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INTEGRATION OF ARTIFICIAL INTELLIGENCE INTO VOCATIONAL TECHNICAL EDUCATION (VTE) FOR ENHANCING PROBLEM-SOLVING SKILLS AMONG BUSINESS EDUCATION STUDENTS IN SOUTH SOUTH AND NATIONAL DEVELOPMENT

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ABSTRACT

This study explores the integration of Artificial Intelligence (AI) into Vocational Technical Education (VTE) to enhance problem-solving skills among business education graduates and national development. Two research questions guided the study. A descriptive survey research design was adopted for the study. The population for the study comprised of 205 of final year Business Education Students in Colleges of Education in South South Nigeria. There was no sampling because the sample size was manageable hence the researcher used census sampling techniques. The instrument for data collection was a structured questionnaire developed by the researcher. Three experts validated the instrument. used for data collection. Cronbach's alpha reliability technique was used to ascertain reliability of the instrument which yielded a coefficient of 0. 82. Mean statistics was used to answer research questions. Findings revealed that integration of AI tools into Vocational Technical Education has significant impact on students. AI tools such as adaptive testing, learning analytics and automated grading were widely recognized and positively perceived. Despite these, respondents highlighted several opportunities AI offers such as real-time feedback, personalized learning and improved assessment accuracy. Respondents also emphasized the need for targeted support such as training, digital infrastructure, policy frameworks, funding and collaboration with tech providers. It was recommended among others that government should initiate and sustain collaborations between educational institutions, industries stakeholders and technology providers so as to facilitate resource sharing and enhance development of relevant AI applications into VTE.

Keywords: Artificial Intelligence, Vocational Technical Education; Problem-Solving; Creativity; Business Education

Introduction

Vocational education provides the practical skills required by business education graduates for national development, economic diversification and poverty reduction. In Nigeria VTE is seen as a key instrument for growth that closes skills-mismatch/ gap with VTE playing a pivotal role. Korter (2025) viewed Vocational Technical Education (VTE) as tools for equipping individuals with practical skills and competencies needed for national

development and economic poverty reduction. In Nigeria, vocational technical education has been recognized as a strategic sector to foster economic growth and address the challenges of youth unemployment and skills mismatch (Korter in Ohene, 2025). However, the existing vocational assessment systems in Nigeria often rely heavily on traditional, standardized testing methods which inadequately measure students' creativity, problem-solving skills and capacity for innovation (Edidiong et al., 2024). Globally, Artificial Intelligence (AI) has emerged as a transformative force in vocational education offering novel ways to improve teaching/ learning and assessment processes. Artificial Intelligence (AI) in education refers to the use of algorithms and intelligent systems to support and enhance teaching, learning, and assessment processes. AI applications include personalized learning environments, automated grading systems, and adaptive testing platforms that adjust in real-time based on student performance. AI integration enables continuous formative assessment, instant feedback, and data-driven analysis of learning patterns and gaps. (Holmes et al., 2023). AI tools assess complex skills like creativity and critical thinking by evaluating open-ended tasks and projects. (Mahamuni et al., 2024). AI transforms assessment from static to dynamic, learner-centered systems. Machine learning enables systems to learn from data, improving performance autonomously. (Kumar & Sharma, 2023). Machine learning algorithms analyze responses to forecast trends and adjust test difficulty. (Nair et al., 2023). Adaptive testing utilizes this capability to deliver personalized assessments that match the learner's proficiency level, thus providing more accurate measures of competence (Minn, 2022).

VTE in Nigeria equips youth with marketable skills that drive industrial growth and diversify the economy. (Chen & Hwang (2020). The Nigerian government is prioritizing VTE in its national development agenda to curb youth unemployment and foster self-reliance through skill acquisition. (Akpan, 2023). Although policies support VTE, but it still suffers from insufficient funding and poor infrastructure limiting its ability to meet labor-market needs. Recent reforms updated VTE curricula with competency-based learning but still fall short of introducing innovative teaching or assessment methods that nurture creativity. (Hui 2020).

Assessment in Nigerian VTE institutions rely solely on traditional method of writing exams, conducting practical and carrying out standardized tests that emphasized rote technical knowledge and manual skills while sidelining creativity, innovation and problem-solving. The absence of continuous, formative assessment denies learners timely feedback and the opportunity to adjust their learning. Without ongoing formative assessments, learners miss timely feedback and the chance to adjust their learning. Limited tech integration restricts personalized, adaptive assessment, leaving a static system that hampers graduates'

readiness for modern industry's complexities. (Edidiong et al., 2024).

