Ethical Challenges for Integrating Artificial Intelligence (AI) into Technical and Vocational Education and Training (TVET) Assessment and Classroom Setting

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Abstract
This study investigates the ethical challenges of integrating Artificial Intelligence (AI) into Technical and Vocational Education and Training (TVET) for the enhancement of assessment and classroom settings.The general purpose ofthis study is to identify and analyze the ethical challenges faced by TVET lecturers, Administrators and students with the use of AI in assessment practices and classroom setting with two specific purposes for the study. Two research questions and two hypotheses guided the study. A descriptive survey design was adopted for the study. The research was carried out in two TVET tertiary institutions in Rivers and Bayelsa States. The population of the research was 183 persons, comprising of 26 TVET educators (lecturers), 15 TVET Non-Academic staff and 142 TVET students. A stratified random sampling technique was employed to select the participants. A structured questionnaire was used to collect data for the study. The instrument was face validated by three experts from the Department of Industrial and Technical Education, University of Nigeria Nsukka. Cronbach Alpha was used to determine the reliability of the instrument which yielded a reliability coefficient of 0.78. The statistical tool used to analyze the data for the study were mean for the questions and ANOVA, which was used to test the hypotheses at 0.05 level of significance. Findings revealed that limited infrastructure, shortage of skilled personnel, and the high cost of AI tools were the major challenges to integrating AI in TVET, as indicated by high mean ratings. The study also found that AI tools are perceived as effective in enhancing student learning through personalized experiences and practical skill development, although their availability and full integration into the curriculum remain limited. The study concluded that while AI technologies are effectively enhancing assessment and classroom engagement in TVET, significant ethical and infrastructural challenges hinder their full integration. However, there was a shared perception among lecturers, administrators, and students regarding both the challenges and the effectiveness of AI tools, highlighting the need for inclusive strategies to support ethical and sustainable adoption of AI in vocational education.
Keywords: *Ethical challenges, Artificial Intelligence (AI), Technical and Vocational Education and Training (TVET), Assessment, Classroom Setting*

Introduction

Integrating Artificial Intelligence AI into Technical and Vocational Education and Training TVET assessment and classroom settings has become inevitable as it is transforming Vocational and Technical education in the digital space. AI offers innovative solutions to enhance learning experiences, modernize administrative tasks, and personalize instruction (Rane, et al., 2023; Sajja, et al., 2023; Okolie et al, 2021). George, and Wooden, (2023) stated that AI has the potential to revolutionize traditional pedagogical approaches and the integration of AI into education presents countless opportunities for educators, students, and institutions alike that has changed the narrative in teaching-learning and efficient engagement of students. Omeh et al. (2025) stated that AI applications, such as ChatGPT, is gradually used in classrooms and they have the potentials to modify the conventional teaching and learning methodologies, particularly in areas of personalized learning, intelligent tutoring systems, and automated assessment. Uzo (2021) identified the need for lecturers and students to develop new competences as a challenge in integrating AI into TVET. Agu et al (2020) also supported the need for AI competencies on TVET educators. Not all lecturers may be conversant with AI tools or competent enough to integrate them into the curriculum as required. Again, students need to learn to use these tools which are complex. Without adequate training and re-training, the potential benefits of AI such as Algorithmic Bias and Privacy Data Protection may not be fully realized, limiting its impact on student empowerment,

In spite of these laudable advancements, the integration also portends some ethical challenges ranging from data privacy, potential algorithmic bias, and issues of transparency and fairness. Oguniyi, (2019) and Asare and Amoako (2022) posited that one major problem for integrating AI into word processing activities in education is the lack of access to required technology and infrastructure. In many educational establishments, students don't have adequate access to the required software or reliable internet services and this could render some students at a disadvantage position and hinder their potentials and ability to acquire critical AI tools and entrepreneurial skills.

This paper examines the integration of AI and the ethical implications in TVET assessment and classroom settings, The paper aims to provide insights for educators, students and policymakers in order to offer a balanced perspective on how artificial intelligence AI can be responsibly integrated ethically into the classroom.

