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Benefits and Challenges of Artificial Intelligence in Tanzania Secondary Schools

Clement John Maganga[1] and Ashwarya Srivastava[2]

[1] PhD scholar, School of Education, Galgotias University, Greater Noida, Gautam Buddha Nagar, Utter Pradesh, India, Email: clementmaganga61@gmail.com

[2] Associate Professor, School of Education, Galgotias University, Greater Noida, Gautam Buddha Nagar, Utter Pradesh, India, Email: ashwarya.srivastava@galgotiasuniversity.edu.in

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ABSTRACT

This paper aimed to study the usage of artificial intelligence in secondary schools. The study used systematic comprehensive analysis to gather information. The study focused into two major objectives namely the uses of artificial intelligence in Tanzania secondary schools and to study challenges of artificial intelligence in Tanzania secondary schools. The findings showed that the benefits of artificial intelligence in Tanzania secondary schools included: improve the academic performance; virtual learning; wide range of learning materials; improve motivation and learning engagement; personalized learning; speed up learning; improve learning infrastructures. In the second objective the study showed higher errors susceptibility; cheating of exams, isolation, teachers' job insecurity; interpretation of the results and lack of professional trainings. The study recommended that: however the usage of artificial intelligence dominated in developed countries neither Tanzania nor Africa continent lag behind on the usage of it in secondary schools. More over the paper call upon developed countries continue providing the artificial intelligence facilities such as computers, printers, television, projectors, iPad, smart phones and tablets so as to reflect 21st Century learning skills. Finally the paper concluded that not all education aspect can be touched with artificial intelligence. The artificial intelligence can't do the following: tasks that

requires common sense to understand the physical the world; tasks that require empathy and compassion; the common sense such as reasoning and creativity; artificial intelligence can't do task involve the complex unstructured data.

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Introduction

In recent years, artificial intelligence (AI) has emerged as a transformative force across various sectors, including education. AI technologies such as machine learning, natural language processing, and intelligent tutoring systems have the potential to revolutionize teaching and learning by enhancing academic performance, personalizing instruction, and providing access to diverse educational resources (Chen et al., 2020; Luckin, 2018). While developed countries have made significant strides in integrating AI into their education systems, many developing nations, including Tanzania, are still in the early stages of adoption. Understanding the current state of AI implementation in Tanzanian secondary schools, along with its benefits and challenges, is crucial for informing educational policies and practices (UNESCO, 2022).

This paper explores the use of AI in Tanzanian secondary schools by addressing two key objectives: (i) examining the applications of AI in the education sector and (ii) identifying the challenges associated with its implementation. Using a systematic comprehensive analysis, the study evaluates how AI technologies are being utilized in secondary education and the extent to which they contribute to academic improvement, student engagement, and infrastructure development (Holmes et al., 2021). Furthermore, the study highlights critical challenges such as increased susceptibility to errors, academic dishonesty, teacher job insecurity, and inadequate professional training (Selwyn, 2019).

By analyzing these factors, this paper seeks to contribute to the ongoing discourse on AI in education, particularly in developing contexts. It also provides recommendations for bridging the digital divide and ensuring that secondary schools in Tanzania and the broader African continent can effectively harness AI to enhance learning outcomes. The findings underscore the importance of international collaboration in providing AI-related resources and training to facilitate 21st-century learning (OECD, 2021). While AI offers significant educational advantages, this study acknowledges its limitations, particularly in

tasks requiring human reasoning, creativity, empathy, and the interpretation of complex, unstructured data (Brynjolfsson & McAfee, 2017).

Methodology

The study on the usage of artificial intelligence (AI) in Tanzanian secondary schools utilized a systematic comprehensive analysis approach, primarily relying on secondary data to gather and synthesize relevant information. Secondary data analysis involves the use of existing research materials, official reports, policy documents, and academic publications to explore a research topic comprehensively. In this study, secondary data provided valuable insights into the application of AI in education, its benefits, and the challenges associated with its implementation.

