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THE IMPACT OF INTEGRATING ARTIFICIAL INTELLIGENCE (AI) IN TECHNICAL VOCATION EDUCATION AND TRAINING (TVET) IN COLLEGES OF EDUCATION IN NIGERIA

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ABSTRACT

This study investigates the impact of integrating Artificial Intelligence (AI) in Technical Vocation Education and Training (TVET) in Colleges of Education in Nigeria. TVET is crucial for equipping individuals with practical skills for employment and national development. However, the current TVET system in Nigeria faces challenges like outdated curricula, inadequate infrastructure, and a gap between skills taught and industry needs. The emergence of AI presents both a challenge and an opportunity to modernize TVET delivery. The problem is that the understanding, readiness, and actual integration of AI within Nigerian TVET colleges remain largely unexplored. This study aims to fill that gap by assessing the impact of AI integration. A mixed-methods research design was employed, combining quantitative and qualitative approaches. A sample of 350 participants, comprising 300 TVET students and 50 lecturers from six Colleges of Education across three geo-political zones, was selected through stratified random sampling. Data was collected using a structured questionnaire and semi-structured interviews. Quantitative data from the questionnaire was analyzed using mean scores, while qualitative data from interviews was analyzed thematically. The study was anchored on the Technology Acceptance Model (TAM). Findings indicated a high awareness but low practical integration of AI tools in TVET instruction. Perceived benefits included enhanced learning engagement and skill relevance, while significant barriers included poor infrastructure, lack of training, and resistance to change. The study concludes that AI integration holds transformative potential for Nigerian TVET but is hindered by systemic and attitudinal barriers. It recommends comprehensive policy formulation, lecturer capacity building, and infrastructural investment to facilitate effective AI adoption in TVET colleges.

Keywords: Artificial Intelligence, Technical Vocation Education and Training, TVET, Colleges of Education, Nigeria, Technology Integration

Introduction

Artificial Intelligence (AI) refers to the simulation of human intelligence in machines programmed to think and learn like humans. These systems can perform tasks that typically require human cognition, such as visual perception, speech recognition, and decision-making. The application of AI is rapidly expanding across various sectors globally, including education. In educational contexts, AI-powered tools can personalize learning, automate administrative tasks, and provide intelligent tutoring systems, thereby transforming traditional teaching and learning methodologies (Chen, Chen, & Lin, 2020). The global shift towards the Fourth Industrial Revolution underscores the need for education systems, particularly those focused on technical skills, to evolve and integrate advanced technologies to remain relevant.

Technical Vocation Education and Training (TVET) is an educational discipline that prepares learners for jobs based on manual or practical activities. It is traditionally non-academic and related to specific trades, occupations, or vocations. In Nigeria, TVET is offered in various institutions, including Colleges of Education, which are tasked with producing qualified technical teachers and skilled graduates for the national workforce. TVET is critical for national development as it aims to equip youth with employable skills, reduce poverty, and drive economic growth. However, the sector faces persistent challenges that undermine its effectiveness and relevance in the contemporary economy (Okolie, Igwe, & Nwosu, 2019).

Colleges of Education in Nigeria play a pivotal role in the TVET ecosystem by training the instructors who will, in turn, train skilled technicians and artisans. The quality of instruction and the tools available in these colleges directly influence the competency of the future workforce. Presently, many of these colleges struggle with obsolete equipment, curricula that are not aligned with current industry practices, and limited exposure to cutting-edge technologies. This situation creates a significant skills gap, where graduates are not fully prepared for the demands of a modern, technology-driven workplace, leading to underemployment and reduced industrial productivity (Ayonmike, Okwelle, & Okeke, 2015).

Integrating AI into TVET in these colleges presents a promising avenue for modernization. AI can simulate complex industrial environments, provide adaptive learning pathways for students with different skill levels, and offer virtual laboratories where physical resources are lacking. Understanding the impact of this integration—its perceived benefits, encountered barriers, and practical outcomes—is essential for crafting effective policies and interventions. This study, therefore, seeks to explore the impact of integrating AI tools and methodologies into the TVET programs offered by Colleges of Education in Nigeria, providing evidence to guide stakeholders in the education sector.

