The Role of Artificial Intelligence In Addressing Global Education Inequality

Ejuchegahi Anthony Angwaomaodoko

Corresponding Author:
ejuchegahi.angwaomaodoko@gmail.com

Abstract. Artificial intelligence (AI) is among the most significant technologies around the globe today and is already in operation daily. It is capable of making learning and teaching more innovative and efficient. This paper discusses the role of Artificial Intelligence in addressing global educational inequalities. It noted personalising learning as one of how artificial intelligence can resolve the issue of global inequity. It emphasised that providing data-driven insights, optimal allocation of resources, and the ability to identify and support students with learning disability are some of how artificial intelligence can solve the problem of global education inequality. There are a few challenges in implementing AI, such as data privacy and security, cost, maintenance of infrastructure, and overreliance on AI. Notwithstanding, AI can ensure that students worldwide have equal education opportunities.

Keywords: education; artificial intelligence; globalisation.

INTRODUCTION

Education has a significant impact on the progress of human civilisation. Since its inception, the introduction of technology has enhanced learning methods in various ways. Web-based or technologically innovative learning environments are gradually replacing traditional classrooms due to the influence of digital technology and the Internet [1]. As a result, the space constraint in a school has been eliminated by the current educational system built on technological advancements such as Artificial intelligence, which promotes involvement from more students worldwide. The modern academic system has efficiently drawn diverse students and teachers to engage in technology-based learning by dispensing information using technology such as Artificial intelligence [1]. With no restrictions on place, time, or student population, online education is becoming more popular daily. Online learning through artificial intelligence has many advantages, including flexibility, reduced prices, and a vast selection of information. However, it is still evolving to maintain the standard of education [2].

Artificial intelligence (AI) has become an influential force that has significantly affected global education inequality in an era of fast technological advancement. In contemporary economic systems, the acquisition of skills through education has become a crucial determinant of individuals' ability to secure their livelihoods, as the development of human capital through education has emerged as a primary means of accessing economic opportunities and ensuring economic well-being. The pivotal role of education in determining economic outcomes suggests that disparities in educational opportunities could perpetuate and compound existing social inequalities, contributing to the persistence of socioeconomic disparities found across virtually all demographic groups. Most importantly, this unequal distribution of educational opportunities is the determinant factor of social mobility that reinforces social stratification, hindering equal access to economic resources and social status.

In a society where educational opportunity is spread much more evenly across society, independent of family background, it will mean much more social mobility and meritocracy. Moreover, strategies for integrating artificial intelligence in educational systems will bear greater strength in inclusiveness and accessibility, thus democratising learning experiences for students from diverse socioeconomic backgrounds and mitigating systemic disparities in academic outcomes [3]. This paper will focus on artificial intelligence's role in bridging the gap of education inequality across the globe in implementing AI for education, including benefits and challenges and ethical considerations that must be considered to ensure optimal usage of artificial intelligence.

RESULTS AND DISCUSSION

Overview of Global Education Inequality. Education Inequality is the uneven distribution of educational resources and achievement due to different socioeconomic, cultural, and geographical factors [4]. It reflects severe social imbalances since it takes away people's social life and livelihood opportunities and limits economic growth [4]. In many low-income countries facing severe social inequality, marginalised groups such as women and children with disabilities, ethnic minorities, and people living in rural areas continue to face barriers to basic education due to poverty, violence, and inadequate infrastructure[4].

In addition, disparity in the quality of education – which results from a lack of adequately trained teachers and a curriculum that is not up-to-date – creates differences in performance levels, especially among students from low-income areas. Low and high performances among the poor and rich, respectively, directly impact social and emotional skills, as well as reading and numeracy development. Quality of life and deprivation are structural barriers to education, and the other forms of these barriers include the general level of poverty and inequality in society [5].

Education inequality significantly impacts people's livelihood, health, and social mobility. Actions to curb education inequality involve expanding access to quality education, enhancing teacher preparedness, promoting inclusive curricula, and addressing socioeconomic disparities [4].

Status of Inequality in Education. The global education system has expanded enormously, and the average level of education has sharply risen. Between 1970 and 2020, the proportion of students enrolled in elementary school increased from 72.31% to 91.24% [6]. The proportion of children without a formal education has decreased [6]. Between 2000 and 2014, the number of university students worldwide more than quadrupled at the higher education level [6].

However, as of 2018, 258 million individuals, or 17% of all children, adolescents, and youth worldwide, were not enrolled in school. Among those not enrolled in school were one in twelve primary school-age children, one in six teenagers of lower secondary school age, and one in three young people of upper secondary school age [7]. In addition, there is a disparity in the world in the number of individuals who do not have access to quality education and, therefore, opportunities in life. Significant differences still exist between and within prosperous and impoverished countries.