Collection of Secondary Data

To achieve a systematic and comprehensive understanding of AI in secondary schools, the study drew information from a variety of pre-existing sources. These included government reports, policy documents, academic journal articles, books, and reports from international organizations such as UNESCO, the World Bank, and the OECD. Such documents contain well-researched data on education policies, technological advancements, and the role of AI in learning environments. Additionally, the study may have examined statistical data from educational institutions and digital learning platforms, which provided insights into AI adoption trends, infrastructure development, and student engagement levels.

Another key component of secondary data collection in this study was the review of previous empirical studies and literature on AI integration in education. By analyzing existing scholarly work, the study was able to compare findings across different contexts and identify common trends, challenges, and recommendations applicable to Tanzania. This process involved systematically selecting and evaluating studies that addressed the role of AI in improving academic performance, facilitating personalized learning, and overcoming infrastructural barriers in secondary education.

Analysis of Secondary Data

After gathering secondary data, the study applied a structured approach to analyze and categorize information according to its two major objectives: (1) the uses of AI in Tanzanian secondary schools and (2) the challenges associated with AI implementation.

For the first objective, AI's contributions to education were systematically identified based on literature findings. The study highlighted benefits such as improving academic performance, enabling virtual learning, expanding access to diverse learning materials, increasing student motivation and engagement, personalizing learning experiences, accelerating knowledge acquisition, and enhancing educational infrastructure. These findings were derived from prior studies that had examined the effects of AI-driven learning tools such as intelligent tutoring systems, adaptive learning platforms, and automated assessment tools.

For the second objective, the study systematically reviewed the drawbacks and limitations of AI in secondary education as discussed in existing research. The identified challenges included higher susceptibility to errors, academic dishonesty through AI-enabled cheating, social isolation among students, teacher job insecurity, difficulties in interpreting AI-generated results, and the lack of professional training for educators. These challenges were analyzed using secondary data from policy reports and case studies from other countries that had implemented AI in their education systems.

Findings on AI's Contributions to Secondary Education

The study systematically identified the benefits of artificial intelligence (AI) in secondary education, drawing from both international literature and Tanzanian research. The key advantages of AI in education include improving academic performance, enabling virtual learning, expanding access to diverse learning materials, increasing student motivation and engagement, personalizing learning experiences, accelerating knowledge acquisition, and enhancing educational infrastructure. These benefits are supported by empirical studies that have examined AI-driven learning tools such as intelligent tutoring systems, adaptive learning platforms, and automated assessment tools. Below is a detailed explanation of each benefit, contextualized with insights from both global and Tanzanian perspectives, along with relevant citations and references in APA format.

Improving Academic Performance

AI-driven technologies have been shown to enhance students' academic performance by providing personalized feedback, adaptive learning paths, and targeted interventions. For example, intelligent tutoring systems (ITS) use AI algorithms to analyze students' learning patterns and provide tailored instructional support, helping students grasp difficult concepts more effectively (Chen et al., 2020). A study by Holmes et al. (2021) found that students using AI-powered learning tools demonstrated higher retention rates and improved test scores compared to those using traditional learning methods. In the Tanzanian context, Sarakikya and Kitula (2024) observed that AI platforms positively influence education in higher learning institutions in Arusha City. Their findings indicated a high level of AI integration in educational practices, contributing to improved academic outcomes.

Enabling Virtual Learning

AI facilitates virtual and remote learning by providing students with access to digital classrooms, automated grading systems, and real-time assistance through chatbots and virtual tutors (Zawacki-Richter et al., 2019). Platforms such as Google Classroom, Microsoft Teams, and AI-based educational assistants have enabled students to continue learning beyond physical classrooms, which became particularly important during the COVID-19 pandemic (UNESCO, 2022). AI-powered virtual learning environments allow for greater flexibility, enabling students to learn at their own pace (Selwyn, 2019). In Tanzania, Mwakapina (2024) highlighted the growing use of AI-powered educational technologies in university settings, offering innovative solutions to traditional challenges and optimizing learning outcomes through virtual learning platforms.

