IMPACT OF ARTIFICIAL INTELLIGENCE (AI) IN THE TEACHING AND LEARNING OF SKILL-BASED EDUCATION IN TVET INSTITUTIONS IN BAYELSA STATE, NIGERIA

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Abstract

This study was conducted using descriptive survey research design. A structured questionnaire titled: Benefits and Challenges of Artificial Intelligence in Teaching and Learning TVET courses was used as instrument for data collection, the instrument was sub-divided into 2 sections, section A and B, with each section contains 16 items, making a total of 32 items on a five-point scales, ranging from strongly agreed = 5, agreed = 4, undecided = 3, disagreed =2 and strongly disagreed = 1. The study was conducted in TVET institutions in Bayelsa State, Nigeria. The population of the study comprised of 50 Lecturers and 15 Administrative staff making a total of 65 respondents in Bayelsa State Institute of Entrepreneurship and Vocational Training Elebele, Bayelsa State Polytechnic Alebiri, Isaac Jasper Boro College of Education Sagbama, and International Institute of Tourism and Hospitality Management, Opolo. No sampling was carried out, as the entire population was studied. The instrument used for collection of data in this study was validated by three experts from the Ignatius Ajuru University of Education, Port-Harcourt. In determining the reliability of the research instrument, the researcher administered 22 copies of the instrument to 22 staff of the Government Science and Technical College, Ahoada. Statistical Package for Social Sciences (SPSS) version 20.0 was used to analyzed the data collected from the respondents. Cronbach alpha reliability coefficient index was used to determine the internal consistency of the instrument. The reliability coefficients obtained for the two segments of the questionnaire were 0.82 and 0.74. The overall reliability index for the instrument was 0.78. This indicated that the instrument was reliable. Data were analyzed using mean and standard deviation, any items with the mean score of 3.50 and above were regarded as agreed and accepted, while any item with the mean score less than 3.50 were regarded as disagreed and not accepted. The results of the study revealed that Artificial Intelligence is beneficial to TVET institutions and it was revealed that challenges were associated with the integration of AI in TVET institutions in Bayelsa State. It was recommended among others that programmes that offer free AI learning resources, technology subsidies for schools, and educational grants can help bridge the gap and promote greater educational equity among TVET institutions.

Keywords: Artificial Intelligence, TVET, Applications of AI, Challenges of TVET in AI Integration and Impact of AI on Teaching and Learning.

Introduction

Technical education is the component of vocational and technical education programme which leads to the acquisition of practical and applied skills as well as basic scientific knowledge. Technical and vocational education provides trained manpower in applied science,

technology, commerce and skills-based training (Poripo, 2024). It provides the technical knowledge and vocational skills necessary for industrial and economic development, skills leading to the production of craftsmen, technicians and other skilled personnel who will be enterprising and self-reliant (Poripo and Youdiowei, 2013). It also provides students with the needed competencies, skills, knowledge, understanding and attitudes to perform as workers in various industrial sectors. According to Etonyeaku (2009), technical education contributes greatly to the economic growth of any nation and has become an indispensable tool for development in this era of globalization. Osuala (2004) stated that the all-important functions of technical education are greatly needed for socio-economic development of Nigeria largely because technical education prepares the recipients to earn a living in an occupation in which success is dependent largely on technical and vocational information, globalization, and information and communication technology (ICT).

Technical and Vocational Education and Training (TVET) serves as a critical framework for preparing individuals to thrive in the rapidly evolving global workforce. In today's world, industries increasingly prioritize knowledge-based economies and digital transformation, demanding the highest levels of vocational, entrepreneurial, and technological skills along with extensive expertise (Hassan, 2021). TVET provides vocational education that equips students with practical skills, enabling them to become productive contributors across a range of professional sectors (Deckker & Sumanasekara, 2025). To remain aligned with technological advancements, TVET must integrate Artificial Intelligence across all facets of pedagogy, resource delivery, educational programs, curricula, and practice facilities (Hassan, 2021). The education sector, like many others, is undergoing significant transformation driven by Artificial Intelligence (AI). The changes occurring in the technical sphere of life with regard to the process, teaching and learning of technical subjects and mode of services delivery together with the mode of information transmission and exchange require that the teaching and learning process of technical education should be effectively and efficiently reorganized to reflect the new emphasis on the use information and communication technology includes Artificial Intelligence in educational service delivery (Poripo & Youdiowei, 2014), (Ugwoke, 2011). One major aspect of the integration of Artificial Intelligence (AI) into Technical, Vocational Education, and Training (TVET) is the creation of dynamic student-teacher interactions, personalized learning experiences, and innovative educational methods, all of which contribute to enhanced performance outcomes of students (Familoni, 2024).

