

THE ADOPTION OF ARTIFICIAL INTELLIGENCE FOR TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING (TVET) IN NATIONAL DEVELOPMENT.

UKELINA, CHRIS UGWUAKONG

07038373874, ukelinachrist04@gmail.com;

Department of Agricultural Education,
FCE, Obudu, Cross River State.

&

UTSU, SOLOMON U.

Department of Agricultural Education,
FCE, Obudu, Cross River State.

Abstract

Integrating Artificial Intelligence (AI) into educational systems generally has become globally imperative, specifically for Technical and Vocational Education and Training (TVET), considering the dynamic nature of the job market demands and the speed at which technology evolves. AI is key to fostering personalized learning, predictive assessment, and curriculum alignment with Industry 4.0 standards. The review showed that Nigeria faces considerable barriers to adopting AI within its TVET landscape, despite mounting evidence that AI can bridge workforce skill gaps, improve employability, and support national development goals. The country grapples with challenges such as limited infrastructure, fragmented policies, insufficient teacher training, and socio-cultural stigmas surrounding TVET programs. And that the adoption of AI in Nigerian for TVET remains fragmented, often descriptive, and lacking in comprehensive synthesis.

Key Words: Artificial intelligence, Technical and vocational Education, National Development

Introduction

Education is an essential tool for achieving development is undergoing a profound transformation globally driven by the integration of Artificial Intelligence (AI) technologies into teaching, learning, and assessment processes. It is obvious in Nigeria today that the current economic trends are not sustainable and that public awareness, education and training are keys to moving the society toward sustainable development. That is, the form of education that promotes the acquisition of appropriate skills and competence in the individual to live and contribute to the development of oneself, the society and the nation at large. No nation can hope to grow and advance technologically without trained individuals with relevant skills, knowledge, values and abilities required in all sectors of the nation's economy. Technical and vocational and training (TVET) is that form of education which can help the nation to produce individuals that can competently stir the various sectors of the economy.

Integrating Artificial Intelligence (AI) into educational systems generally has become globally imperative, specifically for Technical and Vocational Education and Training (TVET),

considering the dynamic nature of the job market demands and the speed at which technology evolves. AI is key to fostering personalized learning, predictive assessment, and curriculum alignment with Industry 4.0 standards (Stephen, 2021).

Countries like India and China support the advancement of AI by planning skills and tactics for developing talent, such as setting up specialized colleges and higher education courses. Then, they provide infrastructure by creating industrial centers that provide the hardware, software, and connectivity needed to spur industry innovation (Shiohira, 2021). Also, western nations like Sweden and Denmark's priorities for skill development include fostering industry-government collaborations to develop tertiary education in AI, promoting lifelong learning and career mobility, and establishing new positions that combine teaching and research (Vinnova., 2018). Similarly, considering the importance of AI in skills development, the Australian government developed a strategic framework for integrating AI into education, including AI awareness, advancing social and human welfare, and ethical strategies (Commonwealth of Australia, 2023).

Nigeria, however, faces considerable barriers to adopting AI within its TVET landscape, despite mounting evidence that AI can bridge workforce skill gaps, improve employability, and support national development goals (Stephen, 2021). The country grapples with challenges such as limited infrastructure, fragmented policies, insufficient teacher training, and socio-cultural stigmas surrounding TVET programs (Ukeje et al., 2024). Existing research on AI in Nigerian TVET remains fragmented, often descriptive, and lacking in comprehensive synthesis.

Sustainable education should involve four major thrusts namely: improve basic education, reorient existing education to address sustainable development, develop public understanding and awareness of technical and vocational education, and training (TVET). The inability of government to promote a sustainable TVET programme make Nigeria to be a consumer of goods, a dumping ground for fairly used products, and a rent collecting economy. For Nigeria to be removed from this status there is, therefore, an urgent need to restructure the Nigerian education system. This can possibly be done through sustainable technical and vocational education and training. For vocational and technical education (VTE), where practical and skill-based training forms the core, AI offers unique opportunities for improving instructional efficiency, creativity, and innovation. AI has evolved from a futuristic concept into a functional educational resource capable of reshaping how knowledge is created, shared, and applied. According to UNESCO (2023), AI represents a revolutionary force in redefining educational delivery by supporting adaptive learning systems, automating assessment, enabling predictive analytics, and creating personalized learning environments.