The term ethics refers to the philosophical study of the meaning of moral right and wrong good and bad**.** Kitchener, (1984). Stated that, ethical challenges are issues that must be carefully considered before taking decisions to ensure that the actions align with moral principles, values, and standards.Beauchamp & Childress (2001)define Ethical challenges as those complex moral conflicts that arise when people are faced with decisions that involve contentious values, principles, or interests. Campbell (2013)and Chukwuedo and Omofonmwan (2022), also stated that Ethical challenges comprise conflicts between the various moral values, principles, or obligations, requiring individuals or organizations to consider other contending interests to balance the different ethical considerations. Contextually,Ethical challenges or concerns are those inevitable difficulties that require proactive and thoughtful considerations for integrating AI in line with the moral principles, values and standards of TVET assessment and classroom setting

Artificial Intelligence AI refers to machines designed to perform tasks requiring human intelligence. These tasks include

learning, problem-solving, and decision-making. AI's rapid growth brings significant advancements and transformative changes. In the realm of education, AI offers innovative solutions to enhance teaching-learning experiences, streamline administrative tasks, and personalize instruction. According to Akgun & Greenhow, (2022) artificial intelligence in student behaviour monitoring and forecasting has raised ethical questions on surveillance and human freedom. Ndom-Uchendu and Nwokike (2024) Stated that personalized learning, improved engagement, enhanced assessment, increased access to education and improved teacher training are some of the impacts of AI in TVET. Mhlanga (2023) and Mclaren (2024) identified providing students with real-time feedback, simulating complex business scenarios, and offering a level of interactivity that traditional educational methods cannot match. (Rane, et al., 2023; Sajja, et al., 2023). With the potential to revolutionize traditional pedagogical approaches, AI integration in education presents a myriad of opportunities for educators, students, and institutions alike. (George, and Wooden, 2023).Integrating Artificial Intelligence (AI) and other modern technologies in higher education and TVET inparticular as TVET play a pivotal role in preparing its recipients for the workforce; andequipping them with the necessary skills, knowledge and attitudes to meet the demands of thedigital era(Ukala, C. C., &Iheukwumere, O. C., 2025)Operationally, Artificial Intelligence (AI) has emerged as a transformative force in various domains, including technical and vocational education and training.

TVET refers to Technical and Vocational Education and Training which is a dynamic and general concept crucial for workforce development and sustainable livelihoods. Okolocha (2006), observed that technical and vocational education is the bedrock of sustainable development of any nation. Amkombe, (2000) Stated that TVET is meant to prepare learners for careers based on manual and practical activities TVET delivers vocational learning that gives students practical abilities to become productive members of diverse professional sectors and the objectives of TVET according to the (NPE) Federal Republic of Nigeria (FRN) (2014:14) P. 24 are:

- To provide trained manpower in applied science, technology and commerce particularly at sub-professional level;
- Provide the technical knowledge and vocational skills necessary for agricultural, industrial, commercial and economic development;
- To provide people who can apply scientific knowledge to the improvement and solution of environmental problems for the use and convenience of man;
- To give an introduction to professional studies in engineering and other technologies;
- To give training and impart the necessary skills leading to the production of craftsmen, technicians and other skilled personnel who will be enterprising and self-reliant; and
- To enable young men and women to have intelligent understanding of the increasing complexity of technology.

It is broadly understood as a comprehensive educational process that, in addition to general education, involves the study of technologies and related sciences, along with the acquisition of practical skills, knowledge, and attitudes relevant to occupations across various economic and social sectors (UNESCO & ILO, as cited in AfDB, n.d.; Digiformag, 2023). UNESCO and ILO**:** According to the joint definition by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the International Labour Organization (ILO), TVET refers to "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 life" (African Development Bank, n.d.; UNEVOC, n.d.). This definition emphasizes the blend of theoretical knowledge with hands-on application. Uduafemhe, Ewim and Karfe (2023) noted that TVET as an aspect of education that evolved from informal learning system to structured formal education that is geared towards eradicating unemployment, assessment of the educational process, economic stability, and the rapid technological changes impacting the workforce.Operationally, Technical and Vocational Education and Training is that aspect of education that is skill and practical oriented, functional and in addition to technologies and other related studies, relevant and capable of serving as shock absorber to poverty and unemployment stress.