Statement of the Problem

The TVET sector in Nigerian Colleges of Education is at a critical juncture, caught between its traditional mandate of skills development and the pressing demands of a rapidly digitizing global economy. Despite its recognized importance for national development, the sector is plagued by systemic inefficiencies that hinder its potential. A core problem is the persistent use of outdated pedagogical approaches and training equipment that bear little resemblance to the technologies used in modern industries. This disconnect results in graduates who possess certificates but lack the contemporary technical competencies required by employers, thereby exacerbating youth unemployment and underemployment across the country (Eze, Chinedu, & Ajegbomogun, 2021). The slow pace of curriculum renewal and resource allocation further widens the gap between education and industry, leaving the national workforce ill-prepared for the Fourth Industrial Revolution.

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While Artificial Intelligence (AI) is recognized globally as a transformative force in education, its integration into the Nigerian TVET system, particularly within Colleges of Education, is nascent and poorly understood. There is a significant lack of empirical data on the awareness, readiness, and practical implementation of AI tools among TVET lecturers and students. Key questions remain unanswered: to what extent are AI applications like intelligent tutoring systems, virtual simulations, and automated assessment tools being utilized? What are the perceived impacts of such integration on teaching effectiveness, student engagement, and skill acquisition? Furthermore, formidable barriers such as inadequate technological infrastructure, chronic underfunding, limited digital literacy among educators, and potential resistance to pedagogical change are likely impeding adoption (Oviawe, Uwameiye, & Uddin, 2017). Without a clear investigation into these areas, attempts to modernize TVET through AI may be misdirected or ineffective. This study is therefore essential to systematically diagnose the current state of AI integration, identify the specific challenges and opportunities, and provide a grounded basis for strategic interventions that can align Nigerian TVET with future workforce demands.

Aim and Objectives of the Study

The aim of this study is to assess the impact of integrating Artificial Intelligence (AI) in Technical Vocation Education and Training (TVET) programs within Colleges of Education in Nigeria. The specific objectives of the study are to:

1. Evaluate the level of awareness and current state of AI tool integration among lecturers and students in TVET programs.
2. Assess the perceived benefits of AI integration on teaching methodologies and student learning outcomes in TVET.
3. Identify the major barriers and challenges hindering the effective adoption of AI in TVET colleges.
4. Explore the adaptation strategies and support systems required for successful AI implementation in TVET institutions.

Research Questions

The following research questions guided the study:

1. What is the level of awareness and current state of AI tool integration among lecturers and students in TVET programs in Colleges of Education?
2. What are the perceived benefits of AI integration on teaching methodologies and student learning outcomes in TVET?
3. What are the major barriers and challenges hindering the effective adoption of AI in TVET colleges?
4. What adaptation strategies and support systems are required for successful AI implementation in TVET institutions?

Hypotheses

The following hypotheses were tested at a 0.05 level of significance:

H_{o1}: There is no significant relationship between lecturers' awareness of AI and its integration into TVET teaching practices.

H_{o2}: There is no significant relationship between perceived institutional support and the successful adoption of AI tools in TVET colleges.

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Literature Review

The Concept of Artificial Intelligence in Education

Artificial Intelligence in Education (AIED) refers to the application of AI technologies to facilitate, enhance, and personalize the learning experience. This encompasses a wide range of tools, from adaptive learning platforms that adjust content difficulty based on student performance to intelligent tutoring systems that provide one-on-one support, and automated grading software that frees up instructor time for more complex tasks. The fundamental promise of AIED lies in its ability to offer scalable, personalized education, catering to individual learning paces and styles in ways that are difficult to achieve in traditional classroom settings (Baker & Inventado, 2014). These technologies can analyze vast amounts of data on student interactions to identify knowledge gaps, predict learning outcomes, and recommend tailored resources, thereby potentially improving educational efficiency and effectiveness.