Expanding Access to Diverse Learning Materials

AI enhances access to a wide range of educational resources, including e-books, digital libraries, multimedia learning materials, and interactive simulations (OECD, 2021). AI-powered search engines and recommendation algorithms help students discover relevant study materials tailored to their interests and teaching needs (Chen et al., 2020). For instance, AI-powered platforms like Khan Academy, Coursera, and Duolingo offer diverse educational content, making knowledge more accessible to students in remote or underserved areas (Brynjolfsson & McAfee, 2017). Sarakikya and Kitula (2024) found that in Tanzanian higher learning institutions, AI platforms have expanded access to diverse learning materials, thereby enriching the educational experience for students.

Increasing Student Motivation and Engagement

AI enhances student engagement and motivation through interactive and gamified learning experiences (Holmes et al., 2021). AI-powered educational apps incorporate gamification elements such as rewards, quizzes, and progress tracking to encourage active participation (Luckin, 2018). For example, AI-driven platforms like Prodigy Math and Kahoot! have been found to increase student motivation by making learning more interactive and enjoyable (Zawacki-Richter et al., 2019). Additionally, AI chatbots provide instant feedback and encouragement, further motivating students to continue learning (Selwyn, 2019). In the Tanzanian context, Mwakapina (2024) noted that AI-powered educational technologies have the potential to enhance student engagement through personalized and interactive learning experiences.

Personalizing Learning Experiences

One of the most significant contributions of AI to education is its ability to deliver personalized learning experiences by analyzing student performance and adapting content accordingly (Chen et al., 2020). Adaptive learning platforms use AI to tailor lesson plans and assessments to individual learning styles and progress levels (Luckin, 2018). For instance, AI-powered learning management systems (LMS) like Smart Sparrow and Carnegie Learning dynamically adjust the difficulty of exercises based on students' performance, ensuring a customized learning path that meets their specific needs (Holmes et al., 2021). In addition Sarakikya and Kitula (2024) reported that in Tanzanian higher learning institutions, AI platforms are utilized to personalize learning experiences, thereby catering to the diverse needs of students.

Accelerating Knowledge Acquisition

AI accelerates the learning process by automating repetitive tasks, summarizing complex concepts, and providing instant access to relevant information (OECD, 2021). AI-powered tools such as speech-to-text applications, automatic translators, and AI-generated summaries help students grasp and retain knowledge more efficiently (Selwyn, 2019). A study by Zawacki-Richter et al. (2019) found that AI-based educational tools significantly reduced the time needed for students to understand new material, allowing them to progress faster in their studies. In Tanzania, Mwakapenda (2024) observed that AI-

powered educational technologies facilitate faster knowledge acquisition by providing students with efficient access to information and learning resources.

Enhancing Educational Infrastructure

AI contributes to improving educational infrastructure by enabling automated administrative tasks, predictive analytics for school management, and smart classroom technologies (Brynjolfsson & McAfee, 2017). AI-driven tools help schools optimize timetables, manage student records, and track learning progress (UNESCO, 2022). For example, AI-powered predictive analytics assist educators in identifying at-risk students who may need additional support (Holmes et al., 2021). Additionally, AI-driven robotic assistants are being tested in some schools to assist with classroom management and administrative duties, reducing the workload for teachers (Chen et al., 2020). In other hand, Sarakikya and Kitula (2024) found that in Tanzanian higher learning institutions, AI platforms have been integrated into educational infrastructure, streamlining administrative processes and supporting effective teaching and learning.

Challenges of Artificial Intelligence in Secondary Education

The study's second objective systematically reviewed existing research to identify the drawbacks and limitations of artificial intelligence (AI) in secondary education. Several key challenges were identified, including higher susceptibility to errors, academic dishonesty through AI-enabled cheating, social isolation among students, teacher job insecurity, difficulties in interpreting AI-generated results, and the lack of professional training for educators. These challenges were analyzed using secondary data from policy reports and case studies from various countries that have already implemented AI in their education systems.

