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Artificial Intelligence and Technical Education Development in Nigeria: A Review of Literature

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Abstract

Artificial Intelligence (AI) is the ability of a digital computer, computer-controlled machine or robot to perform tasks commonly associated with intelligent beings like human beings. The study review literature on the importance, applications and challenges of artificial intelligence in Nigeria. Technical Education (TE) serves as a critical component for fostering economic development by equipping individuals with the necessary skills to thrive in various industries. Meanwhile the rapid advancement of technology, particularly in the realm of Artificial Intelligence (AI), has created a pressing need for educational systems worldwide to adapt and evolve. Its capability to perform tasks previously achievable only by humans has made this technology popular and utilized across various sectors, including technical education. This study looked at various Artificial Intelligence systems in Education, which is an expert system that helps in the delivery of lessons. The findings revealed that there is need to integrate AI into the current state of TE, the major challenges and barriers that hinder AI integration in TE is unavailability of uniform content to serve the AI application and that introduction of AI into the curriculum of TE will contribute to the advancement of Nigerian economic development. There is an urgent need for substantial investment in AI-related infrastructure within institutions TE to providing access to AI tools and technologies and TE programmes should be updated to include AI-related courses and concepts. The following recommendation were made by Increasing awareness among specialists of the requirements of applying artificial intelligence in education and adequate attention to the challenges arising from the applications of artificial intelligence to the jobs.
Key words: Artificial Intelligence, Technical Education, Education, Development.

Introduction

Digitalization and artificial intelligence (AI) are changing the way we work, live, communicate, learn and play. Whether they are aware of it or not, individuals are increasingly encountering advanced technologies such as AI in their everyday lives, in exchanges as diverse as applying for a loan and scrolling through social media, some of

which may have a profound impact on their lives. Artificial intelligence is one of the most prominent modern applications of information systems as a field of modern knowledge that is interested in studying and understanding the nature of human intelligence and its simulations to create a new generation of smart computers that can be programmed to accomplish many of the tasks that need a high ability of inference, deduction and perception, which qualities people enjoy it, is included in the list of smart behaviors. Artificial intelligence (AI) makes it doable for machines to learn from expertise, adjust to perform human-like tasks and new inputs. Using these technologies, computers will be trained to accomplish specific tasks by process massive amounts of knowledge and recognizing patterns in the data. Jim Goodnight (2021).

Historically, technological advances have led to a decline in some jobs and a rise in others (Furman, 2016). One viewpoint argues that AI will play a pivotal role in economic development and will effectively improve production and overall income. AI has the potential to improve people's lives, but it also raises a number of important policies, ethical and social issues, including job creation and job obsolescence. It represents a source of social and political tension, and risks exacerbating inequalities within and across countries.

In recent decades, Artificial Intelligence (AI) has become increasingly present in our lives, having a significant impact in various fields, including education. In the field of education, Artificial Intelligence has many potential applications, as stated by Agnes Ethel (2019), who claims that Artificial Intelligence can simplify the work of teachers, especially in administrative contexts such as calculating graduation rates using student test results. Artificial Intelligence can also facilitate teachers in teaching and learning activities and other types of classroom activities. According to Fernández, Fernández, and Aburto (2019) artificial intelligence is beneficial for both students and teachers because it is used for modern technologies can help teachers and students gain more educational experience, as well as provide information for teachers and management about the practices and scope of artificial intelligence in Technical Education required to gain excellence.

Similarly, Ogunsola (2017), posited that TE, can have many benefits for individuals, society, and the economy such increasing employability, productivity, innovation and entrepreneurship. As economies become increasingly reliant on technology, the integration of AI into TE curricula is essential to prepare a workforce capable of meeting the demands of a rapidly changing job market. The significance of TE in economic development is underscored by its ability to provide practical skills that align with industry needs. Countries that have invested in robust TE systems often experience higher levels of employment and economic stability (MvuhZouliatou, 2017). However, the current state of TE in Nigeria faces numerous challenges, including inadequate infrastructure, limited access to modern technologies, and a lack of alignment between educational outcomes and labor market requirements (Disciplines, 2023). These challenges hinder the effectiveness of TE in preparing students for the realities of the workforce.

