



Interconnection of Creativity, Innovation, Technology, and Digitalization in Teaching Vocational and Technology Education in Colleges of Education in North East Nigeria

¹Aminu Musa Ningi, ²Baba Yahaya Idris, ³Idris Hussaini, ⁴Muhammad Kabiru Ismail

^{1&3}Department of Agricultural Education,

²Department of Adult and Non-Formal Education

⁴Department of Primary Education Studies

Adamu Tafawa Balewa College of Education, Kangere, Bauchi State

ABSTRACT

The 21st century has transformed educational expectations, requiring institutions to produce graduates who are creative, innovative, technologically competent, and digitally literate. This study investigated the extent to which creativity, innovation, technology, and digitalization (CITD) are integrated into the teaching of Vocational and Technical Education (VTE) in Colleges of Education in North-East Nigeria. A descriptive survey design was adopted, involving lecturers and students from six Colleges of Education across the geopolitical zone. Data were collected using a structured questionnaire titled Interconnection of Creativity, Innovation, Technology, and Digitalization Scale (ICITDS), validated by experts and yielding a reliability coefficient of 0.87. Findings revealed that creativity and innovation are applied to a high extent in teaching VTE, while technology integration and digitalization occur at a moderate level. Respondents agreed that CITD enhances student engagement, problem-solving, and skill acquisition; however, challenges such as inadequate infrastructure, unreliable electricity, poor internet connectivity, and insufficient lecturer training hinder full implementation. The study concludes that while CITD integration is recognized as vital for improving teaching effectiveness and employability outcomes, systemic barriers must be addressed. It recommends investment in ICT infrastructure, regular professional development for lecturers, curriculum restructuring to reflect technological realities, and the establishment of a structured policy framework to guide and monitor CITD practices in VTE.

ARTICLE INFO

Article History

Received: April, 2025

Received in revised form: May, 2025

Accepted: July, 2025

Published online: September, 2025

KEYWORDS

Creativity, Innovation, Technology, Digitalization, Vocational and Technical Education, Colleges of Education, North-East Nigeria

INTRODUCTION

The 21st century is characterized by rapid changes in knowledge, skills, and workplace demands, driven by globalization, technology, and digital transformation. As a result, the role of higher education, particularly Colleges of Education, has expanded beyond traditional knowledge transmission to include the cultivation of creativity, innovation, and technological competence in both teachers and learners (UNESCO, 2022; World Bank, 2023). In

Vocational and Technology Education (VTE), this shift is even more critical, as the field focuses on equipping learners with practical skills, problem-solving abilities, and entrepreneurial competencies required for self-reliance and national development (Okoye & Okwelle, 2022).

Teaching in this domain must therefore integrate creativity, innovation, technology, and digitalization to remain relevant in addressing contemporary challenges in education and the labour market. Vocational and Technical

Corresponding author: Aminu Musa Ningi

✉ musaaminuningi@gmail.com

Department of Agricultural Education, Adamu Tafawa Balewa College of Education, Kangere, Bauchi State.

© 2025. Faculty of Technology Education. ATBU Bauchi. All rights reserved



Education (VTE) is essential in equipping people with technical competence for economic development and poverty alleviation. For Nigeria, the increasing unemployment rate has highlighted the significance of an effective VTE system that not only delivers technical competence but also creativity, innovation, and versatility in students. Historically, VTE has been regarded as a second-best option to academic education, but current perspectives highlight its significance in sustainable survival of the family and national development (Fadipe, Obiana, & Zangina, 2023).

Integrating creativity into VTE is key to the development of students' problem-solving capacity and innovation. By creative thinking, teachers can enhance students' ability to adapt to emerging technologies and meet the demands of industries. Innovation in pedagogy continues to heighten the learning process, making education more relevant and responsive to society (Ezeugwu & Okafor, 2025). Technological advancements have transformed instruction delivery in VTE. The utilisation of digital platforms and technology tools offers interactivity, international resource access, and achievement of digital literacy on the part of the learners.