Assessment is part of the educational process where instructors appraise students' achievements by collecting, measuring, analyzing, synthesizing and interpreting relevant information about a particular object of interest in their performance under controlled conditions in relation to curricula objectives set for their levels, and according to the procedures that are systematic and substantively grounded. According to Bachman (2004), "The term 'assessment' is commonly used with a variety of different meanings. Indeed, the term has come to be used so widely in many different ways in the field of language testing and educational measurement that there seems to be no consensus on what precisely it means" (p.6) Bachman, L. F. (2004). Statistical Analyses for Language Assessment. Cambridge: Cambridge University Press. Brown (2004) defined assessment as "any act of interpreting information about student performance, collected through any of a multitude of a means or practices" (p. 304) Brown, T.L.G. (2004). Teachers' conceptions of assessment: implications for policy and professional development. Assessment in Education, 11 (3), 305-322.

Statement of the problem

The integration of Artificial Intelligence (AI) into educational practices, within the Technical and Vocational Education and Training (TVET) is an innovative and trending technology that holds enormous potential for transforming the assessment methodologies and classroom experiences. Artificial Intelligence (AI) readily enhances Technical and Vocational Education and Training (TVET) by providing highly personalized, adaptive, and efficient learning and assessment experiences. AI should rather be seen as a worthy partner that modifies TVET institutions to deliver more personalized, effective, and equitable vocational and technical training, and to simplify assessments, support collaborative work and prepare a highly skilled, competent and adaptable workforce for the future. Unfortunately, integration of AI into (TVET) institutions is rather seen as a potential threat to the conventional teaching and learning process and not delivering personalized, effective, and equitable vocational and technical education and training. The integration has not simplified assessments, support collaborative work and have not prepared the desired skilled, competent and adaptable workforce for our industries and for the future. Based on the forgoing, this study stands in the gap for Addressing these ethical challenges and ensuring that AI integration in TVET serves to enhance learning outcomes and prepare a skilled workforce.

Purpose of the study

The general purpose of this study was to identify and analyze the ethical challenges faced by TVET lecturers, administrators and students with the use of AI in assessment and classroom setting. Specifically, the study sought to achieve the following purposes:

1. Identify the major challenges for integrating AI technologies into TVET assessment and classroom settings.
2. Find out the effectiveness of AI tools being integrated into TVET assessment and classroom settings.

Research Questions

Two research questions guided the study:

1. What are the major challenges for integrating AI technologies into TVET assessment and classroom settings?
2. How effective are AI tools being integrated into TVET assessment and classroom settings?

Hypotheses

Two hypotheses were formulated to guide the research and were tested at 0.05% level of significance.

1. There is no significant difference in the mean ratings of TVET Lecturers, Administrators and Student in the challenges for integrating AI technologies into TVET assessment and classroom settings.
2. There is no significant difference in the mean ratings of TVET Lecturers, Administrators and Student in the effectiveness of AI tools being integrated into TVET assessment and classroom settings.

METHODOLOGY

This research adopted a descriptive survey research design. The study was carried out in two TVET tertiary institutions in Rivers and Bayelsa States. The population of the research was 183 respondents, comprising of 26 TVET educators (lecturers), 15 TVET Non-Academic staff and 142 TVET students. A stratified random sampling technique was employed to select the participants. A structured questionnaire with 12 items was used to collect data for this research. The instrument contains two sections; section A to elicit information onmajor challenges for integrating AI technologies into TVET assessment and classroom settings. Section B to elicit data on the effectiveness of integrating AI tools into TVET assessment and classroom settings. 4point Likert scale of Strongly Agree (4), Agree (3), Disagree (2) and Strongly Disagree (1) was used.The instrument was face validated by three experts from the Department of Industrial and Technical Education, University of Nigeria Nsukka. Cronbach Alpha was used to determine the reliability of the instrument which yielded a reliability coefficient of 0.78. this indicated that the instrument was reliable. Two research assistants were engaged to assist the researcher in administering the questionnaire items. Data collected from the respondents was analyzed using mean to answer the two research questions. ANOVA statistical Analysis was used to test the null hypotheses at 0.05 probability level of significance. Decision was taken as follows: if the calculated significant value is greater or equal to the 0.05, the null hypothesis will be accepted. On the other hand, if the calculated value is less than 0.05, the null hypothesis will not be rejected.

