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ASSESSING ARTIFICIAL INTELLIGENCE ROLE IN REPOSITIONING TECHNICAL AND VOCATIONAL EDUCATION TRAINING (TE) FOR NIGERIAN'S ECONOMIC DEVELOPMENT

***MR. EDO, S. N.; & **EDO, S. A.**

*Department of Agricultural Education, College of Vocational Education, Federal University of Education, Kano. **Department of Business Education, College of Vocational Education, Federal University of Education Kano.

Corresponding Author: sabedofreniqz@gmail.com

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Abstract

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. As the global economy increasingly relies on AI technologies, it is imperative for TE programmes to align their curricula with these advancements to equip students with relevant skills but there seems to be scarcity of studies that dwell on integration of AI in TE and there is the need to assess the role played by artificial intelligent in repositioning the programmeme. Therefore, this paper focused on the assessment of the role of Artificial Intelligence in reposition of Technical Education (TE) for economic development in Nigeria. To achieve the broad aim, this study identifies existing challenges, and highlights the transformative potential of integrating AI into TE. The population of the study was 300 NCE students of Kano Federal University of Education. A total enumeration sampling technique was applied because the population is of manageable size. A validated 15 items questionnaire, designed by the researcher on four point scale ranging from strongly agree (4) –

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Strongly Disagree (1) was used for data collection. Reliability of the instrument was ensured using split-half reliability technique which yielded a cumulative coefficient of 0.79. Data collected were analyses using mean and standard deviation to answer the research questions. 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 TE institutions to providing access to AI tools and technologies and TE programmes should be updated to include AI-related courses and concepts.

Introduction

Nigeria, with over 200 million people, is the most populous nation in Africa and ranks seventh in the world in terms of population (Nigeria Multidimensional Poverty Index, 2022). Nigeria, the largest economy in Africa by nominal GDP, estimated its nominal GDP at 362.81 dollars in 2023 (World Bank, 2023). As population keeps increases in the country, Repositioning TE for economic development is apt considering the current situation our country, Nigeria, is passing through. This is because it will help in addressing the challenges of unemployment, poverty, and insecurity that affects many people in the country. According to Abayomi and Adebayo (2020), TE stands for Technical and Vocational Education and Training. Technical and Vocational Education and Training (TE) is now a critical component in the education system, which is designed to equip individuals with the practical skills and knowledge necessary for specific trades and professions. As industries rapidly evolve with technological advancements, particularly in artificial intelligence (AI), integrating these technologies into TE programs has become increasingly vital. TE has long been recognized as a vital tool for enhancing productivity, reducing poverty, and promoting sustainable economic growth (Pavlova, 2014).

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).

In TE, AI can provide tailored learning experiences, automate routine tasks, and analyses data to improve decision-making. As industries increasingly adopt advanced technologies, the demand for a workforce skilled in AI and related technologies grows, making the integration of AI in TE not just beneficial but necessary (Ng & Nicholas, 2020). This approach not only enhances student engagement and motivation but also increases the likelihood of successful skill acquisition and application. However, advancements in AI have introduced various tools and applications that can significantly enhance the learning experience within TE programs. For instance, Intelligent Tutoring Systems (ITS) and adaptive learning platforms utilize AI to tailor educational content to individual learners' needs and progress, fostering a more personalized and effective learning environment (Woolf et al., 2019). Additionally, AI-driven simulations and virtual reality environments offer immersive, hands-on training experiences that closely replicate real-world scenarios, crucial for vocational education. These innovations improve the quality of teaching and ensure that students are better prepared for the demands of the modern workforce (Baker & Smith, 2020).