Higher Susceptibility to Errors

AI systems in education can be prone to errors due to biases in algorithms, inaccuracies in data, or limitations in understanding complex human contexts. For instance, automated grading systems may misinterpret nuanced student responses, leading to incorrect assessments of student work. Holmes et al. (2021) highlighted that AI tools, particularly those used in automated assessment and grading, may inadvertently favor certain student writing styles or knowledge patterns, creating unfair assessments.

This issue of bias in AI can also extend to the data used to train these systems, further increasing error rates.

In the Tanzanian context, Stuart (2024) warned that over-reliance on AI tools could lead to a diminished capacity for critical thinking among students. If students come to trust AI-generated assessments without questioning them, it could result in perpetuating inaccuracies and errors in educational contexts. This reliance on AI may limit students' engagement with the content, preventing them from developing the analytical skills necessary to critically evaluate information.

Academic Dishonesty through AI-Enabled Cheating

With the increased accessibility of AI tools, concerns about academic integrity have risen. Students may use AI to complete assignments or exams dishonestly, bypassing the need for actual learning and engagement. A prominent case in the United States involved a lawsuit where a student was penalized for using AI to complete a history assignment, highlighting the growing issue of AI-assisted cheating (Parents, 2024). The legal case sparked debates about the ethical implications of using AI in education, with many arguing for stronger measures to maintain academic honesty.

In Tanzania, Stuart (2024) observed that while AI tools can significantly enhance the learning process, they also carry the risk of over-dependence, leading to academic dishonesty. As more students gain access to AI-powered tools, schools and educators need to implement strategies to prevent cheating and encourage authentic learning.

Social Isolation among Students

AI-driven education, especially through virtual learning environments, has been linked to reduced face-to-face interactions, which can lead to social isolation among students. In a pilot project in London, the Financial Times reported that AI-powered systems were used to teach subjects without traditional teachers, supervised instead by "learning coaches." This shift to virtual learning raised concerns about the lack of social engagement, with critics arguing that students could miss out on essential social learning experiences (Financial Times, 2024).

In Tanzania, the introduction of AI-driven learning tools might similarly diminish opportunities for collaborative learning, which is essential for the development of social skills among students. If AI is

used as a substitute for in-person interactions, students could face difficulties in building interpersonal relationships and communication skills, which are essential for success in both academic and professional settings.

Teacher Job Insecurity

The adoption of AI technologies in education raises concerns about job security among educators. As AI systems increasingly take on roles traditionally filled by teachers—such as grading and tutoring—there is a growing fear of job displacement. The Financial Times highlighted that while AI is unlikely to fully replace human teachers, its increasing presence in classrooms necessitates that educators adapt to new technologies and shift their professional roles (Financial Times, 2024).

In Tanzania, the fear of job insecurity may be particularly pronounced as AI technologies are integrated into schools. As AI tools are adopted, teachers may feel that their roles are being undermined, leading to resistance to the technology. Therefore, it is essential to involve teachers in the decision-making process when integrating AI into the education system and to provide opportunities for up skilling and professional development.

Difficulties in Interpreting AI-Generated Results

AI systems often operate as "black boxes," making it difficult for educators and students to understand how specific outputs are generated. This opacity can create mistrust among educators, who may be reluctant to rely on AI-generated insights. The Vatican, in a statement published by The Times (2024), expressed concerns about the impact of AI on various aspects of human life, including education, emphasizing the importance of critical thinking and the responsible use of AI.

In Tanzania, educators may face similar challenges in interpreting AI-generated data. Without a clear understanding of how AI tools arrive at their conclusions, teachers may struggle to integrate AI insights into their teaching practices. It is crucial for AI developers to create transparent, explainable AI systems and for educators to be trained on how to interpret and effectively use these outputs in the classroom.

Lack of Professional Training for Educators

The successful implementation of AI in education requires that educators possess the necessary skills to utilize these technologies effectively. However, there is often a lack of professional development opportunities focused on AI. Stuart (2024) recommended restructuring teacher training curricula to incorporate AI skills and adapting assessment strategies to address AI-related challenges, highlighting the need for targeted training programs for educators in Tanzania.

