The Nexus Between Artificial Intelligence and STEM Education Transformation in Nigeria

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ABSTRACT

Integrating artificial intelligence (AI) into STEM education can revolutionize educational practices and outcomes, particularly in regions facing significant challenges, such as Nigeria. This paper presents a systematic review of the impact of AI on STEM education in Nigeria from 2010 to 2022, addressing the scarcity of expertise and resources that have historically hindered educational progress in the country. Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, a comprehensive search across databases like Scopus and Web of Science was conducted, identifying 37 relevant empirical and opinion articles that met the study's inclusion criteria. The findings reveal that AI has enhanced students' learning capabilities by facilitating personalized and adaptive learning experiences, allowing tailored instruction that meets individual needs. Moreover, AI has bridged accessibility gaps, enabling collaborative learning among geographically dispersed students and providing support for diverse learning needs, including those of students with disabilities. Despite these advancements, the adoption of AI in Nigerian STEM education is still in its nascent stages, facing challenges such as inadequate infrastructure, limited funding, and a shortage of skilled educators. This study underscores the transformative potential of AI in reshaping Nigeria's educational landscape and calls for strategic investments to realize its benefits fully.

Keywords: Artificial Intelligence, STEM Education, Technological impact, Nigeria.

INTRODUCTION

The value of education in human lives cannot be overstated in today's modern education because it enhances both human and material resources. According to Karmanje and Alhassan (2018), education was obtained one-on-one in the human history of civilization, using face-to-face direct teaching and learning techniques. There were insufficient instructional resources to support teachers in their teaching. Teachers and students made every effort to make teaching and learning practicable, accessible, and unhindered. However, today's technology is increasingly used in teaching and learning (Kataria, 2018; Raja & Nagasubramani, 2018). One technological advancement, artificial Intelligence (AI), has made considerable progress in becoming an essential component of the education sector. According to UNESCO (2021), fifty percent of worldwide organizations have incorporated artificial Intelligence into their day-to-day functions. Similarly, educational and training institutes teach their teachers and students the skills of artificial intelligence.

Artificial Intelligence (AI), according to Wartman and Combs (2018), is the ability of a machine or computer to act or think like a human being, to imitate and accomplish things that people do. Similarly, Mohammed and Watson (2019) defined artificial Intelligence as the skillful manner of machines or technologies programmed to imitate humans. Consequently, Popenici and Kerr (2017) posited that artificial

Intelligence is advancing faster in the services and educational systems. It is geared toward automated individualized education to support students of all levels of education through virtual engagement at the student's convenience and time. Raja and Nagasubramani (2018) added that it is much more interactive, making knowledge transfer easy and convenient, demonstrating that reliance and dependency on this technology make life easier and smoother, among other things.

Artificial Intelligence (AI) has infiltrated every aspect of human activity, including education, and hence, the areas of science, technology, engineering, and mathematics (STEM) are not immune to its impact. According to the United States Department of Education (2007), "STEM education programs are defined as those primarily intended to provide support for or to strengthen science, technology, engineering, or mathematics (STEM) education at the elementary and secondary through postgraduate levels, including adult education," (p. 11). Following that, Chute (2009) defined STEM education as an educational exploration that guarantees learning; real-world challenges and possibilities are explored to pursue innovation. The term's origins date back to 1958, when President Dwight D. Eisenhower established both the National Aeronautics and Space Administration (NASA) and the National Science Foundation (NSF), Chute (2009). National Governors Association (2009) claimed that STEM education is essential in the United States of America to ensure that the country's economic competitiveness is maintained and strengthened. For this reason, STEM was transferred to the education system as it was seen as a critical and crucial educational tool to fill the demand for human capital (Chiu & Duit, 2011).

According to the STEM Task Force Report (2014), STEM education's interdisciplinary approach results from the joint efforts of scientists, technologists, engineers, and mathematicians who aim to increase their political influence. The National Science and Technology Council (2013) further supports this notion, stating that the future workforce will consist of STEM professionals because these fields continue to drive innovation and influence various occupational domains.