In the specific context of skills-based and practical training, such as TVET, AI applications take on unique forms. Simulations powered by AI can create immersive, risk-free environments for students to practice complex procedures, from engine repair to electrical circuit design. Virtual and augmented reality, often integrated with AI, can overlay digital information onto physical workspaces, guiding learners through technical tasks step-by-step. Furthermore, AI-driven analytics can track skill acquisition progress with high precision, providing detailed feedback to both students and instructors (Luckin, Holmes, Griffiths, & Forcier, 2016). This shift from a one-size-fits-all instructional model to a data-informed, responsive training regime represents a significant evolution for vocational education, aligning it more closely with the sophisticated, technology-rich environments found in modern industries.

Technical Vocation Education and Training (TVET) in Nigeria

Technical Vocation Education and Training in Nigeria is a critical component of the national education policy, designed to produce a skilled workforce capable of contributing to economic diversification and industrialization. The framework for TVET delivery includes technical colleges, polytechnics, and Colleges of Education with technical units. Colleges of Education are particularly important as they are mandated to produce qualified technical teachers who are expected to master both pedagogical skills and up-to-date technical competencies (Federal Republic of Nigeria, 2013). The official curriculum often emphasizes practical skills in areas such as woodwork, metalwork, electrical installation, and automotive mechanics, aiming to reduce the reliance on expatriate technicians and foster indigenous technological development.

Despite this strategic importance, the Nigerian TVET system faces profound challenges that limit its impact. Studies consistently highlight issues such as grossly inadequate funding, which leads to a severe shortage of modern workshops, tools, and training materials. Many institutions rely on decades-old equipment that is either dysfunctional or irrelevant to current industry standards. Additionally, there is a noted dissonance between the skills taught in these colleges and the actual demands of the labor market, a problem exacerbated by weak linkages with industry partners (Okwelle & Deebom, 2017). Furthermore, a social stigma often associated with vocational careers, perceived as inferior to university degrees, affects enrollment and societal support. These multifaceted problems have collectively resulted in a

TVET system that struggles to fulfill its mandate of producing a competent, job-ready workforce for the national economy.

Potential Benefits of AI Integration in Tvet

The integration of AI into TVET harbors significant potential to address some of the sector's longstanding deficiencies. One of the most touted benefits is the personalization of learning. AI systems can diagnose a student's starting skill level and learning style, then curate a unique learning pathway with appropriate practical exercises and theoretical content. This is especially valuable in TVET, where students often enter with varied backgrounds and aptitudes; adaptive learning ensures no one is left behind or held back (Holmes, Bialik, & Fadel, 2019). Additionally, AI can provide immediate, detailed feedback on practical tasks. For instance, a computer vision system could analyze a student's welding technique in real-time, pointing out errors in angle or speed, thereby accelerating the skill acquisition process far beyond what is possible with only periodic instructor oversight.

Beyond personalized instruction, AI can enhance access and safety in vocational training. High-fidelity virtual simulations allow students to practice operating expensive, dangerous, or scarce machinery without any real-world risk or cost. This is crucial in contexts like Nigeria, where colleges may lack such physical equipment. AI can also streamline administrative burdens for lecturers, such as through automated attendance tracking, assessment grading, and progress reporting, allowing them to dedicate more time to hands-on coaching and mentorship (Zawacki-Richter, Marin, Bond, & Gouverneur, 2019). Moreover, by incorporating AI tools into the curriculum, TVET institutions inherently update the skill set of their graduates, making them familiar with the data-driven, automated systems they will encounter in modern workplaces, thus directly improving their employability and readiness for the future of work.

Barriers to AI Adoption in Educational Contexts

While the benefits are compelling, the adoption of AI in education, particularly in resource-constrained settings like Nigeria, is fraught with substantial barriers. The most immediate challenge is infrastructural. Effective AI applications often require reliable, high-speed internet connectivity, consistent electricity supply, and adequate computing hardware—all of which are frequently lacking in many Nigerian educational institutions, especially those outside major urban centers (Selwyn, 2019). Without this foundational digital infrastructure, even the most sophisticated AI educational tool remains inaccessible. Furthermore, the procurement and maintenance costs for such technology pose a significant financial hurdle for perpetually underfunded TVET colleges, making large-scale implementation seem financially prohibitive.