Moreover, the advent of AI presents both opportunities and challenges for TE. AI, defined as the capability of a machine to imitate intelligent human behavior, has found applications across various sectors, including education (Russell & Norvig, 2021).). This repositioning of TE towards AI not only addresses the skill gap in the workforce but also contributes to broader economic development goals. As Nigeria seeks to diversify its economy and improve its global competitiveness, embracing AI within TE frameworks becomes imperative. AI-powered tools and platforms have the capacity to create immersive learning experiences, simulate real-world scenarios, and provide personalized feedback to students (Disciplines, 2023). By leveraging AI, vocational education institutions can adapt to the unique learning styles and preferences of each individual, ensuring that students receive targeted support and guidance throughout their educational journey (MvuhZouliatou, 2017).

According to Morín (2018), artificial intelligence applications are important in the fields of life, but they are more important for educational institutions, which represent a great necessity that cannot be dispensed with, as universities today are no longer limited to education, but rather have become an essential part of the system of sustainable development in societies. The mission of educational institutions today exceeded the

traditional function of preserving heritage, identity and education. Rather, these institutions today are required to keep pace with technological development through the creation of new methods of education and teaching.

Technical education plays a vital role in preparing skilled and trained workers. In an increasingly complex and rapidly changing world, technical education must continuously adapt to technological advancements relevant to industries. We cannot deny the fact that Technical Education programmes provide beneficiaries with skills for many job opportunities, the skills can be involved in the school public relations activities to educate the community as to what the programme does and how it will benefit graduates. This type of campaign as stressed by Abdulahi (2016) may result in greater public awareness and acceptance as well as increased enrolments into Technical Education programmes.

Rapid advancements in Artificial Intelligence (AI) technology have brought about revolutionary shifts in a variety of industries. Educators are actively looking for ways to smoothly integrate AI into higher education curricula, given the necessity of preparing students for the difficulties of an AI-centric future. Recent curricular developments support the argument for technology integration in science education, as Nicolaou and Petrou (2023) point out. There is growing agreement that integrating AI technology into education can enable teachers to support students' self-directed learning (Caswell & LaBrie, 2017), create learning communities that are collaborative, and foster creativity in understanding concepts (Connolly, Logue & Calderon, 2023).

Educational systems across the world must therefore adopt a new approach to the changing landscape of middle skill jobs and to equip the workforce with digital and transversal skills. Transversal skills can be applied to a wide range of life and work settings and include critical thinking, communication, and financial and media literacy. These skill sets enable workers to adapt to changes and identify and exploit career pathways and opportunities, an important consideration given that individuals are now expected to learn marketable new skills throughout life. Career progression planning will represent a central challenge for some countries over the next decade and beyond,

particularly as public funding for job training programmes is falling in many countries, even as industry-sponsored training is on the rise (ManpowerGroup, 2018).

Artificial Intelligence represents an initial step in the development of learning technologies. This situation is likely to have implications for everyday human life. The use of Artificial Intelligence technology in education has become an increasingly popular topic in recent years. AI offers a lot of potential to enhance students' learning experiences, assist teachers in delivering more effective instruction, and even identify learning issues that may go unnoticed by humans.

However, the use of Artificial Intelligence in education also raises some concerns and challenges. One major concern is that the use of this technology may replace the role of humans in teaching and learning, thereby reducing important human interaction for students' social and emotional development. Additionally, concerns arise regarding student data privacy and ethical issues related to the use of this technology in instruction. Intelligence is one of the most useful concepts used in psychology, because it correlates with lots of relevant variables, like the probability of suffering an accident, earning a higher salary, etc. Psychologists generally do not characterize human intelligence by just one trait but by the combination of many diverse abilities. Intelligence is most often studied in humans but has also been observed in non-human animals, plants and of late studied in machines. This study of intelligence in machines involves the simulation of human intelligence processes by machines, especially computer systems, and therefore it is a set of computational techniques inspired by the way humans use their nervous system and their body to feel, learn and act. (Harkut and Kasat, 2019).