UNESCO (2022) reported that the increasing advancement of artificial Intelligence in conjunction with STEM has greatly assisted in learning robotics and cloud computing, transforming disciplines, economies, and industries through human/machine collaboration. UNESCO believes that STEM courses are critical in preparing youth for the future. Hannafin et al. (1999) and Belland et al. (2020) argued that artificial Intelligence had impacted STEM students by (i) providing instructional tools, suggestions, or ideas that aid in knowledge acquisition, (ii) providing a guide to the students on how to use the available instructional resources; (iii) causing the students to reflect on things as they engage in the learning process; and (iv) assisting and guiding the students to solve real problems. However, artificial intelligence applications are already a part of our daily lives, but several countries, particularly in Sub-Saharan Africa, lack basic computer science courses and curricula, let alone Artificial Intelligence (UNESCO, 2022).

Fomunyam (2019) claimed that the Nigerian government supported STEM education because, in the twenty-first century, it improves critical thinking, creative skills, and analytic skills, among other things, which helped a country's industrial revolution. Moreover, Adeola (2017) posited that STEM education would be the new basic features and needs that support learning in the twenty-first century. This is because students who can acquire or become aware of STEM skills will always progress or fit in any job market. This is because STEM education equips people with skills such as interactive and productive tasks, assisting in information interpretation, developing skills for team collaboration, and improving logical reasoning. In support of this, a study by Le et al., (2013) examined how Artificial Intelligence (AI) was applied to the role of a tutor in computer programming instruction. They concluded that the most common application of AI methods was to offer feedback-based tutoring to students while they were engaged in individual learning.

The assertions of Adeola (2017) seem to be premised on the basis that artificial intelligence (AI) is a rapidly growing field that is being adopted in various sectors globally, including Nigeria. The penetration of artificial Intelligence in STEM education in Nigeria is slow. While there is no reliable data on the

percentage usage of AI in Nigeria, there has been an increasing interest in the field. According to a report by the World Intellectual Property Organization (WIPO, 2021), Nigeria filed 102 AI patents between 2000 and 2019, a significant increase from previous years. This suggests a growing interest in AI research and development in the country. In addition to STEM education becoming increasingly popular in Nigeria, the federal government has taken steps towards improving it through various initiatives throughout the country. These initiatives include the establishment of several institutions that are centered on STEM as well as the implementation of legislation that is meant to boost STEM education. Although Artificial Intelligence can potentially benefit STEM education in Nigeria, many challenges must be solved. The use of artificial intelligence in STEM education is now hampered by a lack of finance and infrastructure, a scarcity of technical skills, and limited access to data. In addition, there is still a shortage of competent educators, inadequate resources, and insufficient infrastructure, all of which contribute to the challenges in successfully implementing successful STEM education programs. Furthermore, Nigeria is one country that is battling to fully integrate technology, particularly artificial Intelligence, into its educational system. Reagan (2018) stated that there is a scarcity of technological experts in Nigeria who can apply their knowledge of algorithms and technology. As a result, many Nigerians struggle to use artificial Intelligence to teach STEM education (Akinsola et al., 2007). On this note, it appears that the teaching of STEM in secondary schools is being hampered because the number of people with expertise in artificial Intelligence is limited (Fomunyam, 2019).

To effectively integrate artificial intelligence into STEM fields in Nigeria, it is imperative to increase investment in research and development, as well as to establish policies and regulations that will guide its use. In light of this, the paper provides a systematic review of the rise of artificial intelligence and its influence on STEM education in Nigeria.

Research Question

1. What is the impact of artificial intelligence on STEM Education in Nigeria?

2. What are the factors preventing artificial Intelligence from impacting STEM Education in Nigeria?

METHODOLOGY

Systematic review procedures were used to search for, select, and extract empirical articles that met the study's criteria. The principles of Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) were also applied (Moher et al., 2009).