Notwithstanding this, limitations such as inadequate infrastructure and limited accessibility to technology persist, which undermine the optimisation of technology incorporation into learning (Jackson, Ekong, & George, 2024). Digitalization is the process of integrating digital technology into all areas of learning, leading to profound changes in teaching and learning processes. In Nigeria, policies like the National Digital Learning Policy are geared towards leveraging digital technology to support learning and mitigate disruption caused by various challenges (Federal Ministry of Education, 2023).

Despite these efforts, the effective use of digitalization for VTE is impeded by infrastructural deficiencies and capacity development among teachers. In Nigeria's North-East region, Colleges of Education are at the forefront of VTE program realization. Therefore, the extent to which creativity, innovation, technology, and digitalization are incorporated into teaching practice remains unexplored. It is

important to learn about the dynamic interaction of these factors to raise the quality of learning and position the graduates in a better position to thrive in an ever-evolving employment landscape.

CONCEPTUAL CLARIFICATION

Concept of Creativity

Creativity is the ability to generate novel and useful solutions or concepts in a learning situation (Ezeugwu & Okafor, 2025). Creativity in VTE occurs when students and instructors devise creative means of solving daily problems, project development, or modifying teaching methods. Instruction through creativity enhances critical thinking, adaptability, and students' capacity for self-directed learning (Jackson, Ekong, & George, 2024).

Concept of Innovation

Innovation is the implementation of new ideas for improving processes, products, or services (Umoru, Ibanga, & Sunday, 2024). Innovation in VTE is evident in innovative pedagogy such as project-based learning, the flipped classroom, and the utilization of smart tools to acquire skills. Innovation enables learners to adapt to industrial transformations and technological advancements, raising employability and productivity.

Concept of Technology

Technology is the hardware, software, and computer applications used to aid in learning and instruction. In VTE, technology includes computer-aided design (CAD), simulations, and other devices used for learning that allow learners to acquire skills in simulated environments. The use of technology in vocational education has been shown to enhance efficiency, engagement, and skill mastery (Jackson, Ekong, & George, 2024).

Concept of Digitalization

Digitalization is the process of using digital platforms and tools to transform learning and teaching. It comprises e-learning platforms, online testing, and multimedia instructional resources. Digitalization not only offers better



access to learning material but also encourages interactive and personalized learning (Federal Ministry of Education, 2023). Digitalization in VTE enables skill attainment and ensures students are proficient in digitally relevant industry skills.

Creativity in Teaching Vocational and Technology Education

Creativity refers to the ability to generate new, original, and valuable ideas that can be applied to solve problems or improve processes. In the context of VTE, creativity enables teachers to design innovative instructional strategies, teaching materials, and assessment tools that make learning practical and engaging (Amabile, 2020). For example, a creative lecturer in technical drawing may design project-based tasks that allow students to develop real-life prototypes, thereby enhancing critical thinking and problem-solving skills. Studies affirm that creativity in teaching encourages learners' active participation, fosters innovation, and improves performance in vocational subjects (NACCCE, 2021; Sawyer, 2022).

Innovation in Vocational and Technical Education (VTE)

Innovation refers to the application of new ideas in practical ways to improve processes, procedures, or products (Ezeugwu & Okafor, 2025). Innovation in Vocational and Technical Education (VTE) is necessary to maximize the effectiveness of instruction, maximize student motivation, and make students acquire skills relevant to the demands of contemporary industry (Umoru, Ibanga, & Sunday, 2024). In VTE, there are different forms of innovation which has to do with instructional strategies, curriculum design, assessment & Evaluation, and institutional practices. Empirical evidence indicates that the incorporation of innovation in VTE leads to higher students' motivation, enhanced learning of hands-on skills, and enhanced employability (Jackson, Ekong, & George, 2024).