Artificial intelligence (AI) is a rapidly evolving field of technology that involves the development of intelligent machines capable of performing tasks that require human intelligence, such as understanding natural language, recognizing patterns, and making decisions based on data in various fields, including medical diagnosis, autonomous vehicles, and education (Verma, 2018; Ocana et al., 2019). Some people also consider Artificial Intelligence (AI) to be a danger to humanity if it progresses unabated. Others believe that Artificial Intelligence (AI) unlike previous technological revolutions will create a risk of mass unemployment. This implies that artificial intelligence is involved in

the project of developing machines endowed with the intellectual processes and characteristic of humans, such as the ability to reason, discover meaning, generalize, or learn from past experiences. Research in Artificial Intelligence (AI) focuses chiefly on the following components of intelligence: learning, reasoning, problem solving, perception, planning and using language.

The major concern of this research is the employment of Artificial Intelligence (AI) in Technical Education as to effectively support instructors in the technological delivery and to enhance innovation for economic development in Nigeria. Specifically, the study sought to determine:

1. The key challenges and barriers of incorporating AI into Technical Education programme in Nigeria.
2. Whether the integration of AI in Technical Education can contributes to economic development in Nigeria.

The aim of this study is to examine the incorporating of Artificial Intelligence (AI) into the instruction of Technical Education in Nigeria. The primary objective is to investigate how AI technologies might improve the overall quality and efficacy of technical education, hence leading to enhanced learning outcomes for learners.

The effective adoption of artificial intelligence (AI) in Technical Education in Nigerian, it is crucial to solve many obstacles and impediments. A major obstacle is the pervasive infrastructural restrictions in several educational institutions nationwide. The lack of sufficient access to technology, such as PCs or tablets, impedes the efficient implementation of AI-powered instructional aids (Aina et al., 2023).

Importance of Artificial Intelligence to Technical Education

- Personalized Leaning: The incorporation of Artificial Intelligence (AI) into Technical Education (TE) programmes has the potential to provide customised learning experiences that cater to the specific requirements of students. Artificial intelligence can be employed to customise the content and tempo of education to align with the specific abilities of individual students, thereby improving their acquisition of theoretical knowledge and practical skills in Technical Education (TE) courses. (Pat pataranutaporn, 2021). TE sector is experiencing rapid growth to meet the needs of an expanding economy. AI-

powered educational materials can be instrumental in delivering captivating and efficient learning experiences. Through the utilisation of AI characters, TE programmes can provide educational content in classrooms and interactive environments (Janius, N., Hassan, Z. B., Atan, N. A., & Idris, M. D. B., 2018). This approach allows for the customisation of instruction to meet the unique requirements of students across different age groups. Consequently, students receive individualised attention and assistance, which is crucial for achieving success in their educational pursuits. Therefore, the implementation of AI in TE education in Nigeria not only improves learning results but also aids the region's endeavours to cultivate a proficient workforce capable of tackling the demands of the contemporary economy. (Pat pataranutaporn, 2021)

- Skill Assessment and Monitoring: The integration of Artificial Intelligence (AI) technologies in Technical Education (TE) programs offers numerous benefits for both instructors and students. These AI-driven tools enable quick responses and provide real-time feedback, enhancing the learning process in TE fields. By utilizing AI for evaluating student achievement and growth, instructors can maintain performance standards while identifying areas for improvement. AI-powered technologies can track students' progress in learning practical skills, offering immediate feedback and facilitating timely interventions to enhance learning outcomes. Moreover, AI enables educators to customize the curriculum and learning experiences to meet the unique requirements and skill levels of each student, promoting individualized learning experiences. By tracking learning preferences, detecting skill gaps, and measuring performance, AI contributes to optimizing the learning environment in TE classrooms. According to Janius, N., Ishar, M. I. M., Yusof, Y., Bang, P., Sid, R., & Wong, G. (2023), AI-powered solutions can collect data, assess performance, verify answers, and provide precise outcomes, enhancing the efficiency and accuracy of assessments. Overall, the integration of AI in TE education in Nigeria empowers both instructors and students, fostering a dynamic and personalized learning environment conducive to skill development and academic success.
- Virtual Reality and simulation: The incorporation of AI-driven virtual reality (VR) and simulation technologies into Technical Education (TE) programmes has significant potential to transform vocational education. These cutting-edge tools offer students