Search Strategy

The articles were gathered by exploring multiple databases, including Scopus and Web of Science. These databases were searched for articles using keywords, titles, and abstracts. The peer-reviewed articles were filtered to identify those that met the exclusion and inclusion criteria.

Exclusion and Inclusion Criteria

Articles that did not meet inclusion criteria including articles that are not artificial intelligence-related, STEM education-related, science, technology, engineering mathematics, and articles that are not peer-reviewed, were not considered. On the other hand, the inclusion criteria were based on peer-reviewed empirical and opinion articles. However, the reason for the opinion articles is based on the premise that artificial Intelligence is a relatively new topic in Nigeria, and as such, most of the articles from Nigeria are opinion papers. Opinion papers were included in the inclusion criteria to accommodate the articles from Nigeria and to understand the impact of artificial intelligence on STEM education in Nigeria.

Data Extraction

The articles were found by searching using particular keywords, such as artificial Intelligence (AI), STEM education, and the impact of AI on STEM education. Table 1 provides a thorough listing of the terms mentioned above for review.

Table 1: Initial Search Strings

Topics	Search Terms
Artificial Intelligence	"artificial intelligence" OR "artificial reality" OR "artificial intelligent agent" OR "artificial support" OR "machine learning" OR "intelligent tutoring support" OR "chat intelligent bot" OR "automated learning tutor" OR "expert tutor" OR "expert system" OR "natural language support system."
AND	
STEM Education	"STEM" OR "science" OR "technology" OR "engineering" OR "mathematics" OR "STEM Education" "Gender" OR
AND	
Impact of AI on STEM Education	"Impact of AI on STEMEd" OR "Impact of AI on science" OR "Impact of AI on mathematics" OR "Impact of AI on science" OR "Factors affecting STEM education" OR "STEM education and its challenges"

Analysis Methods

The systematic review employed EPPI Reviewer software to manage and analyze many academic articles. This tool was chosen for its ability to automate the identification and removal of duplicate records and for its precision in applying predefined inclusion and exclusion criteria. The software facilitated an efficient and rigorous screening process, ensuring only relevant articles were included for detailed content analysis. EPPI Reviewer's comprehensive database search capabilities and systematic approach contributed to a high standard of methodological rigor, enhancing the reliability and reproducibility of the study's findings. The articles that were screened were analyzed using content analysis.

