et al. (2020), Keller et al. (2019)
Workforce Displacement	AI is integrated into education, roles like lecturers, teaching assistants, and administrative staff may become obsolete	Yasmin and Mazhar (2023), Zawacki-Richter et al. (2019)
Cultural values	AI also poses risks, such as accountability issues, data bias, transparency concerns, and socio-economic risks, which can impact African societies	Dugbazah et al. (2021), Ade-Ibijola and Okonkwo (2023), Ruane et al. (2019), Ade-Ibijola and Okonkwo (2023)

Potential bias. ChatGPT's reliance on potentially biased training data can lead to prejudiced or imbalanced responses (Hasanein & Sobaih, 2023). This may perpetuate systemic bias and discrimination, unfairly treating marginalised groups and amplifying forms of prejudice (Dempere et al., 2023). Algorithmic bias can result in discriminatory measures against students from underprivileged communities or ethnic minorities (University of Buckingham Interim Report, 2021). Additionally, cultural and privacy issues can contribute to biases in data generation, posing further challenges (Galindo-Domínguez et al., 2023).

Security. AI poses significant threats to public safety, security, and quality of life. AI chatbots can facilitate disinformation, cyberattacks, and malicious activities (Dempere et al., 2023). Sophisticated cyberattacks can be automated, and deepfakes can impersonate individuals (Krishna, 2024). In education, AI integration raises concerns about data privacy, security breaches, and unauthorised access to sensitive student information (Grassini, 2023; Luan et al., 2020). Students worry about data accumulation, tracking, and potential misuse (Dakakni & Safa, 2023). The risks associated with AI chatbots, including misinformation and impersonation, highlight the

need for regulation (Bates et al., 2020; Bushwick & Mukerjee, 2022). Additionally, AI's use of extensive data carries risks of discrimination and unfair predictions (Keller et al., 2019).

Workforce displacement. The development of AI-based tools like ChatGPT sparks fear of job loss among educators (Bhatnagar, 2020). Roles like lecturers and administrative staff may become obsolete (Yasmin & Mazhar, 2023). However, AI can also automate routine tasks, freeing staff to focus on complex problems and student connections (Bhatnagar, 2020; Klutka et al., 2018). Budget cuts may tempt administrators to replace teaching with automated tools, with cost-cutting being a primary motivation behind AI implementations (Bates et al., 2020). This could lead to job losses or transferring work to machines (Grassini, 2023). The role of instructors needs to shift away from tasks like content presentation and testing, which can be handled by computing (Bates et al., 2020). However, AI cannot replace tasks requiring creativity, such as developing new courses or innovative teaching methods, or interpersonal interactions like counselling, personalised feedback, and issue resolution (Dempere et al., 2023). These tasks require human expertise and empathy.

Cultural values. AI raises ethical concerns, including personalised advice, data privacy, and algorithmic responsibility (Huang et al., 2021). In Africa, ethics can promote cultural values and build confidence in technology development (Ade-Ibijola & Okonkwo, 2023; Dugbazah et al., 2021). However, AI also poses risks, such as accountability issues, data bias, transparency concerns, and socio-economic risks, which can impact African societies (Ade-Ibijola & Okonkwo, 2023; Ruane et al., 2019).

3.3.5. Legislative and infrastructural challenges

Absence of government policies. African countries are behind in developing policies for AI implementation, unlike developed countries like Australia and China (Ade-Ibijola & Okonkwo, 2023). Africa is the worst-performing region in the 2019 Government AI Readiness Index, with only a few countries, such as Kenya, Tunisia, Mauritius, South Africa, and Ghana, ranking in the top 100 (Rutenberg, 2019). However, eight African countries, including Ghana, Kenya, Nigeria, Sierra Leone, South Africa, Uganda, Zambia, and Zimbabwe, are making strides towards regulating AI, according to the Index of Regulation of Artificial Intelligence (Okolo et al., 2023). The lack of AI legislation is largely due to policymakers' limited expertise in technology and AI (Okolo et al., 2023).

Insufficient infrastructure and network connectivity. Africa's AI adoption faces infrastructure barriers, including inadequate network access and limited internet penetration (Ade-Ibijola & Okonkwo, 2023). Electricity and internet infrastructure challenges hinder connectivity, with a large portion of the population remaining unconnected (Okolo et al., 2023). Reliable wireless network connectivity is crucial for AI adoption (Ade-Ibijola & Okonkwo, 2023). Substantial initial investment is required for AI implementation, including hardware, software, and maintenance (Yasmin & Mazhar, 2023). According to Owoc et al. (2021), AI technology demands significant hardware capacity and software capabilities. The education sector lacks basic technology and infrastructure, essential for AI-enhanced learning (Huang et al., 2021).