practical and interactive educational experiences, allowing for hands-on teaching and learning opportunities. VR and simulation technologies enable students to engage with 3D models of technical components and systems, replicating real world environments. This facilitates immersive learning in subjects such as automotive, HVAC, electronics, and renewable energy. Additionally, the use of virtual reality (VR) and simulation learning can effectively decrease educational costs by offering a digital substitute for conventional practical training, while simultaneously improving competence in contemporary skills relevant to the 21st century. By incorporating virtual reality (VR) and simulation learning into Learning Management Systems (LMS), educational institutions in Nigeria can effectively track students' advancement and guarantee their attainment of the designated learning goals. By integrating virtual reality (VR) and simulation-based learning into Technical Education (TE), educational institutions in Nigeria can provide substantial learning prospects while enhancing student involvement. The future of TE training in Bali is anticipated to be a blend of in-person sessions and virtual reality (VR) components. This approach acknowledges the significant impact that VR and simulation technologies can have on Vocational Education and training, especially in Technical subjects. By utilising virtual reality (VR) and simulation learning, students in Nigeria can gain hands-on skills in a controlled and secure setting, effectively addressing the issues arising from inadequate resources and materials for both students and teachers. Therefore, the implementation of virtual reality (VR) and simulation technologies in Technical Education (TE) programmes in Nigeria holds the potential to improve the standard and availability of vocational education, equipping students with the necessary skills for achievement in the contemporary labour market.

- Reduce the Administrative duties: The incorporation of Artificial Intelligence (AI) to mechanise administrative duties in Technical Education (TE) establishments offers substantial advantages for both instructors and learners. By employing artificial intelligence (AI) to automate tasks like assessing assignments and delivering tailored feedback to students, educators in Nigeria can conserve precious time that can be reallocated to more significant facets of their responsibilities. This is especially pertinent in Technical Education (TE) institutions, where students frequently participate in

practical projects and assignments that demand extra time and attention from educators. Moreover, AI can aid instructors in detecting areas of student difficulty by analysing performance data and offering insights into areas of inadequate performance. This allows educators to provide more individualised instruction and mentoring to assist students in overcoming challenges, ultimately improving the educational standards in Technical Education (TE) institutions. AI in Nigeria relieves teachers of administrative tasks, allowing them to concentrate on guiding and coaching students to reach their maximum potential (Hassan, Z. B., Janius, N., Atan, N. A., &

- Idris, M. D. B., 2018). This contributes to enhancing TE education in the area. Hence, the integration of artificial intelligence (AI) into administrative tasks within Technical Education (TE) institutions in Nigeria not only simplifies procedures but also enriches the educational journey for students, ultimately equipping them for triumph in their respective areas of interest.

Benefit of Artificial Intelligence (AI)

AI brings benefits and opportunities to education by facilitating personalization of learning, providing instant feedback and improving efficiency in the assessment process. Thus, artificial intelligence can be integrated into online learning platforms, allowing content and activities to be customized according to the needs and knowledge level of each student. Learning management systems can use artificial intelligence to provide personalized recommendations, automatic feedback and monitor student progress. Thus, students can access relevant materials and resources according to their individual needs. Virtual reality can also help students encourage collaboration and teamwork, and tools like social media can be used to connect students with their peers and instructors.

Challenges of Integrating Artificial Intelligence (AI) in Nigeria Educational System

The use of Artificial Intelligence technology in education has become an increasingly popular topic in recent years. AI offers a lot of potentials to enhance students' learning experiences, assist teachers in delivering more effective instructions, and even identify learning issues that may go unnoticed by humans. However, the use of Artificial

Intelligence in education also raises some concerns and challenges. One major concern is that the use of this technology may replace the role of humans in teaching and learning, thereby reducing important human interaction for students' social and emotional development.

Additionally, concerns arise regarding student data privacy and ethical issues related to the use of this technology in instruction. From its development, several opportunities and challenges for the future development of Artificial Intelligence have emerged.

While internet access and the use of ICTs are not yet a reality in some areas, connectivity is now a basic requirement for education and training institutions and their students, and has a direct effect on the type, scope and quality of the training programmes that can be delivered.

Despite the innovative importance and growth of artificial intelligence technology, it has indeed been faced with some significant challenges especially in developing nation like Nigeria. Nigeria as a nation must endeavour to overcome these challenges in order to improve artificial intelligence. Some of the challenges are seen below.

- **AI human interface**

  There is a clear shortage of advanced skills that will interface between Nigerians and AI technology. The challenge here is the shortage of data science skills with which humans get maximum output from artificial intelligence.