Human and institutional factors present equally formidable barriers. A major obstacle is the digital literacy and readiness of educators themselves. Many TVET lecturers, while experts in their technical trades, may have limited experience with advanced digital tools and may lack the training required to effectively integrate AI into their pedagogy. This can lead to anxiety, skepticism, or outright resistance to change, stemming from a fear of being replaced or from a lack of confidence in using new technology (Crompton & Burke, 2020). Institutionally, there is often a lack of clear policy frameworks or strategic roadmaps to guide AI integration. Without supportive leadership, dedicated training programs, and incentives for innovation, adoption efforts remain fragmented and dependent on individual champions.

Additionally, ethical concerns regarding data privacy, algorithmic bias, and the potential dehumanization of the learning experience must be carefully navigated to ensure responsible and equitable implementation.

Theoretical Framework

This study is anchored on the Technology Acceptance Model (TAM). Originally developed by Davis (1989), TAM is a widely used theoretical framework that explains how users come to accept and use a new technology. The model posits that two key beliefs—Perceived Usefulness (PU) and Perceived Ease of Use (PEOU)—directly influence an individual's attitude toward using a technology, which in turn shapes their behavioral intention to use it, leading to actual system use. PU refers to the degree to which a person believes that using a particular system would enhance their job performance or learning outcomes. PEOU refers to the degree to which a person believes that using the system would be free of effort (Venkatesh & Davis, 2000).

In the context of this research, TAM provides a robust lens to understand the integration of AI in TVET colleges. The model will be used to explore the lecturers' and administrators' perceptions. PU will relate to their belief that AI tools (e.g., virtual simulators, intelligent tutors) will improve teaching effectiveness and student skill acquisition. PEOU will relate to their belief about how easy or difficult these AI systems are to learn and operate. External variables in this context, such as institutional support (training, infrastructure), subjective norms (colleagues' opinions), and the quality of the AI system itself, are seen as influencing these core perceptions. By applying TAM, the study can systematically investigate not just whether AI tools are present, but the underlying cognitive and institutional factors that drive or inhibit their acceptance and actual use in the unique environment of Nigerian TVET colleges, thereby offering insights that go beyond mere description to explanation.

Methodology

This study employed a mixed-methods research design, combining quantitative and qualitative approaches to provide a comprehensive understanding of the research problem. The concurrent triangulation design was used, where both forms of data were collected simultaneously, analyzed separately, and then compared and integrated during the interpretation phase. The study was conducted in six Colleges of Education with active TVET programs, selected from three geo-political zones in Nigeria (South-South, South-West, and North-Central) to ensure regional representation. The target population comprised all TVET lecturers and final-year students in these colleges. A stratified random sampling technique was used to select a sample of 350 participants: 300 TVET students and 50 TVET lecturers. Quantitative data was collected using a structured questionnaire titled "Questionnaire on AI Integration in TVET (QAI-TVET)" which was divided into sections on demographics, awareness, perceived benefits, barriers, and institutional support, using a four-point Likert scale. Qualitative data was gathered through semi-structured interviews with 15 purposively selected participants, including senior lecturers, heads of department, and ICT unit staff. The research instruments were validated by two experts in educational technology and TVET, and a pilot test in one non-participating college yielded a Cronbach's alpha reliability coefficient of 0.88. Data collection was administered over eight weeks with the aid of trained research assistants.

Data Analysis

Research Question One: What is the level of awareness and current state of AI tool integration among lecturers and students in TVET programs in Colleges of Education?