There is a rise in the number of people attending school around the globe, but there are still huge disparities between the affluent and the poor. In Europe and North America, just 1% of primary school-age children miss school; in Southern Asia and Sub-Saharan Africa, this percentage rises to 7% and 18%, respectively [6]. There are still significant disparities in enrolment rates across global areas, as Figure 1 below illustrates, and these inequalities grow with education level. Worldwide, the gender gap in out-of-school rates has decreased in recent decades.
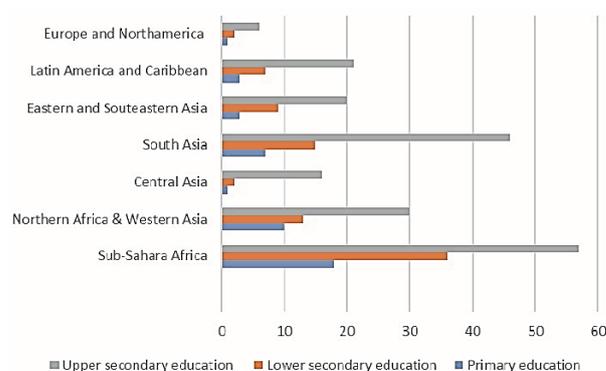

Figure 1 – Out-of-school-rate, primary, lower and upper secondary education, percentage of relevant age group (2019) [8]

There are significant geographical variations. While the percentage of male and female students who drop out of school is the same in Eastern Asia at 3%, the gender gaps are most significant in Sub-Saharan Africa (23% of girls and 19% of boys), Oceania (14% and 9%), and Western Asia (14% and 8%) [8]. Leone compares Global educational growth from a historical standpoint [6]. He emphasised that although more people have been done with their education globally since 1940, there is still a disparity between the wealthiest and poorest nations. Between 1940 and 1980, the average number of education years in Sub-Saharan Africa grew from 2.4 to 6.2. It has increased from 10.5 to 14.1 in the wealthiest nations within the same time frame, showing a persistently significant gap in the Global North and South's educational participation rates [6].

Concept of Artificial Intelligence & its Significance. Two years after Alan Turing, the father of artificial intelligence, passed away in 1956, John McCarthy first used the phrase artificial intelligence (AI). As a result of his research on artificial intelligence, he created the Turing machine. This computer exhibits human-like intelligence through learning, logical reasoning, problem-solving, and other abilities [9]. Artificial intelligence has a lot of untapped potential since it can forecast new situations based on a vast amount of past data. The foundation for the rebirth of artificial intelligence (AI), an essential and indispensable aspect of human existence today, was laid by the development of faster computer processes, the availability of vast quantities of massive data, and the expansion of computational methodologies. Strangely, fewer people consider it artificial intelligence, and the more ingrained it becomes in daily life [10].

Artificial intelligence (AI) is often associated with sophisticated computer programs such as email spam filtering, voice-activated smart speakers such as Amazon Eco, Google Assistant, and Airplay, and automatic banning of mobile numbers. Using neural networks to create autonomous cars without human interaction is another area of AI research [10]. Artificial Intelligence (AI) has been more prevalent over the last several decades and has significantly influenced many areas, including education. AI utilise large language models (LLM) such as ChatGPT, Gemini, Llama, Duolingo, Semantic Scholar, Grammarly, and Khan Academy Khanmigo [11]. Artificial intelligence has led to many advances in teaching, such as the ability to modify and change the way teaching and learning are done. Thus, the development of machines and systems that mimic intelligent human behaviour, such as learning, reasoning and problem-solving, is called artificial intelligence [12].

The ultimate goal of artificial intelligence (AI) is to allow computers to exhibit qualities likened to human intelligence. Sophisticated mathematical algorithms create them, enabling machines to learn and perform tasks efficiently. Intelligent systems are designed to detect patterns and trends, gain knowledge from data and experience, and increase productivity [13]. The primary capability of artificial intelligence is problem-solving, using intelligent systems to manage and solve issues related to logic, mathematics, or information processing. If optimal action is to be discovered, they may use specific policies and procedures or base their choices on the objectives and constraints [12].

Benefits of the implementation of AI in education. Artificial intelligence is transforming education by enhancing teaching and learning. Governments and educational institutions are discussing how best to prepare students in a world where artificial intelligence permeates every aspect of human endeavour and will only become more complex. Research on artificial intelligence, in particular, focuses on cognitive abilities, including learning, reasoning, problem-solving, decision making and language use, among others [4].