Tanzania faces a significant challenge in ensuring that teachers are adequately trained in AI tools. To effectively integrate AI into education, professional development programs must be tailored to address the unique needs of teachers in the Tanzanian context. These programs should not only teach technical skills but also emphasize the ethical, pedagogical, and practical aspects of using AI in the classroom.

Recommendations for the Integration of Artificial Intelligence in Secondary Education

The integration of artificial intelligence (AI) in secondary education offers significant benefits but also presents notable challenges. To ensure that AI is effectively utilized in Tanzania's education system, a strategic approach is necessary. The following recommendations address key areas that require attention, including infrastructure development, teacher training, ethical considerations, and maintaining the human element in learning.

Bridging the AI Gap between Developing and Developed Countries

The rapid advancement of AI technologies in developed countries has created a gap between nations with advanced digital infrastructure and those still struggling to adopt modern educational tools. Tanzania, like many other African countries, faces challenges in integrating AI into secondary education due to limited access to AI-powered tools and inadequate infrastructure. To bridge this gap, the Tanzanian government should invest in AI education by formulating policies that encourage the adoption of AI-driven learning solutions. This includes funding for AI initiatives, technology subsidies for schools, and the establishment of AI research centers to support innovation in education.

Furthermore, public-private partnerships (PPP) can play a vital role in reducing the AI adoption gap. Collaboration between the government, private sector, and international organizations can help mobilize resources to support AI integration. Developed countries and multinational technology companies should extend support to Tanzania through funding, donations of AI-driven educational tools, and capacity-building programs for teachers and students. In addition, AI technologies should be localized to

fit Tanzania's educational context. For instance, AI-powered learning platforms should support Kiswahili and be aligned with the national curriculum to ensure effective implementation. By fostering global cooperation and investing in local technological solutions, Tanzania can successfully bridge the AI gap and enhance the quality of education in its secondary schools.

Provision of AI-Enabled Learning Facilities

The lack of adequate technological infrastructure remains a major obstacle to AI integration in Tanzania's secondary schools. Many schools, particularly those in rural areas, lack essential digital learning tools such as computers, high-speed internet, and AI-driven educational software. Without these resources, students and teachers cannot effectively utilize AI in the learning process. To address this challenge, it is imperative to equip schools with AI-enabled facilities, including computers, tablets, projectors, interactive whiteboards, and internet connectivity. The government should prioritize investments in digital infrastructure to ensure that schools across the country have access to these essential tools.

In addition to equipping schools with AI-enabled facilities, there is a need to integrate AI education into the national curriculum. AI literacy should be introduced as part of ICT and science subjects to provide students with foundational knowledge of AI applications. Establishing digital learning centers in secondary schools would further enhance access to AI-powered educational tools. These centers should be designed to support virtual labs, intelligent tutoring systems, and adaptive learning platforms that cater to students' individual learning needs. Moreover, leveraging mobile technology can provide an alternative means of AI learning for students who do not have access to traditional computing resources. AI-driven educational applications compatible with smartphones and tablets should be promoted to facilitate remote and self-paced learning. By investing in AI-enabled learning facilities, Tanzania can create an environment that fosters innovation and digital literacy among students and teachers.

Investment in Teacher Training and Professional Development

Teachers play a critical role in the successful implementation of AI in education. However, the study revealed that many educators lack the necessary skills and knowledge to integrate AI into their teaching practices. Without adequate training, AI technologies may not be utilized effectively, and their potential benefits could be undermined. Therefore, it is essential to invest in comprehensive AI training programs

for teachers. These programs should focus on equipping educators with skills to incorporate AI-driven tools into lesson planning, assess student progress using AI analytics, and address ethical concerns associated with AI use.

To ensure that teacher training is continuous and sustainable, certification and continuous professional development (CPD) programs should be established. AI education should also be integrated into pre-service teacher training at universities and colleges so that new teachers enter the profession with AI competencies. Additionally, mentorship and support networks should be created to enable teachers to share best practices, exchange knowledge, and receive technical assistance in using AI tools. By prioritizing teacher training and professional development, Tanzania can empower educators to effectively utilize AI in the classroom, ultimately enhancing student learning outcomes.