Despite being imperative to Nigerian College of Education development, innovation is often hampered by underfunding, poor provision of pre-service training for teachers, and deficient

infrastructure (Ezeugwu & Okafor, 2025). Resolving these matters is central to the establishment of an innovation culture and having VTE graduates ready to handle emerging industry needs. In general, innovation in VTE enhances creativity by converting ideas into implementable teaching practices, curriculum reforms, and organizational improvements. It is a driver for having pupils with employable skills, enhancing the effectiveness of teaching, and enhancing industrial and entrepreneurial readiness.

Technology in Vocational and Technical Education (VTE)

Technology refers to the machinery, tools, software, and instructional procedures employed in learning, instruction, and skill acquisition (Jackson, Ekong, & George, 2024). Technology is an integral part of Vocational and Technical Education (VTE) as it plays a role in reshaping the way education is taught, in improving experience-based learning, and in connecting theory to practice. VTE utilizes technologies such as computer-aided design (CAD), machine automation, simulation, and multimedia platforms to facilitate instruction and learning (Umoru, Ibanga, & Sunday, 2024). The technologies facilitate the practice of complex skills in a safe and effective way before their actual application in real-world settings. The use of technology elicits active and participatory learning. For example, virtual labs and computer simulations enable students to experiment, debug, and apply critical thinking in a safe environment (Fadipe, Obiana, & Zangina, 2023).

Technology provides teachers and students with access to vast learning materials, including training videos, electronic manuals, and global best practices. The exposure broadens students' minds and inspires continuous learning (Jackson, Ekong, & George, 2024). Effective technology integration in VTE depends on the capability of teachers to use electronic tools for teaching-oriented activities. Professional development programs are crucial to enhance the technical skills of teachers and enable the effective application of technology in practical and theoretical classes (Ezeugwu & Okafor, 2025).

Corresponding author: Aminu Musa Ningi

✉ musaaminuningi@gmail.com

Department of Agricultural Education, Adamu Tafawa Balewa College of Education, Kangere, Bauchi State.

© 2025. Faculty of Technology Education. ATBU Bauchi. All rights reserved



Digitalization in Vocational and Technical Education (VTE)

Digitalization refers to the application of digital technologies in teaching, learning, and administrative processes for the better delivery and efficiency of education (Jackson, Ekong, & George, 2024). In Vocational and Technical Education (VTE), digitalization is increasingly being recognized as a key driver to better acquire skills by students, access learning content, and engage in practical and theory-based lessons. Digitalization involves the use of e-learning platforms, Learning Management Systems (LMS), and internet-based teaching materials. These platforms enable students to access learning materials at any time and from any place, making self-study and knowledge retention easier (Umoru, Ibanga, & Sunday, 2024).

Online examinations and digital portfolios facilitate real-time evaluation of students' competency and practical skills. This permits continuous feedback and individualized learning, which enhances students' performance overall (Fadipe, Obiana, & Zangina, 2023). Internet-based tools such as discussion forums, video conferencing, and collaborative software enable interaction among students and lecturers. This promotes cooperation, knowledge sharing, and collaborative problem-solving that is necessary in technical and vocational skill development (Ezeugwu & Okafor, 2025). Digitalization allows students to use virtual simulations, computer-based training programs, and interactive multimedia software. They facilitate the acquisition of practical skills, reduce limitations of resources, and provide safe environments for experimentation (Jackson, Ekong, & George, 2024).

STATEMENT OF THE PROBLEM

In Nigeria, the integration of creativity, innovation, technology, and digitalization into Vocational and Technical Education (VTE) is necessary in order to enhance the quality and relevance of education. However, a discrepancy between the effective implementation of these notions in Colleges of Education in the North-East region can be noted. This discrepancy weakens

the students' acquisition of practical skills and their preparation for the dynamic world of work requirements. Although VTE has been found to be a significant contributor to economic development and poverty alleviation, it has not yet reached its full potential due to some issues. Among these issues are inadequate infrastructure, low access to digital technologies, and insufficient emphasis on the development of creativity and innovativeness among teachers and learners (Fadipe, Obiana, & Zangina, 2023).