There are many potential benefits of using AI in education. One of the most significant benefits of AI in education is personalised learning, which allows students to learn at their own pace and in line with their learning preferences, which can improve student academic achievement [14]. Chatbots (OpenAI ChatGPT, Meta Llama, Google Gemini, Microsoft Bing, Claude, Grok, etc.), automated grading and assessment, and intelligent tutoring systems (Smart tutor, eTeacher, Algebra tutor, Mathematics tutor, etc.) can increase productivity, free up teachers' time, and provide more accurate and consistent feedback but the integration of AI into instruction is not without drawbacks.

Another benefit of Artificial intelligence in education is improved accessibility. AI in education supports diverse learners, including the impaired, with speech-to-text or text-to-speech translations and real-time translation. These things make education more inclusive to various learning needs and preferences [14]. Also, these translated tools powered by AI can help break down the barrier between languages, offering accessibility to educational content in the student's preferred language.

In addition, AI ensures efficiency in administrative functions that include scheduling, resource allocation, and communication on routine inquiries. Automated processes guarantee more time for educators to dedicate to teaching and student interaction, improving educational outcomes and feedback. Artificial intelligence also enhances school security by monitoring potential threats and ensuring the continuation of safe and secure learning environments [15].

Also, artificial intelligence can increase student engagement through interactive learning experi-

ences. Dynamic virtual assistants and tutorials answer students' questions, give students more in-depth explanations, and help the students in the learning process in real-time. Therefore, through online tutorials and support, learners can follow up on the lessons at their own pace with time-bound directives for use in a learning and practice process [16].

Role of artificial intelligence in reducing educational inequalities. Artificial intelligence can significantly reduce educational inequalities worldwide by utilising various approaches such as enabling personalised learning, providing data-driven insights, optimising resource allocation, and helping students with learning disabilities. These AI-driven approaches help bridge the gap between students of different socioeconomic backgrounds, learning abilities, and geographical locations, fostering a more equitable educational landscape.

Personalised learning is one of the ways AI helps reduce education inequality. Artificial Intelligence (AI) is employed within the educational context to transform the learning process and make it more student-centred. Personalised learning using technology adapts learning to each student's level and pace [11]. Artificial intelligence in personalised learning involves utilising data by using machine learning algorithms to analyse trends in students' learning behaviour, preferences, and achievements. Such data will help the AI formulate a curriculum for each student's needs [17]. An AI-supported educational system is helping expand global access to education in developing countries [18]. The step-by-step learning approach is personified concerning each student, singled down to the educational materials and activities according to their strengths and limitations. Artificial intelligence closely supervises students' knowledge, making it automatically adaptable to difficulty and support according to need [19].

By providing data-driven insights, artificial intelligence can help reduce educational inequalities [19]. Using machine learning algorithms and chatbots enables educators to analyse large amounts of data regarding student performance and learning behaviour or patterns. Recently, chatbots have been designed to provide new opportunities for communication, automate business tasks, and provide help for students themselves. Other benefits of using chatbots in education include their vast role in providing relative

support to students. Chatbots can, therefore, provide virtual instructors who give instant feedback, answer questions, and support students in learning [20]. Besides that, chatbots can assess the procedure, verify the areas where improvement needs improvement, and give tailored recommendations on learning materials.

Artificial intelligence also plays a key role in optimising the allocation of educational resources through advanced data analytics and algorithms [21]. Data analytics reveal how and when classrooms are used throughout the day or week, highlighting how artificial intelligence supports effective resource utilisation. This analysis enables AI algorithms to recommend the most effective class schedules, ensuring optimal use of every classroom and a balanced distribution of educational activities across time and school locations [15]. Furthermore, through monitoring attendance across numerous classes, AI can point out a trend where a class continuously shows high or low attendance. The school may utilise such information to ensure maximum engagement and attendance of students by changing the scheduling to optimise the use of the resources. For instance, AI could recommend that classes with a poor attendance record be shifted to more optimal times when student historical presence is higher to get the most out of the class time [22]

Another way in which artificial intelligence tackles the issue of global education inequality is in its capacity to identify and assist children with learning impairments or disability. According to UNICEF, there are 79.2 million people with learning disabilities globally, and this figure is continuing to rise [23]. Children with learning disabilities have significant demands for specialised schooling because they affect their listening, thinking, expressing themselves, scientific reasoning, reading, writing, spelling, and arithmetic skills. Due to learning disabilities, over 2.3 million public school students in the United States receive special education services; in nations with less developed socioeconomic systems, this need is even more significant because of the scarcity of resources [24].

According to authors [25], learning difficulties affect students in a broad range of academic capabilities and emotional and social capacities. Research has shown that students with learning disabilities (SWLDs) experience more negative emotions, such as loneliness and despair, than their counterparts without learning disabilities.