Figure 1 The Flowchart of Summary of the Search Strategy and Method of Analysis
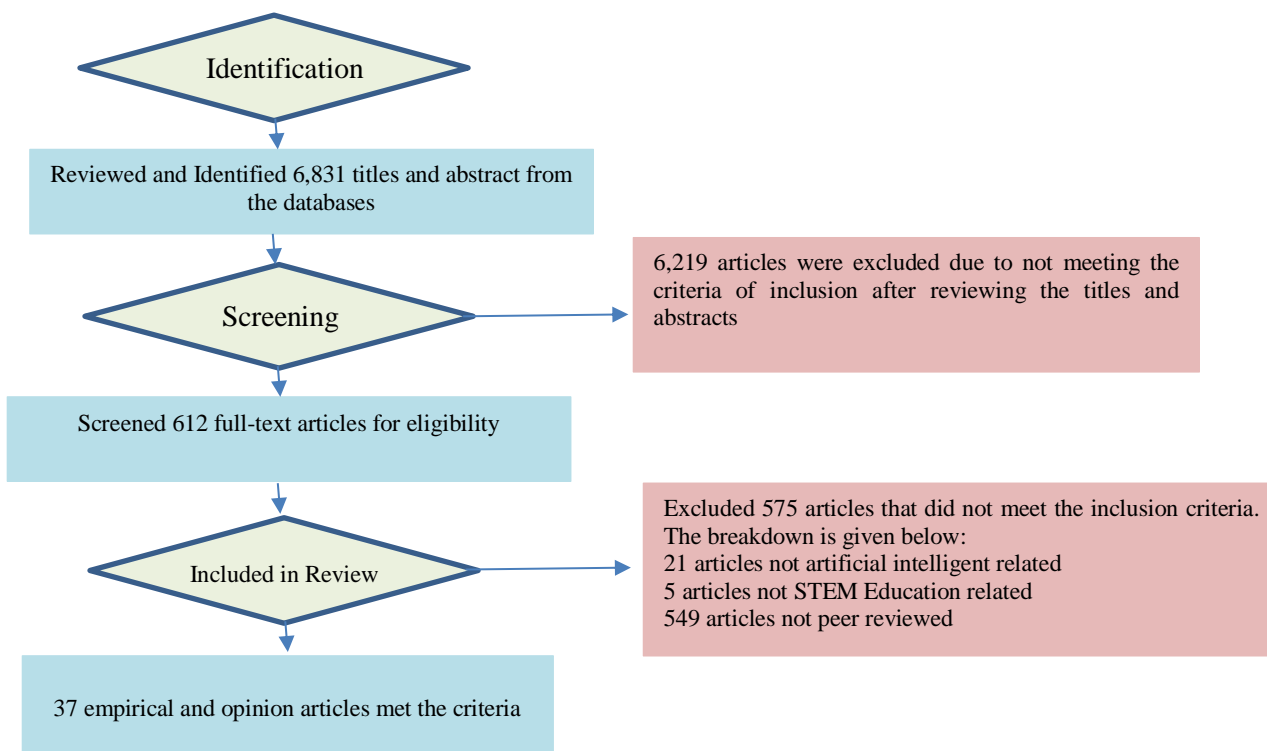
Figure 1 displays the titles and abstracts of the 6,831 citations that were deemed relevant after being culled from the results of electronic searches of databases. Additionally, additional citations were taken from reference lists of previously conducted reviews. As a result, the full texts of 575 articles were obtained. The 575 articles deemed ineligible were excluded for the following reasons: they were not peer-reviewed articles (n = 549), not related to Artificial Intelligence (n = 21), and not STEM Education (n = 5). On this note, 37 articles met the study's eligibility criteria.

Summary of findings for the included articles

Table 2: Summary findings for Articles included in the study

SN	Authors	Year	Title	Methodology	Findings
1	He, et al.,	2021	The impact of STEM education on Mathematics development in children aged 5-6 years	Empirical analysis of pre- and post-test research data analysis	STEM education most directly impacts Children's mathematical abilities since it helps them acquire core skills in problem-solving.
2	Eroglu & Bektas	2022	The effect of 5E-based STEM education on academic achievement, scientific creativity and views on the nature of science.	Quasi-experimental design, descriptive and inferential statistics. Univariate Analysis of Covariance (ANCOVA)	Students who have received an education in STEM can better seek out possibilities connected to STEM, create plans, formulate strategies, and carry out those plans.
3	Colombo & Piva	2020	Start-ups launched by recent STEM university graduates: The impact of university education on entrepreneurial entry.	Prohit regressions	Students are motivated to start creative businesses by receiving an education in STEM fields.
4	Adebayo et al.,	2023	Use of mobile technology to enhance the capacity of teachers to teach family life and HIV education in Nigeria		The swift advancements in technology have enabled the utilization of mobile interventions, which have the potential to assist in enhancing teachers' abilities to impart STEM education to young individuals.
5	Aina	2022	Strategies for Bridging Gender Gap in Science, Technology and Mathematics (STEM) education in national development		The number of women enrolled in the program is significantly smaller than that of men.