The benefits AI brings to TVET is the development of interactive, active learning environments. Deckker & Sumanasekara, (2025) opined that traditional education models often struggled to maintain student interest due to their reliance on physical, skill-based learning. However, the introduction of virtual labs, interactive simulations, and AI-powered gamification transforms these traditional methods. These AI-driven innovations create immersive learning experiences that not only enhance student engagement but also support hands-on learning, helping to prevent academic knowledge loss (Harry, 2023). Through these interactive methods, students are able to stay focused, remain interested, and effectively manage their academic workloads. According to Deckker & Sumanasekara (2025), AI also plays a crucial role in improving accessibility within TVET programs. It ensures that students facing learning disabilities, language barriers, and other challenges remain fully engaged in their studies. According to Abimbola (2024), the widespread adoption of AI in education faces significant challenges, particularly the digital divide. Students in rural areas and low-income communities often lack access to the necessary infrastructure, such as reliable internet and modern computing devices. Furthermore, the digital literacy of students is a key factor in determining their ability to utilize AI-powered educational tools effectively. As Abimbola (2024) highlights, this disparity creates a two-tiered educational system where privileged students benefit from advanced AI-based learning, while others struggle with traditional teaching methods and limited resources.

In integrating AI into Technical, Vocational Education and Training, significant challenges must be overcome to brings about good success. another challenge is the shortage of trained teachers in the required and specialized technical skills to effectively carry-out AI tools in their classrooms (Deckker & Sumanasekara, 2025). The successful use of AI technologies in teaching depends not only on instructors' ability to operate AI-powered systems and interpret AI-generated insights, without adequate training, educators will find it difficult to fully harness AI's potential, resulting in underutilized resources and missed opportunities (Familoni, 2024). To overcome these challenges institutions must develop comprehensive teacher training programs focused on digital literacy and AI competence, empowering educators to integrate these technologies confidently and effectively into their instruction. One major challenge militating against TVET institutions is the inadequate computerized teaching facilities and shortage of technical resources. According to Alotaibi, (2023), lack of modern technology unreliable internet services makes it difficult to access and installed AI in schools. Moreso, maintaining AI platforms presents additional challenges, as

smaller institutions often lack sufficient technical resources and skilled IT personnel to ensure consistent system operation (Bahroun, 2023). Addressing these issues will require increased public investment, strategic private sector partnerships, and support from international funding initiatives to help TVET institutions build the necessary technological foundations for AI-driven education (Memarian, 2023).

The high cost of implementing AI technologies poses another significant obstacle. Financial limitations prevent many public TVET institutions, small training centers, and underfunded organizations from developing, maintaining, and upgrading AI systems (Abimbola, 2024). Securing the necessary funds for AI-compatible hardware, software, and cloud-based learning management systems remains a critical challenge. To move forward, institutions must seek cost-effective AI solutions alongside governmental support and industrial collaborations to make AI learning tools more accessible. Moreover, resistance to adopting AI technologies is a major hurdle. Traditional teaching methods are deeply ingrained in vocational and technical education, and many institutions and educators remain hesitant to embrace AI-based approaches (Deckker & Sumanasekara, 2025; Harry, 2023).

Statement of the Problem

The integration of Artificial Intelligence into the curriculum of Technical, Vocational Education and Training (TVET) is seen as a strategic solution to meet the demands of the modern digital workforce while creating opportunities for enhanced teaching methods. A wide range of AI-powered educational tools such as simulations, virtual laboratories, and intelligent tutoring systems have demonstrated the ability to boost students' engagement and improve learning outcomes within technical, vocational education and training. However, incorporating AI into vocational training raises problems, such as the digital divide and a scarcity of competent teachers knowledgeable about AI technology. These issues may lead to uneven access to AI-driven educational resources, reducing the overall efficacy of TVET programmes. However, the widespread adoption of AI in education faces significant challenges, particularly the digital divide. Students in rural areas and low-income communities often lack access to the necessary infrastructure, such as reliable internet and modern computing devices.

Moreso, to prevent severe challenges and its implications among the TVET institutions, assessing the impact of artificial intelligence in TVET is needed which could help or assist students in handling learning appropriately, thereby avoiding its harmful effects which could affect or jeopardize student's academic performance and future working ambitions. Therefore,

the problem of this study is how to reduce the challenges associated with Artificial Intelligence in teaching and learning of TVET courses in Bayelsa State in order to improve academic performance among TVET institutions.

Purpose of the Study

The general purpose of this study is to investigate the impact of Artificial Intelligence (AI) on teaching and learning of skill-based education in TVET institutions in Bayelsa State. Specifically, the study seeks to:

1. Assess the benefits associated with the integration of AI in teaching and learning of skills-based education in TVET institutions.
2. Assess challenges associated with the integration of AI in teaching and learning of skills-based education in TVET institutions.