The existing TE programmes in Nigeria include various courses offered at technical colleges, polytechnics, and vocational training centers. These programmes cover fields such as engineering, agriculture, business, and information technology. Despite the potential benefits, integrating AI into TE is not without challenges. High implementation costs, insufficient infrastructure, and resistance to technological change are significant barriers. As well as the significant misalignment of programs between the skills taught and the needs of the labor market (Ayonmike, Okwelle & Okeke, 2015). Employers

frequently report a gap between the competencies of TE graduates and the practical skills required in industries, suggesting that curricula often lag behind technological advancements and industry standards. One of the most pressing issues facing TE in Nigeria is the inadequacy of infrastructure and resources. Many TE institutions suffer from outdated equipment, insufficient teaching materials, and poorly maintained facilities (Ekpenyong & Nwaboku, 2020). This lack of resources hinders the ability of these institutions to provide quality education and practical training, thus affecting the competency of graduates. Furthermore, ethical considerations regarding data privacy and algorithmic bias must be addressed to ensure equitable access to AI-enhanced educational opportunities (Selwyn, 2020).

This study aims to comprehensively understand these issues, offering insights into current applications, benefits, challenges, and future prospects of AI in TE. Artificial intelligence (AI) integration in Technical and Vocational Education and Training (TE) has gained significant attention recently. AI technologies offer a range of applications that enhance the learning experience by providing personalized instruction, automating administrative tasks, and delivering data-driven insights. For instance, AI-driven learning analytics can track student performance and predict outcomes, enabling educators to intervene early and tailor support to individual learners (Baker & Smith, 2020). Similarly, adaptive learning platforms adjust the difficulty and style of content delivery in real time, ensuring that students remain engaged and adequately challenged (Zawacki-Richter et al., 2019). These innovations are precious in TE, where hands-on, practical training is crucial for student success. Recent advancements have also seen the development of AI-driven simulations and virtual reality environments that offer immersive training experiences. These tools allow students to practice and refine their skills in a controlled, risk-free environment that closely mimics real-world scenarios (Hwang & Chang, 2021). For example, virtual welding simulators and AI-powered automotive repair trainers allow students to gain practical experience without real equipment's associated costs and dangers (Sacked & Bester, 2020). Such technologies enhance the quality of vocational training and make it more accessible to a broader audience, including those who may not have access to traditional training facilities.

Despite these benefits, integrating AI in TE is not without its challenges. One significant barrier is the high cost of implementing AI technologies, which can be prohibitive for many educational institutions (Khan et al., 2022). Additionally, there is often inadequate infrastructure, such as reliable internet connectivity and modern hardware, particularly in developing regions. Furthermore, resistance to change among educators and administrators can impede the adoption of AI solutions. There are also ethical concerns regarding data privacy and the potential for algorithmic bias, which must be carefully managed to ensure fair and equitable access to AI-enhanced education (Selwyn,

2020).Looking ahead, the future prospects of AI in TE are promising, provided that these challenges can be addressed. Emerging trends such as AI-powered virtual reality training, block chain for credentialing, and advanced data analytics can potentially transform vocational education (Huang et al., 2023). Collaboration between educators, technology developers, and policymakers will be essential to harness these advancements and ensure that AI is used to its fullest potential in TE.

Future research should focus on developing cost-effective AI solutions, improving infrastructure, and addressing ethical concerns to fully realise the benefits of AI in enhancing TE (Wang & Yang, 2023). By doing so, TE can better prepare students for the demands of the modern workforce and contribute to a more skilled and adaptable labour market. Problems Nevertheless, Nigeria still faces structural challenges like unreliable electricity and limited internet connectivity in many parts of the country; these keep technology adoption and innovation low (Oghuvbu et al., 2022; Ekeinde et al., 2022). Poor government funding continues to make research funding inadequate in Nigeria compared to developed countries (Echono, 2023). Other challenges include restricted data access, a scarcity of AI professionals, and the absence of clear policies guiding responsible AI use and advancement. Nevertheless, Nigeria's large population, fast-growing IT sector, and natural resources that have not been fully tapped presented a massive opportunity for development and the expansion of AI technologies.