Technical and vocational education and training curriculum in Nigeria

Technical and vocational education and training (TVET) is a term that refer to all aspects of the educational process involving, in addition to general education, the study of technologies and related sciences and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic and social life (FRN, 2014). The policy equally stated the goals of TVET to include among others the provision of trained manpower with technical knowledge and vocational skills necessary for agriculture, applied science, technology commercial and economic development of the country.

As lofty as this may be, the current curriculum as it is being operated has not enabled the citizens to live sustainably. Enabling people to free themselves from poverty and to build sustainable livelihood is a key role for both education and a prerequisite for sustainable development, which brings together three pillars of development: society, environment, and economy (UNESCO, 2008).

The inclusion of TVET in the curriculum has been an integral part of national development

strategies the world over and Nigeria cannot be an exception because of its impact on human resource development, productivity and economic growth (Chaedar, 2002). The curriculum of education in Nigeria has been based partly on theory and heavily bias toward examination and certification. This has resulted in a negative attitude towards technical and vocational education by citizens as it is thought to be meant for school dropouts and the never do well academically. Whereas the national policy on education originally had its cardinal objective to promote the acquisition of appropriate creative skills, abilities and competence both mental and physical as equipment for the individual to live in and contribute to the development of the society (FRN, 2014).

Now, over sixty years of Nigeria's existence as a nation, there seemed to be no established institutional apparatus nor did it seem likely that a sustainable curriculum would be put in place in the nearest future. According to Obanya in Ezeh and Ore (2016), the current educational system in Nigeria is too examination conscious, thus students study to pass examination and gain little or no knowledge. He maintained that the manpower to change the system is there, but the political will was lacking as most government policies on education were mere “pronouncements and not policies” and that, for such to be policies, they must be interactive and participatory. This may be one of the reasons for high levels of unemployment in the country. Thus, the need to restore our attitude and consciousness about TVET cannot be over emphasized.

A critical look at the Nigerian education sector reveals the challenges of incoherence in policy formulation and implementation. Unsuccessful attempts have been made in the past to restructure the curriculum but the implementation has remained a major problem. There is need for enactment, enlightenment and enforcement of the right and sustainable educational curriculum in general and specifically that of the technical and vocational education.

In spite of its impact on the economy, TVET is still not given the place it deserves and this may be one of the reasons for the rising unemployment rate, unemployable graduates, and poverty in the country. It is now commonly said that Nigerian graduates are unemployable. The education curriculum as operated in Nigeria requires students of agricultural science to undergo one year practical programme as part of the total training period as it is the standard in most faculties and colleges or agriculture all over the world. However there are no places to send the students for their training to acquire practical skills as prescribed by the curriculum. **(Bisong, J. A., Orebiyi, B. and Osazee, M. A. (2024)).**

At this point in our national history, that is, almost half a century after independence, Nigeria still have limited functional research centres, standard farms (crops and animals) agricultural engineering training centres for students to be sent to for their one year training for vocational skills. This limits the acquisition of practical skills for agricultural development. This is why 99% of Nigerian farmers are still subsistence farmers and are still using crude implement and methods to farm with limited access to farm inputs, in spite of the many universities and colleges of agriculture in the country.

Conceptually, educational stakeholders hardly differentiate between the terms technical and vocational education. It had been wrongly held in the society that TVET is for those who are incapable of pursuing academic programmes. Thus vocational and technical education has made slow progress over the years. For the avoidance of doubt vocational education is that skills based programme designed for sub-professional level education and based on a specific vocation. While technical education is that which facilitates the acquisition of practical and applied skills as well as basic scientific knowledge. The difference between the two terms is that vocational education is

designed for a particular vocation while technical education does not target any particular vocation, but gives general technical knowledge. Therefore, while every vocational education programme is technical in nature, not all technical education programmes are vocational Chinedu, C. C. & Olabiyi, O. S. (2015).

The current system of vocational training in agriculture is inadequate to meet the skill requirement of rapid food production which is evident by high level importation of cereal and livestock products. The existing agricultural vocational education system will need to be restructured, additional resources provided, and well established and funded apprenticeship centres provided to improve output. The vocational training or apprenticeship centres can be made to charge fees at least for the more specialized courses which should be ploughed back to make the scheme sustainable. There should be less emphasis on certificates or examinations in implementing the curricula content of the various programmes. Emphasis should be on practical skills acquisition. The teaching of pre-vocational subjects in the primary and junior secondary schools should be stressed and taken very seriously to raise the interest of students for the vocational programmes at their early growth stage (Ali, I; Muhammad, R. R; Azlan Bin, A, L, Amirmudin, B, U, Muhammad, S. S, and Yahya, B, B. (2012)).