Results

Table 1

Mean Responses of Respondents on theMajor Challenges for Integrating AI Technologies into TVET Assessment and Classroom Settings

s/n	Item statement	$\bar{X}$	Std. Dev.	Remark
1	Limited Infrastructure and Funding	3.79	0.41	A
2	Shortage of Skilled AI Educators and Technicians	3.67	0.47	A
3	High Cost of AI Tools and Software	3.60	0.51	A

4	Resistance to Technological Change	2.55	0.70	A
5	Alignment with Industry Requirements	1.14	0.35	D
6	Algorithmic bias and Data Privacy and Security Concerns	1.89	0.62	D
	Grand Mean	**2.77**	**0.51**	**A**

Key: *$\bar{X}$ = Mean;SA = Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree;*

The data in table 1, suggests that respondents generally agree (Grand Mean = 2.77) that there are notable challengesto integrating AI into TVET classroom settings and assessments. Item 1 – 3 has mean ranges from 3.60 – 3.79 indicating that the respondents strongly agree that Limited Infrastructure and Funding ($\bar{X}$ = 3.79),Shortage of Skilled AI Educators/Technicians ($\bar{X}$ = 3.67) and High Cost of AI Tools and Software ($\bar{X}$ = 3.60) are three issues reflect major constraints that hinder AI adoption. The respondents also agree that resistance to technological change is also part of the challenges while disagreeing that item 5 and 6 are not challenges to the integration of AI technologies into TVET assessment and classroom settings.

Table 2

ANOVA analysis on the mean ratings of TVET Lecturers, Administrators and Student in the Challenges for Integrating AI Technologies into TVET Assessment and Classroom Settings.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.01	2	0.00	0.04	0.96
Within Groups	11.83	180	0.07		
Total	11.834	182			

The results in table 2 showed no statistically significant difference between the groups, $F(2, 180) = 0.04$, $p = 0.96$**.** Since the p-value (.96) is much greater than the 0.05 significance level, therefore, the null hypothesis was not rejected. This suggests that the perceptions of Lecturers, Administrators, and Students are statistically the same regarding the challenges of integrating AI into TVET assessment and classroom settings.

Table 3

Mean Responses of Respondents on the Effectiveness of AI Tools Being Integrated into TVET Assessment and Classroom Settings.

s/n	Item statement	$\bar{X}$	Std. Dev.	Remark
1	AI tools in TVET programs adequately prepare students for industry-relevant technical competencies.	3.77	0.43	SA
2	AI tools in TVET programs have significantly improved the technical skills of students.	3.37	0.51	A
3	Students in TVET programs benefit from AI tools that offer personalized learning experiences tailored to their skill levels	3.46	0.51	A
4	AI-driven tools are effectively integrated into the curriculum to address the specific skill needs of students.	2.40	0.77	D
5	The availability of AI tools in Nigerian TVET program is sufficient	1.41	0.49	SD

6	To effectively support students' learning and skill development. The use of AI tools in TVET program provides students with practical, hands-on learning experiences.	3.56	0.78	SA
	Grand Mean	**3.00**	**0.58**	**A**

Key: *$\bar{X}$ = Mean;SA = Strongly Agree; A = Agree; D = Disagree; SD = Strongly Disagree;*

The Grand Mean of 3.00in Table 3 indicates that, overall, respondents agree that AI tools are effective in TVET assessment and classroom settings with some aspects more positively rated than others.Respondents strongly agreed that AI tools prepare students for industry-relevant technical skills ($\bar{X}$ = 3.77).They support hands-on, practical learning experiences ($\bar{X}$ = 3.56). The respondents also agreed that AI has improved students' technical skills ($\bar{X}$ = 3.37). and offer personalized learning experiences ($\bar{X}$ = 3.46).These responses show that AI tools are valued for their impact on learning quality, skills development, and personalization in TVET. The respondents disagreed that AI tools are effectively integrated into the curriculum to meet specific skill needs ($\bar{X}$ = 2.40) and that there is sufficient availability of AI tools in Nigerian TVET programs ($\bar{X}$ = 1.41).