6	Aina	2022	STEM Education in Nigeria: Development and Challenges		Education in the STEM fields has paved the way for advancements in Nigeria's health care, agricultural, and telecommunications sectors. However, STEM education in Nigeria faces several hurdles, including inadequate finance, a lack of innovative and employable skills, a shortage of research findings, and underqualified teachers, amongst other difficulties.
7	Kaleci & Korkmaz	2018	STEM education research: Content analysis	Content analysis	Students have benefited, both academically and professionally, from STEM education.
8	Mizell, S., & Brown, S. D.	2016	The Current Status of STEM Education Research 2013-2015	Content Analysis, Deductive Approach	Without a solid STEM background, 21st-century leaders cannot succeed.
9	Okorafor et al.	2015	Women participation in science, technology, engineering, and mathematics in Nigeria: Challenges and way forward		Women remain underrepresented in STEM. The gender gap in STEM impedes progress in the knowledge-based economy driven by science and technology. This study connects cultural beliefs, socialization, and gender inequality in STEM.
10	Abdulrahman et al.	2017	Educational Planning and STEM Development in Nigeria		STEM has the potential to enhance education in Nigeria, and if the government is committed, Nigeria can become a global contender in STEM advancement.
11	Ezeobi & Aluko,	2021	Gender-based imbalance on women's rights issues in stem education in Nigeria and way forward		STEM education has improved Nigerian education, but women face several challenges. These impediments include gender inequity, mortality rates, ownership and family duties, cultural differences involving traditional

					attitudes and religion, a preference for male children over female children, and inheritance laws.
12	Fomunyam	2019	Teaching STEM education in Nigeria: Challenges and recommendations		Nigeria adopted STEM education to alleviate the shortage of skilled labor and satisfy the existing technological demands.
13	Aliyu et al.	2021	Integrated STEM education as premise of education for sustainable development in Nigeria	A survey research design. Online questionnaire	There is a consensus that STEM education is an integral component of a comprehensive curriculum, which enables students to engage in experiences that are perceived as "more pertinent," "less disjointed," and "more engaging."
14	Abdullahi et al.	2019	Gender gap in science and technology education in Nigeria.		Although STEM education has been demonstrated to be advantageous to various cultures, female students are underrepresented across most of Nigeria's educational systems, particularly in this field.
15	Kennedy & Odell	2023	STEM Education as a Meta- discipline.		STEM education today focuses on creativity and solving complex contextual problems.
16	Iroaganachi & Nkiko	2017	Health, Information, Perception and Demographic Variables as Correlate of Gender Equality in Science Technology Engineering and Math (Stem) Education in South-West Nigeria	Video simulation	STEM education is essential for employment in every industry, particularly medicine-related fields. However, to facilitate progress in science, STEM education must emphasize engagement.
17	Han et al.	2021	Factors influencing student STEM learning: Self-efficacy and outcome expectancy, 21st-century skills, and career awareness.	Survey and path model	The results indicated that both direct and indirect effects of teacher self-efficacy and outcome expectancy were evident in students' knowledge regarding STEM achievements.

18	Obomanu & Adaramola	2011	Factors Related to under Achievement in Science, Technology and Mathematics Education (STME) in Secondary Schools in Rivers State, Nigeria.	Questionnaires, Frequencies, percentages, bar charts, mean, standard deviation, variance, and analysis of variance were used	Young individuals have a solid aversion to subjects related to science, technology, and mathematics (STEM). Additionally, parents are often too occupied to help their children with their schoolwork, there is insufficient funding, and stakeholders can significantly impact STEM performance.
19	Zhang & Aslan	2021	AI technologies for education: Recent research & future directions	Bibliometric analysis, inductive content analysis	STEM education can help close the divide between the progress made in artificial intelligence technology and how that progress can be applied to education, ultimately leading to the nation's advancement.
20	Muhammda, et al.,	2023	The impact of artificial Intelligence and machine learning on workforce skills and economic mobility in developing countries: A case study of Ghana and Nigeria	Qualitative research design; focus group	Since these nations' educational systems cannot meet demand, the growing use of AI and ML technologies creates a labor force skills deficit.
21.	Chukwudi et al.,	2018	Effect of Artificial Intelligence on the Performance of accounting operations among accounting firms in South East Nigeria	Descriptive research design. 185 respondents. A structured questionnaire, linear regression	The Performance of accounting functions has been impacted by artificial Intelligence.
22	Sanusi et al.,	2022	Investigating Learners' Competencies for artificial intelligence education in an African K-12 Setting	A quantitative methodological approach was used. It adopted a survey research design. Questionnaire, 605 respondents	Integration of artificial Intelligence has a relationship with learners' competencies—the need to ensure collaboration between learners' competencies and Artificial Intelligence.