The problems related to curricula became noticeable soon after Nigeria's independence from colonial rule in 1960 as stakeholders in the Nigeria educational system were rethinking the education system by mid-1960s with particular reference to the curriculum being taught in the schools (Oghiagbephan, 2015). Till date the Nigeria educational policy is not capable of providing the needed manpower development to stir the nation's socio-economic needs left by the colonial master. According to Oghiagbephan this is due to the non-directional policies issue of government which is the main bane of the educational system with particular reference to the curriculum structure. It is now traditional for the country's leaders to abandon a policy mid-way resulting in more than three different educational systems so far engaged in the country since independence.

There is need to push for a well redesigned, monitored, controlled and implementable curriculum programme. That curriculum should equip the child with the requisite functional and entrepreneur skills of becoming self-employed on graduation. That curriculum is said to be functional or sustainable. A functional curriculum is one that is designed to teach students skills which allow them function as competent and accepted adults and emphasizes independent living skills, vocational skills as well as social and communication skills (Oladiran, S. O. & Uzoka, N. (2020)).

In agriculture, evidence suggests a positive correlation between vocational education and productivity among farmers using modern technologies or AI assisted tools, but less impact as might be expected among those using traditional methods due to lack of training. According to Birdsall (1993) the farmers with four or more years of vocational education were more likely to adopt new innovations and modern inputs than the less educated ones. Also in Nepal, the completion of at least seven years of vocational training in agriculture increased productivity of wheat by over a quarter, and rice by 13% (Jamison and Moock, 1994).

TVET is an important contributor to technological capability and technical change in industry, increasing human capital, and economic efficiency. This may not be achieved in Nigeria if there is no correlating relevance between school curriculum and labour need (Oghiagbephan, 2015) Therefore, he called for a policy to institute one year attachment scheme to every degree and non-degree awarding programmes in the nation's institutions.

The 6th edition of National Policy on Education addresses some of the concerns of sustainable TVET at formulation stage. However, there are serious challenges with its implementation. These include; inadequate funding of TVET, inadequate teaching and training facilities and centre, policy somersault of the government, negative perception of TVET by the society, shortage of teaching personnel (Okolie, Igwe, & Nwajiuba, 2022). Consequently, the gap between classroom learning and industry requirements continues to widen, leaving graduates inadequately prepared for employment in technologically advanced work environments.

Artificial Intelligence, with its broad range of applications such as intelligent tutoring systems, robotics, machine learning, and data-driven diagnostics, offers a strategic solution to these long-standing deficiencies. The incorporation of AI tools in vocational training can provide students with access to intelligent simulation environments where they can perform complex tasks, test real-world scenarios, and receive immediate performance feedback (Audu & Otu, 2020).

AI and Technical and Vocational Education and Training (TVET).

Artificial intelligence (AI) is transforming vocational education in exciting ways. A few examples of the ways AI is transforming TVET include the following:

- (i) Personalized learning paths: AI tailors training to individual students' needs, pace, and learning style.
- (ii) Simulated training environments: AI-powered simulations mimic real-world scenarios, reducing risks and costs
- (iii) Skills assessment and feedback: AI tools provide instant, data-driven feedback, helping students improve faster
- (iv) Predictive support: AI identifies students at risk and suggests interventions

In Nigeria, AI in vocational education could boost skills development in the following areas:

- (i) Tech skills: Coding, data analysis, cyber security
- (ii) Industry 4.0 skills: Automation, robotics, and AI itself
- (iii) Practical trades: AI-enhanced training for mechanics, electricians, plavers, etc.

Technical and Vocational Education and Training is inherently practical, requiring active participation, experimentation, and hands-on experience. The traditional approach to TVET instruction in Nigeria relies heavily on teacher demonstrations and repetitive manual practice. However, this model is constrained by limited access to modern tools and consumable resources. AI's entry into this domain marks a paradigm shift from routine manual teaching to smart learning environments characterized by automation, virtual simulation, and real-time performance analytics. For example, AI-based intelligent tutoring systems (ITS) can mimic the role of human instructors by providing personalized guidance, while machine learning algorithms can track student progress and suggest corrective measures. These features are particularly valuable in disciplines like computer hardware maintenance, where diagnostic precision, procedural sequencing, and creative problem-solving are essential (Moustafa, M & Moustafa, W (2013)). Moreover, AI-integrated augmented reality (AR) and virtual reality (VR) tools allow students to explore 3D models of circuits and hardware components interactively in electronics studies, which enhances conceptual understanding and reduces dependency on physical laboratories (Chen & Huang, 2022).