Research Questions

1. what are the benefits associated with the integration of AI in teaching and learning of skills-based education in TVET institutions?
2. what are the challenges associated with the integration of AI in teaching and learning of skills-based education in TVET institutions?

Significance of the Study

The findings of this study is of immerse benefits to TVET educators and students, TVET institutions, technology experts and researchers. This study will x-ray the benefits and challenges of AI to enable educational stakeholders have the knowledge of the challenges facing AI integration in TVET institutions and the way forwards. It provides a comprehensive understanding of the current applications of AI in vocational and technical education and highlights emerging opportunities for future development. The study will help TVET Teachers and institutions in preparing students to meet the rapidly technological demands of today's workforce with the use of AI. If this study is published, researchers will benefit and it will be added to body of knowledge and literatures.

Methodology

This study was conducted using descriptive survey research design. A structured questionnaire titled: Benefits and Challenges of Artificial Intelligence in Teaching and Learning TVET courses was used as instrument for data collection, the instrument was sub-divided into 2 section sections, section A and B, with each section contains 16 items, making

a total of 32 items on a five-point scales, ranging from strongly agreed = 5, agreed = 4, undecided = 3, disagreed =2 and strongly disagreed = 1. The study was conducted in TVET institutions in Bayelsa State, Nigeria. The population of the study comprised of 50 Lecturers and 15 Administrative staff, making a total of 65 respondents in Bayelsa State Institute of Entrepreneurship and Vocational Training, Elebele, Bayelsa State Polytechnic Alebiri, Isaac Jasper Boro College of Education Sagbama, and International Institute of Tourism and Hospitality Management, Opolo. No sampling was carried out, as the entire populations were studied. The instrument used for collection of data in this study were validated by three experts from the Ignatius Ajuru University of Education, Port-Harcourt. In determining the reliability of the research instrument, the researcher administered 22 copies of the instrument to 22 staff of the Government Science and Technical College, Ahoada. Statistical Package for Social Sciences (SPSS) version 20.0 was used to analyzed the data collected from the respondents. Cronbach alpha reliability coefficient index was used to determine the internal consistency of the instrument. The reliability coefficients obtained for the two segments of the questionnaire were 0.82 and 0.74. The overall reliability index for the instrument was 0.78. These indicated that the instrument was reliable. Data were analyzed using mean and standard deviation, any items with the mean score of 3.50 and above were regarded as strongly agreed or agreed and accepted, while any items with the mean score less than 3.50 were regarded as strongly disagreed, disagreed and not accepted.

Results

Research Question 1: What are the benefits associated with the integration of AI in TVET institutions?

Table 1: Benefits associated with the integration of AI in TVET Institution.

S/N	Benefits of Using AI in TVET Institutions	X	SD	Decision
1	driving transformative changes in education	3.61	0.68	Agreed
2	AI enables the creation of dynamic student-teacher interactions	357	0.52	Agreed
3	personalized learning experiences	3.71	0.68	Agreed
4	contribute to enhanced performance outcomes	3.59	0.67	Agreed
5	development of interactive and active learning environments	3.69	0.46	Agreed
6	AI fosters engaging learning spaces that promote deeper student involvement	3.80	0.61	Agreed

7	introduction of virtual labs, interactive simulations	3.79	0.34	Agreed
8	AI-driven innovations create immersive learning experiences that not only enhance student engagement	3.54	0.50	Agreed
9	support hands-on learning, helping to prevent academic knowledge loss	3.69	0.46	Agreed
10	tailored to individual student needs	3.59	0.47	Agreed
11	AI algorithms analyze student performance data to assess abilities and characteristics	3.50	0.57	Agreed
12	AI-driven approach breaks away from the standardization of traditional teaching methods	3.71	0.82	Agreed
13	AI plays a crucial role in improving accessibility within TVET programs	3.67	0.70	Agreed
14	It ensures that students facing learning disabilities, language barriers, and other challenges remain fully engaged in their studies	3.71	0.82	Agreed
15	ensuring that all learners, regardless of physical or intellectual limitations, have access to high-quality educational opportunities	3.67	0.70	Agreed
16	Machine learning algorithms enable AI systems to analyze student performance data, identifying gaps in knowledge as well as industry-specific demands.	3.77	0.61	Agreed

Source: Field Survey, (2025)

The result in Table 1 above revealed that respondents agreed to all the 16 items that the use of Artificial Intelligence is beneficial to TVET institutions. The Table 1 shows that there are benefits associated with the integration of AI in TVET Institution. It also revealed that the integration of AI in TVET Institutions helps to ensuring that all learners, regardless of physical or intellectual limitations, have access to high-quality educational opportunities. Machine learning algorithms enable AI systems to analyze student performance data, identifying gaps in knowledge as well as industry-specific demands were among the benefits of AI in TVET institutions in Bayelsa State.