Lack of structured data. Another challenge for AI adoption in Africa is the lack of accessible and relevant data for African researchers, particularly in domains like agriculture, healthcare, and voice/text recognition (Okolo et al., 2023). Effective data governance requires regulations that ensure data accessibility, availability, completeness, accuracy, integrity, consistency, auditability, and security (Owoc et al., 2021). AI initiatives rely on high-quality and diverse data to provide accurate responses, and a lack of structured data ecosystems can lead to system failures (Ade-Ibijola & Okonkwo, 2023). Moreover, AI algorithms developed in Western countries may not be directly applicable to African contexts due to differences in demographics and conditions (Yu, 2020).

3.4. User-related Challenges

Three challenges related to users were uncovered through the systematic review as shown in Table 7.

Table 7
User-related challenges

Challenges in assessment	*Supporting statements*	*Authors*
User Attitudes	Africans are very sceptical in adopting and using new technology due to culture	Ade-Ibijola and Okonkwo (2023), Okonkwo et al. (2019), Chatterjee and Bhattacharjee (2020), Wang (2008)
Digital Skills and Literacy	Digital skills literacy is a significant barrier to the adoption of AI	Okolo et al. (2023), Dempere et al. (2023), Bianco (2021), Okolo et al. (2023)
Lack of Local AI Talent	AI system comes with significant costs and requires skilled personnel for successful implementation	Yasmin and Mazhar (2023), Ade-Ibijola and Okonkwo (2023), Keller et al. (2019), Ajadi (2020)

3.4.1. User attitudes

Ade-Ibijola and Okonkwo (2023) highlight the challenge of users' attitudes towards AI adoption in Africa, citing cultural and social influences that make Africans sceptical of new technology. Attitudes are a key predictor of adoption, with favourable, negative, or apprehensive views impacting usage (Okonkwo et al., 2019; Wang et al., 2008). Individuals' behavioural intentions to use AI in higher education are also influenced by their attitudes (Chatterjee & Bhattacharjee, 2020).

3.4.2. Digital skills and literacy

Digital skills literacy is a significant barrier to the adoption and implementation of AI in Africa (Bianco, 2021; Dempere et al., 2023; Okolo et al., 2023). Out of all world regions, sub-Saharan Africa has the lowest percentage of citizens equipped with digital skills, equalling about half of the average level of digital skills adoption seen globally (Okolo, et al., 2023).

3.4.3. Lack of AI talent

Africa's tech ecosystem is growing, but there's a notable gap in AI development, partly due to the high costs and need for skilled personnel (Yasmin & Mazhar, 2023). External entities like Google and Microsoft are driving AI research laboratories in Africa, supporting local start-ups (Okolo et al., 2023). However, acquiring AI expertise is challenging, leading to a shortage of skilled workers, particularly in emerging markets like Africa (Ade-Ibijola & Okonkwo, 2023). Proficiency in programming is essential for AI advancement, and upskilling employees is crucial to adapt to the evolving landscape (Keller et al., 2019).

4. Discussion

The integration of AI in higher education improves effectiveness, efficiency, and quality of work (Bates et al., 2020). AI can alleviate lecturer workloads by automating routine tasks like grading and assessment, freeing up time for research and innovation (Aldosari, 2020). This is particularly beneficial in African countries with large class sizes (100-200 students) and staff shortages. Rather than replacing teachers, AI can complement the strained labour force, enhancing productivity and efficiency. By automating routine work, AI can help lecturers focus on other responsibilities. As Bates et al. (2020) note, while cost-cutting is a primary motivation for AI implementation in some contexts, in developing countries with existing staff shortages, AI can support educators in managing their workload. AI tools can assist educators in lessening their current workload and transferring a significant portion of workload to machines.

AI technology can help bridge educational inequities in developing countries by providing remote personalised teaching, especially in areas lacking qualified teachers (Hao, 2019; Huang et al., 2021). This can enable students in remote areas to access high-quality teachers and resources,

promoting a more equitable educational experience. One teacher can conduct remote online teaching for students in multiple areas, facilitating resource sharing and interactions with outstanding teachers (Huang et al., 2021). However, investing in technological infrastructure, internet, and power availability is crucial to realising this potential (Ade-Ibijola & Okonkwo, 2023). Without addressing these infrastructure gaps, AI may perpetuate the digital divide and create unfair advantages for those with access to technology, particularly in areas with geographical problems and underdevelopment. Governments need to invest heavily in infrastructure to ensure equal access and opportunities for all, levelling the playing field for students in previously neglected and underserved areas.