Technical and Vocational Education and Training and National Development

National development is like building a solid foundation for a country's growth. It involves improving economic, social, and political aspects to enhance citizens' quality of life. It includes:

- Economic growth: Boosting industries, infrastructure, and job creation
- Education and skills: Equipping citizens with relevant skills for the modern world

- Healthcare: Ensuring access to quality medical services
- Infrastructure: Building roads, energy, and digital connectivity

Well trained graduates of vocational education will be employers of labour. (Nwanoruo and Oporum (2008), have stated that vocational and technical education is a gateway to real growth and development of Nigeria as a nation. Sokyes, and Zakka (2009) posited that vocational and technical education is skilled- oriented and employment motivated; as it is very obvious that vocational education in the era of ICT is an indescribable means of reducing unemployment in our society.

To alleviate the age long problem of graduate without employment, vocational and technical education plays the role of training the Nigeria youths in the definite skills such that the gap between the labour market and the preparatory courses is bridged by employing AI tools in technical and vocational and training. This would ensure individuals possess the relevant skills in the jobs that exist in the society (Moustafa, M. and Moustafa, W. (2013)).

They five key innovation attributes influencing the adoption process: relative advantage, compatibility, complexity, trialability, and observability. These attributes align well with the dynamics of integrating AI in TVET systems in Nigeria, where perceived advantage, contextual fit, and infrastructure readiness play vital roles.

In the context of Nigerian TVET, relative advantage corresponds to the perceived benefits of AI tools in improving teaching, learning, and administrative processes. Compatibility addresses how AI aligns with existing educational practices, cultural expectations, and national curricula. Complexity relates to challenges in implementing AI systems, especially in under-resourced environments. Trialability and observability highlight the importance of pilot programs and visibility of success stories to encourage wider adoption. (Olabiyi, O. S (2018))

Economically it is observed that times are shifting to stages of graduates not being employees only but becoming employers in the job market. Vocational education therefore provides an increase in the skill options available to the learner for an effective survival in the economy (Ali. I., *etal.* (2012)).

Vocational education should be based on an analysis of each occupation to determine what is required by an individual to perform as a successful worker in a given occupation Ihimekpen and Olise (2004). An occupational analysis should be carried out periodically to ensure the acquisition of relevant and up to date skills. For instance, an efficient and functional vocational education will lead to a shift from over reliance on oil driven economy to that of industry driven one (commerce and agriculture). A vibrant vocational education is will reduce over reliance on oil and ultimately lead to the diversification of the economy that will lead to national development (Moustafa, M. and Moustafa, W. (2013)).

Conclusion

From the foregoing is very clear that the position of vocational education is a prerequisite in the development of any nation, Nigeria inclusive. The review highlights that large-scale AI integration is contingent upon improving the innovation's perceived relative advantage, ensuring compatibility with institutional goals and cultural contexts, and reducing the complexity of implementation. Despite growing interest and awareness among lecturers and students, AI implementation in Nigerian TVET remains fragmented due to inadequate infrastructure, limited technical expertise, and the absence of clear ethical and regulatory frameworks.

In contrast, international examples demonstrate that with coordinated investment and robust policy support, AI can be a powerful driver of pedagogical innovation, enhanced learning outcomes, and labor market alignment in vocational education.