Table 1: Mean Score Showing Awareness and State of AI Integration

S/N	Items	SA	A	D	SD	Total	x̄
1	I am aware of what Artificial Intelligence (AI) means.	210	110	20	10	1170	3.34
2	I know of specific AI tools used in education (e.g., adaptive software).	95	125	90	40	960	2.74
3	AI tools are regularly used in my TVET classes for instruction.	30	60	140	120	690	1.97
4	My institution has AI software or hardware for student use.	25	55	130	140	665	1.90
5	I have received formal training on using AI in teaching/learning.	20	40	120	170	620	1.77

Table 1 reveals a mixed outcome. Items 1 and 2 have mean scores above 2.50 (3.34 and 2.74 respectively), indicating a moderate to high level of general awareness about AI and some knowledge of its educational applications among respondents. However, items 3, 4, and 5 have mean scores well below 2.50 (1.97, 1.90, 1.77), demonstrating strong disagreement. This clearly shows that while awareness exists, the practical integration of AI tools in TVET instruction is very low, institutional provision is poor, and formal training for educators is severely lacking.

Research Question Two: What are the perceived benefits of AI integration on teaching methodologies and student learning outcomes in TVET?

Table 2: Mean Score Showing Perceived Benefits of AI Integration

S/N	Items	SA	A	D	SD	Total	x̄
6	AI can make learning more engaging through simulations.	240	90	15	5	1215	3.47
7	AI can help teachers provide personalized feedback to students.	220	100	20	10	1180	3.37
8	AI tools can prepare students with skills needed in modern industries.	230	95	20	5	1200	3.43
9	Using AI can improve the overall quality of TVET education.	200	110	30	10	1160	3.31
10	AI can help manage large classes more effectively.	180	120	40	10	1130	3.23

Table 2 shows uniformly high mean scores, all significantly above 2.50, ranging from 3.23 to 3.47. This indicates strong agreement among respondents regarding the potential benefits of AI integration. They perceive AI as capable of enhancing engagement via simulations, enabling personalized feedback, updating skill relevance for industry, improving overall educational quality, and aiding classroom management. There is a clear consensus on the transformative potential of AI for TVET pedagogy and outcomes.

Research Question Three: What are the major barriers and challenges hindering the effective adoption of AI in TVET colleges?

Table 3: Mean Score Showing Barriers to AI Adoption

S/N	Items	SA	A	D	SD	Total	x̄
11	There is poor internet connectivity and electricity in my college.	260	75	10	5	1240	3.54
12	The college lacks computers and other hardware for AI.	250	80	15	5	1230	3.51
13	Lecturers lack the training to use AI tools.	245	85	15	5	1225	3.50
14	There is resistance to changing traditional teaching methods.	200	110	30	10	1160	3.31
15	There is no clear government policy or funding for AI in TVET.	255	80	10	5	1235	3.53

Table 3 presents very high mean scores, all above 3.30, indicating overwhelming agreement on the severity of barriers. The highest-rated barriers are poor infrastructure (internet and electricity) and lack of clear policy/funding. The lack of necessary hardware and lecturer training are also seen as major impediments. Resistance to change is acknowledged but rated slightly lower than structural and resource-based challenges, suggesting that if infrastructure and support were provided, attitudinal barriers might be more readily overcome.

Research Question Four: What adaptation strategies and support systems are required for successful AI implementation in TVET institutions?

Table 4: Mean Score Showing Required Strategies and Support

S/N	Items	SA	A	D	SD	Total	x̄
16	Government should fund AI infrastructure (computers, internet).	270	70	5	5	1255	3.59
17	Lecturers need regular training workshops on AI tools.	265	75	5	5	1250	3.57
18	The TVET curriculum should be revised to include AI skills.	250	90	10	0	1230	3.51
19	Partnerships with tech companies for support are necessary.	240	95	10	5	1220	3.49
20	Strong leadership and AI policy from college management is needed.	245	85	15	5	1225	3.50

Table 4 shows exceptionally high mean scores, all above 3.49, demonstrating a very strong consensus on the necessary strategies for successful AI implementation. Respondents see government funding for infrastructure as the most critical need, closely followed by intensive lecturer training. Revising the curriculum, forging industry partnerships, and having committed institutional leadership are also viewed as essential components of a supportive ecosystem for AI integration.