Studies have it adaptive testing enhances engagement, reduce anxiety and identifies accurate strength/weakness insights. Implementing these techniques in VTE can significantly improve the assessment of creativity and innovation by accommodating diverse learner's profiles.

AI tools such as natural-language processing and adaptive testing, personalize learning gives real-time tailored feedback, moving beyond the memorization focus of traditional exams by analyzing performance patterns. These AI-enabled assessments captures critical thinking, creativity, and problem-solving skills. Hao, et al., 2024). These intelligent systems can adapt the difficulty of questions based on learners' responses, identify misconceptions early and suggest targeted interventions, thereby fostering deeper engagement and continuous improvement (Babumdo, 2023).

Moreover, AI-powered assessment tools are capable of evaluating open-ended and project-based tasks which are vital for measuring creativity and innovation competencies required for success in the 21st-century workforce (Iqbal, 2023). Such tools can process large volumes of data including written text, multimedia submissions and interactive simulations to provide a more holistic evaluation of students' capabilities beyond conventional exams. The integration of AI into vocational education assessment also supports scalable and cost-effective evaluation solutions, addressing resource limitations common in many developing countries. Recent studies underscore the importance of using tools AI to enhance educational outcomes in developing countries where resource constraints and outdated assessment approaches hinder quality training (Hassan et al., 2022).

In the Nigerian context, the potential of AI in vocational education is gaining recognition, especially as the country seeks to align its educational outcomes with global standards and market demands (Aderigbe, et al., 2023). However, current VTE assessment frameworks in Nigeria remain largely manual and inflexible failing to reflect the dynamic nature of technical skills and creative problem-solving required in modern industries (Edidiong et al., 2024). This disconnects, contributes to a workforce that may possess technical know-how but lacks the innovative capacity to drive sustainable economic growth. Integration of AI to tools into vocational education to redesign assessment systems offers an opportunity to bridge this gap by fostering an environment where creativity and innovation are systematically nurtured and evaluated.

Statement of the Problem

Despite the global adoption of AI-supported educational technologies, many Nigerian VTE institutions continue to struggle with outdated instructional and assessment strategies that limit students' acquisition of creativity, innovation, and problem-solving skills (Adebayo & Aremu, 2022, Okoye &

Okwelle,2020). Business Education students in south-south Nigeria often learn in environments with limited access to AI-driven platforms such as automated assessment tools, intelligent tutoring systems, digital simulations, and creativity-enhancing applications (Adeoye 2021, UNESCO,2022), as a result, students graduate with insufficient digital competence, limited exposure to innovation-driven learning and inadequate problem-solving capacities required for sustainable national development. Although evidence from global studies shows that AI improves assessment efficiency, fosters creativity, strengthens innovation, and enhances students' real-world problem-solving skills (Bai et al,2022; Alam, 2023, Goksel& Bozkurt 2019), there is limited empirical research on how these tools can be harnessed with vocational technical education programmes in Nigeria. This gap raises the concern that without AI integration, Business Education graduates may remain underprepared for digital-driven workforces, thereby affecting national productivity and innovation capacity. This study therefore investigates the integration of AI in VTE to enhance problem-solving skills among Business Education students in South-South and national development.

Purpose of the Study

The main purpose of this study is to examine the integration of artificial intelligence into Vocational Technical Education (VTE) to enhance problem-solving skills among Business Education Students in Colleges of Education in South-South and national development. Specifically, the study seeks to,

1. Determine how AI integration enhances problem-solving skills among Business Education students in South-south Nigeria.
2. Examine ways in which AI-enhanced Vocational Technical Education (VTE) contributes to national development.

Research Questions

1. How does AI integration enhance problem-solving skills among business Education students in South-South Nigeria?
2. In what ways can AI-enhanced VTE contribute to national development?

Methodology

This study adopted a descriptive survey research design using a population of 205 VTE graduates registered with the Vocational Technical Education Practitioners Association of Nigeria (TEPAN). Krejcie and Morgan's table was used to arrive at a sample size of 205 respondents. A stratified sampling technique was employed to ensure a good representation across different six states are well represented. A 20-item research questionnaire titled: Impact of Artificial Intelligence in Teaching and Learning Vocational and Technical Education Questionnaire (IAITLVTEQ) was developed by the researchers on a 4-point rating scale of: Strongly Agree (SD)…4, Agree(A)3…, Disagree (D) 2... and Strongly Disagree (SD)1. The instrument was validated and subjected to reliability testing using the Cronbach's Alpha reliability technique which yielded a reliability index of .89. The

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instrument was then used for data collection through direct contact and with the aid of two research assistants. Data collected was analyzed using mean statistics to answer research questions. Items with 2.50 and above were regarded as agreed while items below 2.50 was regarded as disagreed.