References

- Ali, I; Muhammad, R. R; Azlan Bin A, L, Amirmudin, B, U, Muhammad S. S, & Yahya B, B. (2012). Implementation of technical and vocational education in post-primary schools in Nigeria: A qualitative approach. *International Journal of Humanities and Social Science Invention* 1 (1) .30-33
- Audu, R., & Otu, B. (2020). Integrating artificial intelligence into vocational and technical education for sustainable skill development in Nigeria. *Journal of Technical Education and Training*, 12(4), 45–57. <https://doi.org/10.30880/jtet.2020.12.04.005>
- Bisong, J. A., Orebiyi, B. and Osazee, M. A. (2024).** The Future of Vocational Education Trends and Innovations in Blended Teaching Methodologies in Nigeria. *International Journal of Sub-Saharan African Research (IJSSAR)* 2 (3), 267-277, <https://doi.org/10.5281/zenodo.13858389>
- Chen, Y., & Huang, X. (2022). *Augmented reality and artificial intelligence in vocational training: A systematic review*. Computers & Education, 190, 104616. <https://doi.org/10.1016/j.compedu.2022.104616>
- Chinedu, C. C. & Olabiyi, O. S. (2015). Empowering Nigerian youths through technical vocational education and training for enhancing national security. *Journal of Technical Education and Training*, 7(1), 10-22.
- Commonwealth of Australia. (2023). Australian Framework for Generative Artificial Intelligence in Schools Australian Framework for Generative Artificial Intelligence in Schools Acknowledgement of Country. <https://www.education.gov.au/schooling/resources/australian-framework-generativeartificial-intelligence-ai-schools>
- Ezeh, Ore, D. O. (2016). Academics call for restructuring of educational system. Retrieved on 10th February, 2018 from www.guardian.ng/news/academics-call-for-restructuring-of-educational-system.
- Federal Republic of Nigeria (2014). *National Policy on Education* (6th ed.). Lagos: Nigerian Educational Research and Development Council (NERDC) Press.
- Oghiahephan, A. D. (2015). Restructuring educational goals for national and economic development in Nigeria. *Journal of Research and Method in Education (JRME)*, 5(4), 8-14.
- Ogbondah, L. & Wobi, K. (2014). Revitalizing technical and vocational education in Nigeria for youths and National development. *Journal of education and practice*, 5(24), 163 – 168.
- Okolie, U. C., Igwe, P. A., & Nwajiuba, C. A. (2022). Vocational education and training in sub-Saharan Africa: Addressing the skills gap through innovation. *Education + Training*, 64(2), 214–230. <https://doi.org/10.1108/ET-03-2021-0078>

Oladiran, S. O. & Uzoka, N. (2020). Innovative Policies for Implementation of TVET Curriculum in Enhancing Students Competencies for Sustainable Industrial Development in South-West, Nigeria *Vocational and technical education journal (VOTEJ)* 2 (1), 2734- 2697

Olabiya, O. S (2018). Corruption: the bane of effective implementation of technical vocational education and training curriculum towards developing a workforce. A paper presented at the conference Centre University of Ibadan Oyo state.

Moustafa, M & Moustafa, W (2013). Technical and Vocational Education and Training (TVET) Challenges and Priorities in Developing Countries. [www.unevoc.unesco.org/.../TVET Challenges_and_Pri...](http://www.unevoc.unesco.org/.../TVET_Challenges_and_Pri...)

Shiohira, K. (2021). Understanding the impact of artificial intelligence on skills development Education 2030. Published in 2021 by the United Nations Educational, Scientific and Cultural Organization. <http://en.unesco>.

Stephen, O. O. (2021). Information technology, technical vocational education in developing workforce towards globalization. In Research Anthology on Business and Technical Education in the Information Era (pp. 631–648). <https://doi.org/10.4018/978-1-7998-5345-9.ch035>

Ukeje, I. O., Elom, C. O., Ayanwale, M. A., Umoke, C. C., and Nwangbo, S. O. (2024). Exploring an Innovative Educational Governance Framework: Leveraging Artificial Intelligence in a Stakeholder-Driven “Open Campus Model” in South East Nigerian Universities. *International Journal of Learning. Teaching and Educational Research*, 23(6), 416–440. <https://doi.org/10.26803/ijlter.23.6.19>

UNESCO. Artificial Intelligence and Education: Guidance for policy-makers. Paris: United Nations Educational, Scientific and Cultural Organization. <https://unesdoc.unesco.org/ark:/48223/pf0000370675> (2023).

United Nations Educational Scientific and cultural organizations (UNESCO) (2004) Synthesis report: *Improving access, equity and relevance in technical and vocational education and training (TVET)*. Bangkok, Thailand. UNESCO.

United Nations Educational Scientific and cultural organizations (UNESCO) (2006). Education for sustainable development tool kit. UNESCO.

Vinnova. (2018). Artificial intelligence in Swedish business and society - Analysis of development and potential. Summary <https://www.vinnova.se/contentassets>