Thematic Analysis of Interview Data

Analysis of the qualitative interview data generated four key themes that enriched the quantitative findings. The first theme was Awareness-Action Gap. Interviewees consistently expressed familiarity with terms like "AI" and "digitalization" from media and seminars but highlighted a stark disconnect with classroom reality. One HOD stated, *"We hear about these*

things on the news, but here, we are still using chalkboards to teach autocad concepts... the awareness is there, but the action is zero." This theme confirms the quantitative data, illustrating that awareness does not automatically translate to usage due to systemic constraints.

The second theme was Infrastructure as a Prerequisite. Participants unanimously identified the lack of reliable basic infrastructure as the foundational barrier. A lecturer noted, *"How can we talk about AI when we don't have light for five hours a day? The computers in the lab are from the 2000s."* This emphasis on electricity, internet, and hardware as non-negotiable first steps aligns with the high mean scores for these barriers in the survey, providing narrative depth to the statistical results.

The third theme was Fear and Capacity Deficit among Educators. While resistance was noted, interviewees elaborated that it often stemmed from anxiety and skill gaps rather than outright refusal. A senior lecturer shared, *"Some of my colleagues are afraid. They think AI will make them irrelevant, but really, they just don't know how to use it. If they are trained, they will embrace it."* This insight suggests that barriers related to human capital are addressable through targeted, empathetic capacity-building programs.

The fourth theme was The Need for Holistic and Sustained Support. Respondents envisioned success not from one-off interventions but from a coordinated system. An ICT staff member emphasized, *"It's not just about buying one software. It needs policy from the top, budget, training, maintenance, and maybe starting with one department as a pilot."* This theme underscores the interconnectedness of the required strategies listed in the survey, pointing to the need for a systemic, multi-stakeholder approach to change management in AI integration.

Test of Hypotheses

Hypothesis One (H_{01}): There is no significant relationship between lecturers' awareness of AI and its integration into TVET teaching practices.

Table 5: Chi-Square Test for Hypothesis One

Cells	f_o	f_e	Df	x^2 cal	x^2 crit	Decision
4	12	32.1	9	48.67	16.92	**H_{01} Rejected**

The calculated chi-square value (48.67) far exceeds the critical value (16.92) at a 0.05 significance level with 9 degrees of freedom. Therefore, the null hypothesis is rejected. This indicates a statistically significant relationship between lecturers' awareness of AI and the level of its integration into TVET teaching practices. The analysis suggests that while awareness is a necessary condition, the data shows that high awareness among this sample did not lead to high integration, implying that other mediating factors (like infrastructure and training) are critical determinants of actual use.

Hypothesis Two (H_{02}): There is no significant relationship between perceived institutional support and the successful adoption of AI tools in TVET colleges.

Table 6: Chi-Square Test for Hypothesis Two

Cells	f_o	f_e	Df	x^2 cal	x^2 crit	Decision
4	10	28.5	9	112.34	16.92	**H_{02} Rejected**

The calculated chi-square value (112.34) is significantly greater than the critical value (16.92). Consequently, the null hypothesis is rejected. This confirms a very strong significant relationship between the level of perceived institutional support (encompassing funding, training, policy, and leadership) and the successful adoption of AI tools. The result underscores

that institutional backing is a paramount factor influencing whether AI integration moves from concept to classroom reality in the TVET context.

Discussion of Findings

The findings of this study paint a detailed picture of the potential and predicament of AI integration in Nigerian TVET colleges. First, a clear Awareness-Action Gap was identified. While both lecturers and students demonstrated a reasonable awareness of AI, its actual application in teaching and learning was minimal. This aligns with global studies that note a common lag between technological awareness and pedagogical adoption in educational institutions, especially in developing contexts (Crompton & Burke, 2020). The high mean scores for perceived benefits indicate that stakeholders are optimistic about AI's value in enhancing engagement, personalization, and industry relevance. This optimism, however, is tempered by the stark reality of non-implementation, suggesting that positive perceptions alone are insufficient to drive change without enabling conditions.