Thus, it will support SWLDs' social and emotional development in addition to helping them achieve their academic requirements. Additionally, learning disabilities negatively impact students in STEM fields because learning in these areas requires students to assimilate information, such as absorbing, remembering, and applying what they have learned in class [26]. According to authors [27], artificial intelligence (AI) can independently score scores in essays, identify literacy difficulties among SWLDs, and develop psychological profiles of SWLDs as it considers their spelling and learning problems [28].

Challenges faced in using Artificial Intelligence to solve Global Educational Inequality. Implementing artificial intelligence in solving global educational inequality faces various challenges. One of the significant challenges is that artificial intelligence requires high accuracy and reliability to enable the system to perform optimally and effectively [29]. Artificial intelligence systems must provide reliable findings and results, which presents a serious challenge. AI cannot wholly replicate human intelligence; therefore, it is necessary to monitor and control the quality of information given to the system to ensure correct outcomes and test development with set guidelines, requiring certification of competency experts [29].

Another challenge is accessibility to technology; implementing artificial intelligence in education requires a high-level and robust infrastructure, which is very expensive for implementation and maintenance; this creates barriers and hitches for educational institutions that want to implement artificial intelligence, especially in developing countries. Authors [30] assert that the use of AI in education, particularly research in the design of curriculums, is constrained by cost and technology dependency.

Data security and privacy are other significant challenges in implementing artificial intelligence to solve educational inequality. In the process of cybercriminal activity, student data might be collected or extracted using AI technology, which can be very dangerous for the students and the institutions; this will be checked by strict regulation and security measures regarding the security and privacy of students' information or data [31]. It is, therefore, imperative that information and data on students has to stay confidential and protected from misuse.

Another critical challenge is the reluctance among educators and educational institutions to change from traditional teaching methodologies or practices. The incorporation of AI within educational systems not only concerns technological adaptation; it also implies a change in methods and practices [11]. Educators might be unwilling to use AI tools because of a lack of understanding, fear of losing jobs, and disbelief in AI's ability to teach effectively. By providing comprehensive training and showing the tangible benefits of AI to education, this resistance could be mitigated and hence encourage wider adoption of the technology [32].

Also, an insufficient number of experts in using artificial intelligence presents a massive barrier to the practical application of AI in education; this constitutes a skills gap that might hinder developing and deploying innovative AI solutions, slow their adoption, and reduce their impacts [33]. Such experts are also hard to recruit because the demand is always higher than the supply. In addition, skill development for the existing educators is a time-consuming and high-expense endeavour, which further lengthens the process of development and implementation of artificial intelligence [32]

Ethical considerations in ensuring optimal usage of Artificial intelligence. Implementing artificial intelligence across different industries, even in education, brings tremendous benefits and raises profound ethical considerations. The optimised use of AI raises issues such as bias, privacy, accountability, and transparency [34]. Regarding bias, Artificial intelligence algorithms are trained over large datasets that might already have a bias; this could lead to unfair or discriminatory outcomes in cases where they are not corrected. In an educational setup, for instance, an AI could become biased toward students more represented in a particular data set [35]. Hence, this raises issues or further buttresses the existing educational inequalities that are already present. In this regard, it is essential to pay careful attention to the diverse datasets and implement procedures for fairness at every step of AI development. Developers continuously monitor and update AI systems to remain impartial and fair.

Privacy is another essential aspect of ethical considerations [36], including student data related to their learning habits, performance, and sometimes even personal details. Privately securing these data is very important. It is thereby necessary for organisations to have reasonable measures concerning data protection and com-

pliance with appropriate data protection regulations like the General Data Protection Regulation [34]. Organisations should implement clear data usage policies and inform users about how their data is collected and used. Accountability is also essential in the ethical deployment of AI [4]. Artificial intelligent systems are capable of making decisions that can have a variety of effects on the lives of individuals; it is, therefore, imperative to establish who is responsible for such decisions.

CONCLUSIONS

In conclusion, artificial intelligence can ensure that students worldwide have equal access to education through personalised learning, data-driven insights, optimal allocation of resources and the ability to identify students with learning disability or impairments early. In addition, AI can help students communicate and collaborate more effectively with teachers. Policymakers, educators, and technology developers must overcome many obstacles and challenges before implementing artificial intelligence to address global educational inequality. These include maintaining high levels of integrity and reliability, high procurement and maintenance costs, technology dependency, and data privacy and security concerns. Despite all these challenges, educators and policymakers should not underestimate the potential advantages that AI can bring to this initiative. Educators, technologists, and policymakers can harness the transformative power of artificial intelligence by fostering a culture of collaboration, intelligence, and diversity to overcome systemic barriers and empower students through more effective learning experiences.

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