23	Umar	2019	STEM education as a catalyst for national development: problems and prospects in Nigeria.	Systematic review approach	STEM education is a crucial factor in the development of any nation, with scientific research and practical applications in STEM fields contributing significantly to rapid economic growth.
24	Kazu et al.,	2021	The effect of STEM education on academic Performance: A meta-analysis study.	The sample was then meta-analytically examined using the CMA program	Education in the STEM fields, which have progressed with the field of science, has been shown to have the most significant effect on the economy.
25	Lit et al.,	2022	A systematic review of high impact empirical studies in STEM education.	Specification of the publication search using the four WoS categories listed under "education": "Education Educational Research," "Education Scientific Disciplines," "Psychology Educational," and "Education Special".	STEM education is gaining more attention and a more comprehensive range of disciplinary Content due to the increasing number of high- impact empirical research published in journals across various STEM fields.
26	Jamali et al.,	2022	The role of STEM Education in improving the quality of education: A bibliometric study	A bibliometric analysis was carried out to assess the scientific outcomes of integrated STEM education's role, specifically in enhancing the quality of education (as outlined in SDG 4).	The results of this study show that STEM helps us better understand how integrated STEM education can improve the quality of education.
27	Onyema	2019	Integration of emerging technologies in teaching and learning process in Nigeria: The challenges.	Structured questionnaire. Secondary data. 200 respondents. Data were analyzed using descriptive statistics.	Utilizing technologies like artificial Intelligence facilitates the attainment of educational goals in teaching and learning.

28	Hinojo-Lucena et al.,	2020	Science performance and mapping of the term (STEM) education on the Web of Science	Bibliometrics, Co-ward analysis	Despite persistent gender disparities, the prominence of "STEM" in education is increasing and has a considerable impact, particularly in science education. "STEM" is an acronym for science, technology, engineering, and mathematics.
29	Ubawuike	2018	Science, technology, engineering and mathematics (STEM) education: A catalyst for entrepreneurship and economic growth in Nigeria.		Enhancing Nigeria's economy is crucial for reducing its dependence on oil and addressing the issue of youth unemployment. In this regard, promoting education in the STEM fields is imperative as it forms the foundation for innovation, entrepreneurship, and workplace proficiency.
30	Olebara	2022	Improved Yuampei Computer Science teaching: For secured development of developing countries	Adopted a review of the literature of Computer Science Policies	Artificial Intelligence has transformed and caused desired sustainable development
31	Badmus & Jita	2023	Investigation of factors influencing career choice among STEM undergraduates in Nigeria universities.	One-way ANOVA	STEM has influenced career and interpersonal development
32	Ogbonnia,	2017	Artificial Intelligence as an imperative to the effective delivery of instructional materials' Content	Systematic review approach	ICT and Expert system research on academic achievement have mostly focused on Primary, Secondary, and Tertiary Education, but they have not examined how Artificial Intelligence systems might improve instructors' tasks. Teachers' time and skill limit their capacity to supply updated, inexpensive, accessible teaching resources.

33	Onile-ere, et al.,	2021	Science, technology, engineering And mathematicsenrolment patternsand factors influencing the choice to study science among female secondary school students in Nigeria		A considerable portion of female high school students who participated in a survey exhibited insufficient self-confidence to register forpre-university STEM courses, indicating a propensity to pursue non-STEM fields in college.
34	Fomunyam	2019	Teaching STEM education in Nigeria: Challenges and recommendations.		STEM education bridges the gap of unemployment
35	McDonald	2016	STEM Education: A Review of the Contribution of the Disciplines of Science and technology, engineering and mathematics		Current efforts and educational reforms worldwide have centered on broadening the enrollment of students in STEM disciplines and ensuring that they receive proper education and training to qualify for employment in STEM professions.
36	Akinsowon &Osisanwo	2014	Enhancing interest in sciences, technology, and mathematics (STEM) for the Nigerian folk.		Women's education was generally deemed unproductive in Africa, particularly in rural regions, and this perception was particularly evident in Nigeria, where girls were viewed as destined for domestic chores such as cooking.
37	Ahmd. Et al.,	2020	Artificial Intelligence in Education: A panoramic review	Bibliometric Analysis	The application of artificial Intelligence has improved the development of society.