Results

Research Question 1: How does AI integration enhance problem-solving skills among Business Education Students?

Table 1: Mean Ratings on how AI integration enhance problem-solving skills among Business Education Students

SN	ITEMS STATEMENT	SA	A	D	SD	X	DECISION
1	AI tools improve the accuracy and efficiency of assessments in my courses	70	65	60	10	2.95	Agreed
2	The use of AI-based platforms provides timely feedback on my academic performance	80	67	50	8	3.65	Agreed
3	AI applications make complex business concepts easier to understand	71	62	57	15	2.92	Agreed
4	AI encourages creative thinking in assignments and project tasks	70	66	59	10	2.96	Agreed
5	AI platforms help me generate innovative solutions to class tasks	75	80	38	12	3.06	Agreed
6	AI simulations expose me to real-life business problems, improving problem-solving skills	71	62	62	10	2.95	Agreed
7	AI-assisted learning increases my confidence in handling complex tasks	70	65	55	15	2.93	Agreed
8	The use of AI makes learning more interactive and engaging	75	76	44	10	3.05	Agreed
9	AI integration inspires me to develop new strategies for solving business-related problems solving business	70	77	43	15	2.99	Agreed
10	AI enhances my overall performance by strengthening creativity and problem-solving skills	77	65	55	8	3.03	Agreed
	Grand mean					3.05	Agreed

Source: Field Survey, 2025

The results showed that all the item statements received mean scores above the decision rule of 2.50 indicating agreement among respondents that AI positively influences these areas. For example, item statements 1 recorded individual mean scores of 2.95, 3.65,2.92,2.96,3.06,2.95,2.93,3.05,2.99, and 3.03, with a grand mean of 3.05. this indicates that respondents generally agreed that AI tools improve problem-solving skills. The high means suggest that students perceive AI integration as effective in enhancing assessment practices, promoting creativity and innovation, and strengthening problem-solving. The grand mean of 3.05 further

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reinforce the finding that respondents generally agree with all the statements, demonstrating a positive perception of integration in their vocational technical education

1. Research Question 2: In what ways can AI-enhanced VTE contribute to national development?

Table 1: Mean Ratings on ways can AI-enhanced VTE contribute to national development.

SN	ITEMS STATEMENT	SA	A	D	SD	X	DECISION
1	AI-enhanced education improves students' employability skills	80	65	40	20	3.00	Agreed
2	AI integration strengthens Nigeria's digital workshop	76	63	51	15	2.98	Agreed
3	AI-supported training fosters innovation among students	65	60	57	23	2.81	Agreed
4	AI tools prepare students for modern workforce that require digital skills	74	73	40	18	2.99	Agreed
5	AI-enhanced learning promotes entrepreneurship development	75	73	50	7	3.05	Agreed
6	AI integration supports technological advancement in Nigeria	80	60	50	15	3.00	Agreed
7	AI-assisted skill development enhances national productivity.	77	65	52	11	3.01	Agreed
8	Graduates trained with AI are better equipped to contribute to national innovation.	75	60	55	15	2.95	Agreed
9	AI-based vocational education reduces the skill gap between Nigerian students and global peers.	70	65	50	20	2.90	Agreed
10	AI enhanced learning strengthens national competiveness in the global economy.	80	60	50	15	3.00	Agreed
	Grand mean					2.96	Agreed

Source; field survey 2025

The results indicate that all item statements received mean score above the decision rule of 2.50, showing that respondents generally agreed that AI integration positively impact national development, for example, item statements 2 recorded individual mean scores of 3.00, 2.98, ,2.81,2.99,3.05,3.00,3.01,2.95 ,2.90 and 3.00. With a grand mean of 2.96. this implies that respondents perceived AI as playing a significant role in enhancing the quality of education, strengthening students' competencies, and fostering skills relevant to national development. Overall, the finding confirms that AI integration into vocational technical education is a strategic approach for equipping Business Education students with competencies that support national development in south-south Nigeria.