Statement of the problem

Nigeria faces multiple obstacles that prevent it from exploiting AI innovations for economic development and technical innovation, despite the potential benefits, the rapid advancement and the integrating of Artificial Intelligence (AI) technologies into Technical Education (TE) systems worldwide is not without challenges. In Nigeria, TE institutions lack sufficient AI infrastructure, possess limited skilled professionals and inadequate funding for AI research. Furthermore, unstable power supply, inadequate Internet accessibility outdated curricula, inadequate infrastructure, and a mismatch between the skills taught and the needs of the labor market. These issues are worsen by limited access to modern technologies. The integration of AI into TE has the potential to enhance the quality and relevance of vocational training, tailoring it more closely with the evolving demands of the economy. Therefore, there is a significant gap in knowledge regarding the current state of AI integration in Nigerian TE, the barriers to its adoption, and its potential impact on economic development. Addressing these challenges is crucial for repositioning TE to support Nigeria's economic growth and competitiveness in the global market.

Purpose of the Paper

This study aims at assess Artificial Intelligence role in reposition of Technical Education for economic development in Nigeria. Specifically, the study sought to determine:

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

Research Questions

1) What are the key challenges and barriers to incorporating AI into TE in Nigeria?
2) Can AI integration in TE contribute to economic development in Nigeria?

Methodology

This study employed a descriptive survey design. This design was considered appropriate because the researcher is interested in collection of data from the respondents based on opinions, perception regarding the role of AI in repositioning TE. The population of the study was NCE 300L students of federal University of Education, Kano. A total enumeration sampling technique was applied because the population is of manageable size. Therefore, the sample size was 200 students. A 15 items questionnaire, designed by the researcher was used for data collection. The instruments were designed on four likert scale of Strongly Agree (SA) = 4, Agree (A) = 3, Disagree (D) = 2, Strongly (D) = 1. The instruments were validated by experts in Faculty of Vocational and Technical Education in Federal University of Education, Kano respectively to ensure face and content validity and comments and suggestion the experts were incorporated to produce the final version administered for data collection. Reliability of the instrument was ensured using split-half reliability technique which yielded a cumulative coefficient of 0.79. Data collected were analyses using mean, standard deviation. The mean and standard deviation was used to answer the research questions.

Results

Table 1: Descriptive Statistics Showing Challenges and barriers of incorporating AI in TE

SN	Challenges and barriers of AI	Mean	Standard deviation	Decision
1	Lack of skilled personnel affect the integration of AI in TE programmes	3.20	0.62	Agreed
2	Nigerian institutions face financial constraints in the adoption of AI Technologies in TE	3.28	0.55	Agreed
3	Cultural or societal attitudes impede the adoption of AI in Nigerian education	3.32	0.79	Agreed

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4	Government policies and regulations impact the incorporation of AI in TE	3.32	0.07	Agreed
5	Technical challenges (e.g., access to electricity, internet connectivity) hinder AI integration in TE	3.30	0.65	Agreed
	Grand Mean	**3.28**		**Agreed**

Data in Table 1 revealed that all the five items on the challenges of AI integration in TE had their mean rating between 3.20 - 3.30 with a grand mean of 3.28 above the cuf-off point of 2.50. This result shows that the respondents agreed the five identified challenges on AI integration into TE programme in Nigeria for economic development. Challenges such as lack of skilled personnel, financial constraints, Cultural or societal attitudes, Government policies and regulations and technical challenges such as access to electricity and internet connectivity hinder AI integration into TE programme.

Table 2: Descriptive Statistics Showing how AI Integration in TE can contribute to Economic Development

SN	AI in Technical Education	Mean	Standard deviation	Decision Rule
1	AI integration in TE programmes will improve the employability of graduate	2.85	4.82	Agreed
2	AI-driven skills acquired in TE will boost productivity in key Nigerian industries	3.52	0.54	Agreed
3	AI in TE play crucial role in fostering innovation and entrepreneurship among students	3.15	0.61	Agreed
4	Adoption of AI in TE will bridge the skills gap in the workforce	3.20	0.32	Agreed
5	Integration of AI in TE has the potential to impact overall economic growth	2.91	0.80	Agreed
	Grand Mean	3.12		**Agreed**

Data in table 2 revealed that all the five items on AI integration in TE can contribute to economic development had their mean rating between 3.89 – 3.4 with a grand mean of 3.12 which are all greater than the cut-off mean of 2.50. This result showed that the respondents agreed that AI integration into the curriculum of TE will contribute to the development of Nigeria economy.