Additionally, the curriculum does not accommodate the digital skills that are necessary in modern vocational education (Umoru, Ibanga, & Sunday, 2024). The North-East geopolitical region, with its unique socio-economic forces and infrastructural constraints, must battle with additional bottlenecks in adopting and leveraging these educational innovations. The low digitization level of educational technology centers in Colleges of Education within the region further aggravates the issue (Mohammed, 2018). These issues can be tackled by comprehensively understanding how creativity, innovation, technology, and digitalization intersect within the scope of VTE in the North-East. This study aims at investigating these intertwinements for the sake of informing actions that can enhance the effectiveness of vocational and technical education in the region.

Objectives of the Study

1. Determine the extent to which creativity is applied in teaching VTE in Colleges of Education in North-East Nigeria.
2. Examine the role of innovation in enhancing the teaching and learning process of VTE.
3. Investigate how technology is integrated into instructional delivery in VTE.
4. Assess the influence of digitalization on teaching and students' skill acquisition in VTE.

Research Questions

1. To what extent is creativity applied in teaching VTE in Colleges of Education in North-East Nigeria?

Corresponding author: Aminu Musa Ningi

✉ musaaminuningi@gmail.com

Department of Agricultural Education, Adamu Tafawa Balewa College of Education, Kangere, Bauchi State.

© 2025. Faculty of Technology Education. ATBU Bauchi. All rights reserved



2. What is the role of innovation in enhancing the teaching and learning of VTE?
3. How is technology integrated into instructional delivery in VTE?
4. What influence does digitalization have on teaching and students' skill acquisition in VTE?

METHODOLOGY

The study adopted a descriptive survey study design to examine the connection between creativity, innovation, technology, and digitalization in the teaching process of Vocational and Technical Education (VTE) among Colleges of Education in North-East Nigeria. The descriptive survey design is appropriate because it allows the researcher to get systematically data from respondents on their perception, practice, and experience without changing the study context (Aminu, 2022). The population of this study specifically comprises all lecturers who teach vocational and technical education and students who are enrolled in these departments during the 2024/2025 academic session in Colleges of Education within the North-East geopolitical zone of Nigeria. The zone consists of six states: Adamawa, Bauchi, Borno, Gombe, Taraba, and Yobe.

The population is justified because these groups are directly involved in the teaching and learning process where creativity, innovation, technology, and digitalization are either practiced

or lacking. A stratified random sampling technique was employed in selecting the colleges (one from each state i.e. 6) also a proportionate stratified random sampling technique was used to select participants from the population of lecturers and students in the selected Colleges of Education (i.e. student 525 out of 2378, lecturers 154 out of 216) using research Advisors' 2006 sample determination table as guide.

A structured questionnaire designed to capture information on the interconnection of creativity, innovation, technology, and digitalization in the teaching of Vocational and Technical Education (VTE) titled "Interconnection of Creativity, Innovation, Technology, and Digitalization Scale" (ICITDS) validated by three experts from Federal University of Kashere with a reliability index of 0.87 was used for data collection. The data was collected through direct administration of the questionnaire to the selected participants. Completed questionnaires were retrieved immediately by the researchers. The data collected from the questionnaires were analyzed using descriptive and inferential statistical tools to address the research questions and test the hypotheses.

RESULTS

Research Question 1:

To what extent is creativity applied in the teaching of Vocational and Technical Education in Colleges of Education in North-East Nigeria?

Table 1: Extent of Creativity in Teaching VTE

Item Statement	Mean	SD	Interpretation
Lecturers use creative methods to explain concepts in VTE	3.18	0.62	High Extent
Students are encouraged to propose innovative solutions during practical activities.	3.25	0.58	High Extent
Creative project-based learning is regularly incorporated into VTE courses.	2.98	0.65	High Extent
Teaching activities allow students to experiment and explore new ideas.	3.12	0.60	High Extent
Grand Mean	3.13		High Extent

The result from the table 1 above indicates that creativity is being employed to a very large extent in imparting Vocational and

Technical Education in the sample Colleges of Education. Lecturers were identified by the respondents to use creative methods in teaching

Corresponding author: Aminu Musa Ningi

✉ musaaminuningi@gmail.com

Department of Agricultural Education, Adamu Tafawa Balewa College of Education, Kangere, Bauchi State.