Discussion of Findings

The findings of the study revealed that AI utilization positively impacts on teaching and learning of VTE. This is in line with the position of Selwyn (2019) who insisted that AI facilitates adaptive learning systems and tailors it to individual student needs. The findings also collaborate the view of Zawacki-Richter et al. (2019) who noted that AI-driven platforms shape learning experiences and adjusts educational content accordingly to meet students varying abilities. This equally affirmed the position of Ng et al. (2021) who stated that AI helps in grading, virtual tutors, and intelligent feedback that help to reduce workload for teachers. The findings are similar with that of Chen et al. (2020) who agreed that the use of

AI tools offer safe, convenient and cost-effective alternatives for skill acquisition. This is related with the thought of Pan et al. (2021) who affirmed that AI adequately prepares graduates with globally accepted VTE skills. This means that AI utilization positively impacts on teaching and learning of VTE in Benue State. Findings from the study also showed that challenges affecting the utilization of AI in teaching and learning of VTE include: High cost of funding AI in VTE, lack of adequate literacy among VTE teachers, poor data privacy policy, over-reliance on AI, and increasing the gap between students from different socio-economic backgrounds. This is related to the view of Selwyn (2019) who echoed that AI integration is less accessible for underfunded institutions.

The study also linked with the findings of Ng et al. (2021) who insisted that many VTE teachers lack skills to integrate AI tools effectively into teaching and learning processes. The study also reflects the view of Chen et al. (2020) who reaffirmed that AI-driven systems pose a risk to student's data privacy and security. Findings from the study equally links with that of Pan et al. (2021) who be laboured that AI-based simulations reduces practical learning experiences that is crucial for VTE programmes. The study equally reflected the submission of Zawacki-Richter et al. (2019) who insisted that due to social-economic disparity, not all students are able to access AI-driven learning tools. This point to the fact that addressing the challenges using: Adequate VTE funding towards AI utilization, using AI to train VTE teachers, good policy on data privacy will position south south on the world map on producing graduates who meet global standards.

Findings from the study affirmed that strategies such as: Collaborations to fund AI-based VTE programmes, adopting open-source AI tools/software to reduce costs, providing AI training programmes for VTE teachers to enhance their AI competency, use of privacy-preserving AI solutions to protect student data from misuse, combining AI-driven instruction with practical, hands-on training to help students acquire both all aspects of VTE and implementing policies that target expansion of AI access to rural areas through infrastructure development, are the strategies for implementing AI in VTE teaching and learning. This is related to the submission of Schmid et al. (2021) who insisted that public-private partnerships (PPP) and open-source AI tools can help institutions overcome financial barriers. This affirmed the position of Jin et al. (2022) who stressed that cloud-based AI solutions can reduce hardware costs. This also collaborates the findings of Ng et al. (2021) and Chen et al. (2020) who noted that teacher training schools should adopt AI for preparing teachers. The findings also align with that of Selwyn (2019) who advocated for institutional policies that enforce the use of AI. Findings from the study also affirmed the queue of Pan et al. (2021) who insisted that the use of AI prepares students to acquire both theoretical and applied skills. This also fits like the that of Schmid et al. (2021) who reiterated the provision of AI infrastructure

for underprivileged areas as a step towards inclusivity. This implies that the aforementioned strategies will address challenges affecting integration of AI tools utilization into VTE skills for creativity and innovation.

Conclusion

The study examined the integration of Artificial intelligence (AI) into vocational Technical Education (VTE) and its impact on enhancing problem-solving skills among Business Education students in Colleges of Education in South-South Nigeria, as well as its contribution to national development, the findings indicate that respondents perceived AI as highly effective in improving assessment practices, fostering creativity, enhancing innovation, and developing problem-solving skills. Additionally, AI integration is seen as contributing positively to national development by enhancing students' competencies, promoting innovation and preparing them for technologically advanced workplaces. The study concludes that AI is a crucial tool for modernizing vocational technical education, equipping students with 21st- century skills and strengthening the capacity of Nigeria's future workforce, its integration can help bridge the gap between traditional teaching methods and the demands of a digital economy, ultimately contributing to sustainable national development

Recommendations

Based on the findings, the following recommendations are made

1. Government and policy Makers should invest in AI infrastructure and digital tools for vocational technical institutions to ensure effective integration of AI in teaching, learning and assessment, also develop policies that mandate inclusion of AI-based learning in Business Education curricula across tertiary institutions.:
2. Government and relevant stakeholders should invest in the purchase and utilization of AI equipment for teaching VTE so as to achieve and sustain its impact.
3. Government and relevant stakeholders should set up a monitoring and evaluation team to constantly supervise the utilization of AI equipment used for teaching and learning VTE in South South.
4. Government through relevant stakeholders should champion the creation and implementation of policies and regulations that support AI integration in teaching and learning VTE in South South, Nigeria.

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