FINDINGS AND DISCUSSIONS

Impact of Artificial Intelligence on STEM Education

Artificial Intelligence (AI) continues to revolutionize Science, Technology, Engineering, and Mathematics (STEM) education, transforming educational practices and outcomes in unprecedented ways. IntegratiSng AI into STEM learning environments improves the educational experience and provides students with the requisite skills to thrive in a technology-driven world. Studies have found that Artificial intelligence has been impacting STEM education in the areas of Personalized and Adaptive Learning, and through these learning experiences, AI has introduced a paradigm shift in the delivery of education. Unlike traditional one-size-fits-all teaching methods, AI-powered platforms analyze individual student performance data to tailor instruction to their unique learning styles and needs. This adaptive learning approach ensures that students

receive the right level of challenge and support, thereby improving their comprehension and retention of complex STEM concepts (Rau, 2022). As a result, students are more engaged and motivated, which is crucial for mastering subjects that are often perceived as difficult. It also found that AI empowers educators by providing them with sophisticated tools that enhance their teaching abilities. For example, AI can automate administrative tasks such as grading and attendance tracking, freeing up time for teachers to focus on more meaningful student interactions (Luckin, 2018). Furthermore, AI-driven educational tools such as virtual laboratories and simulations offer students hands-on experiences vital for deepening their understanding of STEM subjects. These tools make abstract concepts more tangible and allow students to experiment and learn in a risk-free environment.

Another significant impact of AI on STEM education is its potential to bridge accessibility gaps. AI technologies can provide personalized support to students with diverse learning needs, including those with disabilities (Cheng & Lai, 2020). For instance, AI-powered speech recognition and text-to-speech tools can assist students with hearing or visual impairments, making STEM education more inclusive. Additionally, AI can extend the reach of quality STEM education to remote and underserved areas, where access to resources and skilled educators may be limited.

AI's role in STEM education extends beyond knowledge acquisition and fosters innovation and critical thinking among students. Project-based learning integrates AI to encourage students to tackle real-world problems, develop innovative solutions, and engage in critical thinking (Holmes et al., 2019). This approach prepares students for future careers in STEM fields and equips them with the skills to become leaders and innovators in an AI-driven economy. AI can transform STEM education into a global collaborative endeavor (Pedro et al., 2019; Marshall,2009; Lee & Perret,2022). Through AI-enabled platforms, students from different cultural and geographical backgrounds can collaborate on projects, share knowledge, and learn from each other. This global perspective is essential in today's interconnected world, where many challenges, such as climate change and public health, require collaborative, cross-disciplinary solutions. Notwithstanding, the area of Data-Driven Educational Strategies has an immense impact as AI's ability to analyze vast amounts of educational data enables schools and policymakers to make informed decisions that can enhance STEM education outcomes. By identifying patterns in student performance, AI can help educators pinpoint areas where students struggle and develop targeted interventions (Kamalov et al., 2023). This data-driven approach grounds educational strategies in evidence, resulting in more effective teaching and learning practices.

Finally, as AI continues to permeate various industries, there is a growing demand for STEM professionals with AI expertise. Through the integration of AI into STEM education, schools are preparing students for the jobs of the future. In Nigeria, for example, STEM education has already yielded positive results in healthcare, agriculture, and telecommunications (Aina, 2022). By equipping students with AI skills, educators ensure that they are employable and capable of driving innovation in these critical industries.