Research Question 2: What are the challenges associated with the integration of AI in TVET institutions?

Table 2: The challenges associated with the integration of AI in TVET Institutions.

S/N	Challenges and Problems of Using AI in TVET Institutions	X	SD	Decision
17	many fearing that AI could replace their traditional roles	3.82	0.85	Strongly Agreed

18	struggle to keep pace with rapid technological advancements among TVET Teachers	4.16	0.12	Strongly Agreed
19	Resistance to AI adoption often stems from uncertainty	3.96	0.98	Strongly Agreed
20	lack of information, and misconceptions about artificial intelligence	3.68	0.56	Strongly Agreed
21	AI as a supportive tool rather than a replacement for teachers	3.96	0.98	Strongly Agreed
22	Legal and ethical concerns further complicate AI integration	3.66	0.96	Strongly Agreed
23	combination of inadequate infrastructure and limited technical resources	3.91	0.78	Strongly Agreed
24	Outdated technology and unreliable internet connectivity	4.14	0.84	Strongly Agreed
25	difficult to establish AI-enhanced learning environments	4.16	0.12	Strongly Agreed
26	maintaining AI platforms presents additional challenges	3.94	0.70	Strongly Agreed
27	lack of sufficient technical resources and skilled IT personnel to ensure consistent system operation	3.67	0.62	Strongly Agreed
28	Financial limitations prevent many public TVET institutions	3.79	0.34	Strongly Agreed
39	Securing the necessary funds for AI-compatible hardware, software, and cloud-based learning management systems remains a critical challenge	3.69	0.46	Strongly Agreed
30	resistance to adopting AI technologies is a major hurdle	4.16	0.12	Strongly Agreed
31	Traditional teaching methods are deeply ingrained in TVET, and many institutions and educators remain hesitant to embrace AI-based approaches	3.94	0.70	Strongly Agreed
32	The high cost of implementing AI technologies poses another significant obstacle	3.66	0.96	Strongly Agreed

Source: Field Survey, (2025)

The result in Table 2 revealed that respondents were strongly agreed to all the 16 items as challenges associated with the integration of AI in TVET institutions. The results in Table 1 also shows that financial limitations prevent many public TVET institutions, lack of sufficient technical resources and skilled IT personnel to ensure consistent system operation, securing the necessary funds for AI-compatible hardware, software, and cloud-based learning management systems remains a critical challenge associated with the integration of AI in TVET institutions in Bayelsa State.

Discussion of the Findings

The finding of this study is in consonance with the study of Alotaibi, (2023) and Hassan, (2021) who stated that global economies and job markets continue to transform, higher education institutions must increasingly adopt AI-driven technologies to ensure students acquire essential technical competencies This preparation involves not only training students to utilize AI tools effectively but also empowering them to develop and interact with AI systems, equipping them for active participation in the technological future of TVET institutions.

The finding of this study is in agreement with the study of Alotaibi, (2023) who stated that outdated technology and unreliable internet connectivity, especially in low-income and rural areas, make it difficult to establish AI-enhanced learning environments. The author furthermore, maintained that AI platforms presents additional challenges, as smaller institutions often lack sufficient technical resources and skilled IT personnel to ensure consistent system operation. Abimbola, (2024), also opined that the high cost of implementing AI technologies poses another significant obstacle and financial limitations prevent many public TVET institutions, small training centers, and underfunded organizations from developing, maintaining, and upgrading AI systems.

Conclusion

Technical education is the component of vocational and technical education programme which leads to the acquisition of practical and applied skills as well as basic scientific knowledge. Technical education provides trained manpower in applied science, technology and commerce. To remain aligned with technological advancements, TVET must integrate Artificial Intelligence across all facets of pedagogy, resource delivery, educational programs, curricula, and practice facilities

Recommendations of the Study

Based on the findings of the study, the following recommendations were made:

1. it is crucial for governments and educational institutions to invest in digital infrastructure.
2. Make AI-powered learning tools more affordable, and provide targeted support for underserved communities.

3. Programs that offer free AI learning resources, technology subsidies for schools, and educational grants can help bridge the gap and promote greater educational equity.
4. By ensuring that all students have access to these transformative tools, we can reduce disparities and create a more inclusive educational landscape for TVET.
5. As AI becomes increasingly integrated into education, there is an urgent need for comprehensive ethical frameworks to guide its use.
6. Educational institutions must prioritize the development of fair, accountable, and transparent AI systems that ensure equitable access for all students.
7. To achieve this, government officials should work closely with educators and AI developers to create safeguards that protect student rights while promoting ethical practices in AI implementation.

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