- **Inadequate investment**

  Another challenge of artificial intelligence in Nigeria is that not all business owners or managers are willing to invest in it. The funds required to set up and implement Artificial Intelligence is very high, thus not every business owner or organization want to invest in it.

- **Software malfunction**

  A case of software or hardware crash could be highly frustrating to researchers especially in Nigeria where storage and retrieval systems are poor as no technology is perfect. Hence, software tasks performed by humans can be difficult to trace and this kind of problem can be frustrating and discouraging.

- **Cultural and religious barriers**

  There is so much religious intolerance that seriously militates against AI technology in Nigeria. Cultural affiliation and religion bigotry are the two most common barriers to the development of Nigeria; hence AI technology is not spared. Language barrier might not be much of a challenge to artificial intelligence progress in Nigeria, but persons of the same tribal affiliation are usually biased in working cooperatively with other tribes especially in knowledge acquisition.

Conclusion

In general, the incorporation of Artificial Intelligence (AI) into Technical Education (TE) programs in Nigeria offers a multitude of benefits. These benefits include the creation of personalized learning experiences, the enhancement of skill development, and the expansion of job opportunities (Janius, N., Hassan, Z. B., Atan, N. A., & Idris, M. D. B., 2018). Adaptive Learning Systems (ALS) have emerged as an innovative method to transform the conventional teaching model in the field of scientific education. Artificial intelligence (AI)-driven Adaptive Learning Systems (ALS) aim to individualise the learning process for every learner, departing from the standardised approach, Adeyemi (2020). ALS, ITS, and Virtual Laboratories/Simulations in scientific education showcases the revolutionary capacity of AI. These technologies not only tackle conventional difficulties but also facilitate personalised, captivating, and efficient learning experiences for secondary school students in Nigeria and other places (Nguyen & Rasmussen 2016). The diverse and comprehensive utilization of AI in scientific education indicates a transition towards a pedagogical environment that is more responsive to individual student needs, centred on students, and enhanced by technology (Adeyemi, 2020).

Television and Vocational Education and Training (TE) institutions in Nigeria can significantly improve the quality of education and better prepare students for the evolving demands of the contemporary job market if they take advantage of the benefits of artificial intelligence (AI) and address the challenges that it presents. Although there are significant benefits associated with artificial intelligence (AI), it is essential for all parties involved to maintain vigilance regarding the potential drawbacks of AI and to ensure that

the technology is used responsibly to prevent its misuse. As the demand for skilled professionals in technical fields such as engineering and technology continues to rise, the incorporation of artificial intelligence (AI) into technical vocational education and training (TE) holds the potential to improve the sector's efficiency and relevance in Nigeria and beyond. It is essential for individuals and society to take an active role in embracing these advancements, cultivating an atmosphere of adaptability and readiness to take advantage of the opportunities that are presented by artificial intelligence technology in Technical Education (TE). Nigeria can position itself at the forefront of technological innovation in vocational education by taking informed action and working together with other organisations. This will pave the way for a world that is more prosperous and competitive in the future. Therefore the vocational school and institution in Nigeria, may grab this opportunity to implement the new Teaching and Learning pedagogy process by using AI so that our students can be more advance and can be more competitive in real world in the vocational field.

Recommendations

Considering the importance, challenges and applications surrounding artificial intelligence in Nigeria, the following recommendations emerged from the finding of the study to enhance its development that:

1. To address the shortage of qualified instructors, there should be focused efforts on training and up skilling educators in AI and related technologies. This could involve specialized training programmes, partnerships with industry experts, and continuous professional development initiatives
2. Government and private sector collaboration is essential to overcome the financial and technical barriers hindering AI integration in TE. This could include securing funding, providing incentives for private sector investment, and establishing public private partnerships to share resources and expertise.
3. There is an urgent need for substantial investment in AI-related infrastructure within TE institutions. This includes modernizing facilities, providing access to AI tools and technologies, and ensuring that students have hands-on experience with the latest advancements. TE programmes should be updated to include AI-related courses and concepts. This will require a comprehensive review of current curricula and the development of new, relevant content that aligns with global standards and the needs of the modern workforce.
4. The government should develop and implement policies that support the integration of AI in TE. This includes creating a conducive regulatory environment, offering incentives for

AI adoption, and ensuring that policies are aligned with the goals of enhancing employability and economic growth.

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