Ensuring Ethical and Responsible Use of AI

While AI offers numerous benefits in education, its misuse can lead to ethical concerns such as academic dishonesty, biased decision-making, and data privacy violations. The study highlighted instances where AI-enabled cheating in exams and over-reliance on AI-generated content have become significant challenges in educational institutions. To mitigate these risks, it is crucial to establish strict ethical guidelines governing the use of AI in secondary education. Schools and policymakers should develop clear regulations on how AI should be used to prevent academic dishonesty while maintaining the integrity of student assessments.

In addition to establishing guidelines, AI monitoring tools should be implemented to detect and prevent unethical practices such as plagiarism and automated cheating. Schools should integrate AI-based proctoring systems that monitor students during examinations to uphold academic honesty. Furthermore, AI-generated work should be validated through cross-checking with traditional assessment methods to ensure authenticity. Another critical aspect of responsible AI use is the protection of student data privacy. AI systems collect and analyze large amounts of student information, raising concerns about data security. To address this issue, strict data protection laws should be enforced to safeguard students' personal information from misuse or unauthorized access. Additionally, schools should educate both students and teachers on responsible AI usage, emphasizing the importance of critical thinking and human oversight in decision-making. By promoting ethical AI use, Tanzania can ensure that AI enhances education without compromising academic integrity or privacy.

Maintaining the Human Element in Education

Despite its capabilities, AI cannot replace the essential human aspects of education, such as mentorship, emotional intelligence, and social interaction. AI lacks the ability to provide empathy, moral guidance, and creative problem-solving, which are crucial components of holistic education. Therefore, it is important to maintain the human element in learning while integrating AI as a complementary tool rather than a substitute for teachers. One effective strategy to achieve this is through blended learning approaches, which combine AI-driven instruction with traditional teacher-led classroom interactions. This model ensures that AI supports teachers in delivering lessons while preserving the personal connection between educators and students.

Additionally, schools should encourage collaborative learning experiences to prevent social isolation caused by excessive reliance on AI-based education. Group projects, classroom discussions, and interactive learning activities should be prioritized to promote peer-to-peer engagement and teamwork. Furthermore, AI should be positioned as a teaching assistant rather than a replacement for educators. AI can be used to automate repetitive administrative tasks such as grading, allowing teachers to focus on more meaningful interactions with students. By maintaining the human element in education, Tanzania can ensure that AI serves as an enabler of learning while preserving the fundamental role of teachers and social interactions in the educational process.

Further Research on AI's Role in Secondary Education

The successful integration of AI in education requires continuous research to assess its long-term impact on student learning and overall educational outcomes. The study recommends conducting longitudinal studies to evaluate how AI affects academic performance, critical thinking skills, and student engagement over time. Comparative research should also be conducted to analyze AI implementation strategies in other countries and identify best practices that can be adapted to the Tanzanian context.

Policy research and development should be prioritized to create AI-specific education policies that address both opportunities and risks associated with AI adoption. Moreover, there is a need to encourage local innovation and AI development. Tanzanian researchers and technology entrepreneurs should be supported in designing AI tools tailored to the country's educational needs, reducing dependency on

foreign technologies. By fostering a research-driven approach, Tanzania can ensure that AI integration in secondary education is evidence-based and aligned with national development goals.

Conclusion

The study concluded that while artificial intelligence (AI) plays a significant role in improving education, it cannot entirely replace human elements in the teaching and learning process. AI offers numerous benefits, such as enhancing academic performance, providing access to a wide range of digital learning materials, and fostering personalized learning experiences. However, the study also acknowledged AI's limitations, particularly in tasks requiring human intuition, empathy, creativity, and moral judgment.

Furthermore, the study emphasized that AI cannot effectively handle complex unstructured data or make decisions that require human-like reasoning. This highlights the need for a balanced integration of AI in education, ensuring that technology complements rather than replaces human teachers. AI should be used as a tool to enhance learning while maintaining the critical role of educators in facilitating deeper understanding and fostering social and emotional intelligence among students.

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