Table 4

ANOVA Analysis on the Mean Ratings of TVET Lecturers, Administrators and Student in the Effectiveness of AI Tools Being Integrated into TVET Assessment and Classroom Settings.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.15	2	0.07	0.88	0.42
Within Groups	14.80	180	0.08		
Total	14.94	182			

Table 4 above shows ANOVA analyses which revealed no statistically significant difference in mean ratings across the three groups, F(2, 180) = 0.88, p = 0.42. Since the p-value (.42) is greater than the 0.05 level of significance, therefore, the null hypothesis was not rejected. This indicates that the three groups share similar perceptions regarding the effectiveness of AI tools in assessment and classroom settings in TVET.

Discussion of Findings

The study revealed that limited infrastructure and funding**,** shortage of skilled AI educators, and the high cost of AI tools were the most critical challenges identified by respondents. These findings align with the report by Mhlanga (2023), who highlighted that many African TVET institutions face poor funding and lack access to modern digital infrastructure necessary for AI adoption. Similarly, Okolie et al. (2021) emphasized that technical education institutions in Nigeria struggle with inadequate ICT facilities, which hinders the deployment of AI and other digital tools. Interestingly,resistance to change**,** data privacy concerns, and alignment with industry standards were not seen as major challenges. This contrasts with Asare and Amoako (2022), who noted that ethical concerns and resistance from educators unfamiliar with AI technologies can delay integration. The discrepancy may be due to regional differences in awareness levels or the respondents' exposure to AI-related policy discussions.

In research question two, respondents agreed that AI tools are effective in enhancing

technical skill development, offering personalized learning, and providing hands-on learning experiences. This is in line with Chukwuedo and Omofonmwan (2022), who found that adaptive AI platforms improved student performance in electrical and mechanical trades in Nigerian TVET centers. However, respondents disagreed that AI tools are widely available or fully integrated into the curriculum. This finding is supported by UNESCO-UNEVOC (2021), which noted that although AI technologies have great potential for TVET, they are still in the pilot or experimental phase in most developing countries, particularly in sub-Saharan Africa.

No significant differences were found among the views of Lecturers, Administrators, and Students regarding both the challenges and effectiveness of AI tools in TVET. This uniformity in perception suggests a shared experience of the opportunities and limitations of AI within the current Nigerian TVET system. This outcome aligns with the findings of Agu et al. (2020), who concluded that regardless of role, most stakeholders in Nigerian TVET institutions are aware of AI's value but face similar systemic barriers to adoption.

Conclusion

This study investigated the ethical challenges and effectiveness of integrating Artificial Intelligence (AI) technologies into Technical and Vocational Education and Training (TVET) assessment and classroom settings. The findings revealed that major challenges include limited infrastructure and funding, shortage of skilled AI educators and technicians, and the high cost of AI tools. On the other hand, respondents agreed that AI tools are effective in enhancing student learning by improving technical skills, enabling personalized learning, and supporting hands-on experiences, despite their limited availability and integration into the curriculum.

Hypothesis testing showed no significant difference in the mean ratings of lecturers, administrators, and students regarding both the challenges and effectiveness of AI integration, indicating a shared perspective across stakeholder groups. Finally, while AI holds great promise for advancing TVET education, addressing infrastructural, financial, and human resource gaps is essential to ensure its ethical and effective adoption.

Recommendations

Based on the findings and supported by related literature, the following recommendations are made:

1. The government and educational stakeholders should invest in modern digital infrastructure, including AI-compatible tools and platforms, to reduce access limitations.
2. Regular training workshops should be organized to develop AI competency among lecturers and technical staffin TVET institutions.
3. The TVET curriculum should be reviewed to ensure seamless integration of AI tools, aligning with current industry needs and global technological trends.
4. Government should collaborate with tech companies to provide affordable or open-source AI tools for educational use, fostering sustainability.

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