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Discussion of Findings

Finding of research question one showed that currently AI has not been fully integrated into TE programme in Nigeria. This result may not be unconnected to concern of stakeholders that the use of AI in education may limit students' ability to develop critical thinking and independent problem-solving skills and the non-readiness of government through relevant agencies to formulate policies and provide resources necessary for AI integration in education especially in TE (Akgun & Greenhow, 2022). This finding is consistent with the report of Eno et al. (2024) that despite the global acceptance and use of generative AI, its full potential integration particularly in teaching and learning, has not been fully realized. Also, it is in line with the expression of Shuaibu (2024) that the poor integration of AI in vocational education is as a result of various hurdles such as inadequate infrastructure, shortages of qualified trainers and AI experts, and ethical considerations regarding data privacy and bias mitigation. The study found in research question two that AI integration in TE is confronted with challenges such as lack of skilled personnel, financial constraints, Cultural or societal attitudes, Government policies and regulations and technical challenges such as access to electricity and internet connectivity hinder AI integration into TE programme. This may be attributed to poor funding of education sector by Nigeria government which affects a lot of things including technology integration in TE. This result aligns with the report of Zhang et al (2019) that apart from opportunities of AI integration, there are significant challenges to address which include issues of equity, privacy, and the ethical use of AI. This finding is in tandem with the report of Shuaibu (2024) that the integration of AI in TE is as a result of various challenges such as inadequate infrastructure, shortages of qualified trainers and AI experts, and ethical considerations regarding data privacy and bias mitigation. The finding is similar to the report of Suharsono, D. (2023) that the main challenges faced by vocational education in adopting AI include data security, unequal access to technology, and uncertainty regarding the roles of humans and machines. Finding of research question three revealed that AI integration into the curriculum of TE will contribute to the advancement and development of Nigeria economy.

This finding may be attributed to the fact that the integration of AI technologies in TE will help re-organized and re-structured TE and training system aimed at fostering economic growth by generating new skills and creating avenue for revenue generation in the economy. This result is consistent with that report of Olojuolawe (2024) that the adoption of artificial intelligence would positively influence the growth of technical education and the marketability of its graduates in the labour market thereby advancing the economy. The finding also aligns with the report of Amdan et al. (2024) who stress that by adopting AI-assisted education, TE sector can initiate a profound transformation aimed at enhancing educational achievements, promoting innovation, and equipping the

workforce with the necessary skills for the modern economy. Similarly, Eno et al. (2024) proposes that Also, integration of generative AI pedagogical strategies in the curriculum will create avenue for comprehensive training programs for TE educators, develop repository interactive platforms including online courses and tutorials tailored to building digital literacy in TE and promote students' employability, entrepreneurship, and socioeconomic advancement in the digital era. The study revealed from the aspect of hypothesis that there is no significant difference between mean response of male and female students on the role of AI integration into TE curriculum in contributing to economic development in Nigeria is hereby accepted.

This result may be connected to the fact that everyone (male and female) are becoming aware and embracing the potential advantages of AI in education and all aspects of the economy. This result is consistent with the report of Ukeh and Anih (2024) that there was no statistically significant distinction found in mean ratings of male and female lecturers regarding the utilization of artificial intelligence-based tools for teaching and research. The finding also aligns with the report of Audu et al. (2023) that there is no significant difference between the mean scores of male and female students on the extents extent of artificial intelligence supporting students' academic performance in public universities in North-Central, Nigeria is accepted.

Conclusion

The study concluded from the findings that AI is currently not well-integrated into Nigerian TE programmes and this is due to various challenges which include absence of AI-related courses, inadequate infrastructure, and a shortage of qualified instructors which significantly hinder the effectiveness of these programmes in preparing students for the demands of a technologically advanced labour market. It was also concluded that despite these challenges, there is a positive belief regarding the potential of AI integration in TE in shaping the Nigeria economy. If properly implemented with good policies, AI could substantially enhance graduates employability, boost industrial productivity, stimulate innovation and entrepreneurship, bridge the workforce skills gap, and contribute to overall economic growth in Nigeria.

Recommendations

The following recommendations emerged from the finding of the study 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.
4. 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 .
5. 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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