AI holds promise in addressing ethno-linguistic challenges in higher education. Africa is home to a rich tapestry of ethnolinguistic groups. The differences in ethical origins in Africa have various impacts on different aspects of life including communication, education, social dynamic and business. Language barriers can cause discrimination especially for ethnic minority groups. AI stands as a beacon for multilingualism and linguistic inclusivity, as it dismantles language barriers and fosters a multilingual ethos in educational spaces (Malik et al., 2023). AI powered natural language translation systems have the potential to facilitate communication and understanding across different ethnic and linguistic groups. AI driven solutions for language interpretation can better serve diverse ethnic communities ultimately improving access to education. This can create a more inclusive learning environment and ensure that all students have equal access to educational resources and opportunities.

Developing countries in Africa and other regions suffer from lack of state of the art equipment to conduct experiments and other practical work necessary for an education experience that is complete. AI powered simulation and other related technologies can provide the students with the practical exposure and experiential learning, which improves the quality of learning (Chen et al., 2020). Virtual reality classrooms provide skills that can be learned in the absence of real life experiences in an affordable way. For example, learning how to fly an aeroplane cannot only be obtained from books and teachers. AI, through its virtual environment, provides the required situations and the experience of how it works.

In higher education institutions, the student body is composed of individuals from diverse backgrounds. This diversity can present challenges for educators as they strive to bring out the best in each student. Pasipamire (2024) makes the point that to teach students with wide-ranging abilities in a way that accommodates their different education backgrounds is a challenge. The "one-size-fits-all" approach often used in higher education can leave many disadvantaged students behind, especially in developing countries where the digital divide remains significant. The AI systems could adapt the instructional approach to accommodate each student's unique learning style and progress (Grassini, 2023). Students can receive personalised guidance tailored to their unique writing style, allowing them to pinpoint and focus on specific areas requiring improvement (Hasanein & Sobaih, 2023). AI promotes self-directed learning, allowing students to explore subjects at their own pace and style (Hasanein & Sobaih, 2023), and students can customise the tutors according to their needs of pace, time, and space (Hemachandran et al., 2022).

The integration of AI in higher education in developing countries has potential benefits, but several challenges need to be addressed. Firstly, limited availability of relevant data hinders AI effectiveness (Okolo et al., 2023). Moreover, security threats and privacy concerns also pose significant barriers, with students worried about data collection and breaches of privacy (Dakakni & Safa, 2023; Grassini, 2023). Additionally, cultural and social influences make Africans skeptical about adopting new technology due to concerns over privacy and secrecy in cultural practices (Ade-Ibijola & Okonkwo, 2023). Furthermore, developing countries need to address the skills gap in IT, as AI system establishment requires significant costs and skilled personnel (Yasmin & Mazhar, 2023). Nevertheless, despite these challenges, AI can bridge educational inequities by providing remote personalised teaching (Hao, 2019; Huang et al., 2021). Therefore, addressing these challenges is crucial to harnessing AI's potential and creating a more equitable and efficient higher education system.

5. Conclusion and Recommendations

The integration of AI into higher education, particularly in developing countries, offers transformative potential but requires strategic and inclusive action to fully realize its benefits. A key recommendation is to embed AI into higher education curricula to equip students with relevant skills that align with the demands of the future workforce. By gaining foundational knowledge and competencies in AI, students will be better prepared for evolving job markets where such skills are increasingly essential.

However, developing the AI ecosystem should not be the sole responsibility of educational institutions. Governments in developing countries must also play a vital role by investing in infrastructure and improving network connectivity, especially in rural and underserved regions. This investment is critical to ensure equitable access to AI technologies and the benefits they bring, regardless of geographical location.

In addition to infrastructure, there is a pressing need for widespread training on the use of AI in academic environments. This training should be made available to students, educators, and IT professionals alike, covering both practical applications and ethical considerations. Addressing issues such as academic dishonesty and digital literacy within the local context—particularly in Africa—is essential to overcoming resistance and ensuring culturally sensitive implementation. Furthermore, the establishment of clear national and institutional policies is necessary to guide the use of AI in higher education. These policies should emphasize the protection of personal data and privacy, preventing misuse and commercial exploitation of sensitive information. Robust governance frameworks can help create a safe and trusted environment for AI deployment. Another crucial aspect is the ongoing professional development of educators. Lecturers and academic staff should receive regular training on emerging AI tools and innovative teaching methodologies. By staying up to date with technological advances, they will be able to enhance their teaching, support student learning, and model responsible AI usage. Lastly, higher education institutions must also take proactive steps to safeguard academic integrity in the age of AI. Investing in fraud detection systems such as plagiarism checkers is essential. At the same time, universities should develop clear and relevant policies, foster collaborative relationships with institutions already experienced in AI integration, and build supportive networks that facilitate knowledge sharing and mutual growth. Collectively, these measures will help developing countries overcome existing challenges and harness the full potential of AI in transforming higher education.

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