To cap it all, while AI offers numerous benefits, it also raises important ethical and societal questions that STEM education must address. The STEM curriculum should integrate discussions about the ethical use of AI, data privacy, and the potential social impacts of AI technologies (Borenstein & Howard, 2021). This holistic approach ensures that students are not only technically proficient but also socially responsible and aware of the broader implications of their work.

Factors Affecting STEM Education

According to the findings of this study, both students' and teachers' expectations regarding the outcomes of their lessons directly and indirectly affect the students' knowledge of STEM-related achievements. Another piece of research concluded that young people strongly dislike science, technology, and mathematics, but parents are too busy to assist their children with their homework (Obomanu & Adaramola, 2011). A lack of

financial resources and stakeholders significantly influences STEM performance (Fomunyam, 2019). Several difficulties, such as limited funding, a shortage of creative and employable skills, an absence of significant research findings, and a dearth of qualified teaching staff, plague STEM education in Nigeria (Abdulraheem-Mustapha, 2021). Students who identify as female have had their applications to participate in some STEM education programs declined due to cultural factors that give male students a higher priority. Although fewer women participate in the program than men, this is the case. The gender gap in STEM education persists today a barrier to growth in knowledge-based economies powered by research and technology (Okorafor et al., 2015). The history of education is replete with gender inequality that limits female students' access to particular learning opportunities (Ilokanulo et al., 2021). There is a connection between this phenomenon and cultural attitudes and practices of socialization that encourage gender imbalance in STEM fields.

The results of the empirical and opinion articles show that a sizeable percentage of female students in secondary schools lacked the self-assurance necessary to enroll in pre-university STEM classes and were more likely to pursue non-STEM fields of study once they reached college. Education for women was generally considered pointless across Africa, particularly in rural areas, and this perception prevailed more than anywhere else. This idea has remained prevalent in Nigeria, where girls are frequently expected to carry domestic responsibilities. The cultural ideas of Nigerians have had a severe impact on the education of Nigeria's female population.

CONCLUSION

The emergence of artificial intelligence created numerous opportunities in Nigerian education. This allows Nigerian educators to integrate AI into STEM disciplines, leading to improved quality and modes of instruction delivery. It is also obvious that artificial intelligence and STEM education are inextricably linked, facilitating collaborative learning among students and overcoming geographical barriers. AI's revolutionary aspect lies in its ability to enable students to participate in meaningful, collaborative learning experiences, regardless of their geographical dispersion. AI offers students customized study options catering to their unique learning preferences and requirements, fostering a more inclusive and flexible learning environment. These advancements underscore the transformative potential of AI in reshaping educational paradigms and fostering a more interconnected and dynamic learning community.

RECOMMENDATIONS

Arising from the results of this study, the researchers propose the following recommendations presented under four thematic topics

i. **Curriculum Modernization**: To prepare students for the future workforce, it is essential to modernize the curriculum by integrating data literacy and AI concepts. This includes introducing new STEM courses focused on the practical applications of AI and embedding AI-related topics into existing STEM curricula. Such revisions will help students understand AI's influence across various industries and equip them with the necessary skills.

ii. **Policy Integration**: Policymakers should mandate the strategic incorporation of advanced AI technologies into educational frameworks. This initiative will revolutionize teaching and learning by fostering a more dynamic, adaptive, and personalized educational environment aligned with the 21st-century knowledge economy's demands.

iii. **Teacher Training and Development:** The government should prioritize the recruitment of AI experts to train educators, empowering them to harness AI in their teaching practices. Transforming teachers into tech-savvy facilitators will maximize AI's potential to create engaging, individualized learning experiences, enhancing STEM education.

iv. **Promoting Inclusion and Diversity**: Stakeholders, including the government, should collaborate to promote inclusion and diversification in STEM fields. Initiatives should target women and students from marginalized or underprivileged areas and leverage AI to create flexible learning environments that accommodate diverse student needs, ensuring that every learner has the opportunity to excel.

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