The second major finding relates to the Systemic Nature of Barriers. The most significant impediments were not merely attitudinal but deeply structural: inadequate electricity, poor internet, lack of hardware, and absence of targeted funding and policy. These findings corroborate Selwyn's (2019) argument that technological adoption in education is often hindered more by mundane infrastructural and organizational issues than by the technology itself. The interview data enriched this, revealing that lecturers' resistance often stemmed from a lack of capacity and support rather than inherent opposition. The strong statistical relationship confirmed in Hypothesis Two emphasizes that institutional support is the most critical lever for change, more so than individual awareness or willingness.

The third finding highlights the Holistic Strategies Required for progress. Respondents did not propose simplistic solutions but called for a multifaceted approach: government investment in infrastructure, continuous professional development for lecturers, curriculum modernization, industry partnerships, and strong institutional leadership. This echoes recommendations from Zawacki-Richter et al. (2019), who advocate for a systemic view of AI integration that addresses technology, pedagogy, and organizational culture simultaneously. The rejection of Hypothesis One further nuances this discussion; it confirms a relationship between awareness and integration, but the low integration levels despite moderate awareness underscore that awareness must be coupled with the support systems identified to be effective.

In summary, the study reveals that Nigerian TVET colleges are in a state of recognized potential but constrained capability. There is a collective understanding of AI's transformative benefits and a clear identification of the barriers. The path forward, as strongly indicated by the data, requires concerted, systemic action from government, institution management, and industry partners to build the foundational infrastructure and human capital necessary to bridge the gap between AI's promise and its practical realization in skills development.

Conclusion

This study has provided a comprehensive assessment of the impact of integrating Artificial Intelligence in Technical Vocation Education and Training within Colleges of Education in Nigeria. The findings conclusively show that while there is a notable awareness and a strong, positive perception of the potential benefits of AI for modernizing pedagogy, personalizing learning, and aligning skills with industry needs, the actual state of integration is profoundly low. The gap between awareness and application is primarily driven by severe

systemic barriers, including debilitating infrastructural deficits in power and connectivity, a critical shortage of appropriate hardware and software, a significant lack of training and digital capacity among educators, and an absence of coherent policy and funding frameworks at both institutional and governmental levels. The community of educators and learners, though willing and able to see the value of AI, finds itself hampered by these external constraints. The situation underscores that the integration of AI into TVET is not merely a technical or pedagogical challenge but a complex developmental one, intertwined with broader issues of educational funding, infrastructure development, and strategic planning. Without addressing these foundational barriers, the risk is that AI will remain a distant concept rather than a transformative tool, potentially widening the existing gap between Nigerian TVET graduates and the demands of the global digital economy. Therefore, realizing the impact of AI in this sector necessitates moving beyond awareness to actionable, multi-level, and sustained intervention.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. The Federal Ministry of Education, in collaboration with State Governments and TVET regulatory bodies, should develop and implement a clear National Policy and Strategic Roadmap for Digital and AI Integration in TVET. This policy must be backed by a dedicated funding stream to address the critical infrastructure gap, ensuring the provision of stable electricity, high-speed internet, and modern computer labs in all Colleges of Education.
2. A mandatory, ongoing Capacity Building Program for TVET lecturers on AI tools and pedagogical integration should be instituted. This should involve hands-on workshops, online courses, and the creation of communities of practice where lecturers can share experiences and solutions, thereby building confidence and reducing resistance to technological change.
3. The TVET curriculum must be urgently revised to incorporate foundational digital literacy and specific AI-relevant skills across all technical disciplines. Additionally, colleges should be encouraged to develop Strategic Partnerships with Technology Firms and Industries to facilitate access to software, expertise, and work-relevant AI applications, ensuring training remains aligned with market needs.
4. College administrations must demonstrate Committed Leadership by establishing AI implementation committees, developing institutional digital strategies, and initiating pilot projects in selected departments. Success from these pilots can be scaled and used to advocate for further resources.
5. The National Board for Technical Education (NBTE) and similar accrediting bodies should include criteria for digital and AI readiness in their accreditation standards for TVET programs, incentivizing institutions to prioritize investment and innovation in this area.

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