© 2025. Faculty of Technology Education. ATBU Bauchi. All rights reserved

delivery, enhance innovative problem-solving, and incorporate project-based learning. However, the grand mean indicates that although creativity is employed, there are areas that need to be addressed to achieve an immensely high level of creative teaching practices

Research Question 2:

What is the role of innovation in enhancing the teaching and learning of Vocational and Technical Education?

Table 2: Role of Innovation in Enhancing VTE Teaching and Learning

Item Statement	Mean	SD	Interpretation
Innovative teaching strategies improve students' understanding of VTE concepts.	3.28	0.59	High Role
Innovation in instructional methods increases students' engagement in practical activities.	3.35	0.57	High Role
Adoption of modern instructional tools enhances lecturers' effectiveness.	3.22	0.61	High Role
Innovative approaches promote critical thinking and problem-solving among students.	3.30	0.60	High Role
Grand Mean	3.29		High Role

The findings indicate that innovation contributes significantly to enhancing the teaching and learning of VTE in the selected Colleges of Education. New innovative approaches to teaching, including the use of modern teaching tools, interactive learning methods, and problem-solving activities, are attested to by respondents

to have a positive impact on students' understanding, engagement, and acquisition of skills.

Research Question 3:

How is technology integrated into instructional delivery in Vocational and Technical Education?

Table 3: Integration of Technology in VTE Instructional Delivery

Item Statement	Mean	SD	Interpretation
Lecturers use computer-aided tools and software in teaching VTE courses.	2.95	0.78	Moderate Integration
Technology such as simulations and digital labs is employed for practical skill development.	3.02	0.81	Moderate Integration
Online resources and multimedia tools are integrated into lesson delivery.	2.88	0.75	Moderate Integration
Technology enhances students' understanding and mastery of vocational skills.	3.10	0.80	Moderate Integration
Grand Mean	2.99		Moderate Integration

The findings from the table 3 revealed that the extent of technology integration in the teaching of Vocational and Technical Education (VTE) in Colleges of Education is at a moderate level (Grand Mean = 2.99, SD ≈ 0.78). This indicates that while lecturers and students make use of digital tools, simulations, multimedia resources, and computer-aided applications, such

practices are not yet fully maximized in the teaching and learning process.

Research Question 4:

What influence does digitalization have on teaching and students' skill acquisition in Vocational and Technical Education?

Table 4: Influence of Digitalization on Teaching and Skill Acquisition

Item Statement	Mean	SD	Interpretation
Digital platforms improve the efficiency of VTE lesson delivery.	3.20	0.61	High Influence
Students acquire vocational skills faster through e-learning and digital simulations.	3.25	0.59	High Influence
Digitalization enhances collaboration and communication between lecturers and students.	3.18	0.62	High Influence
Integration of digital tools prepares students for technology-driven workplaces.	3.27	0.57	High Influence
Grand Mean	3.23		High Influence

The findings in the table 4 above indicated that digitalization significantly affects the efficiency of teaching and learning skill acquisition by students in VTE. The respondents agreed that digital platforms and tools enhance lesson delivery, accelerate learning of practical skills, facilitate communication, and prepare students with the needs of modern workplaces. While this effect is positive, its extent is not yet high. This suggests that there needs to be greater digital infrastructure, internet penetration, and training for lecturers and students.

DISCUSSION OF FINDINGS

The result from research question one revealed that creativity is highly integrated into the teaching of VTE in Colleges of Education in North East Nigeria. Lecturers often encourage originality, problem-solving, and hands-on activities, but such practices are not consistently applied across institutions. This finding supports Amabile's (2020) assertion that creativity thrives when educators adopt open-ended teaching strategies and create enabling environments for learners. Similarly, Njoku and Okeke (2022) emphasized that creativity is critical in equipping students with entrepreneurial and problem-solving skills. However, the moderate level observed suggests that more needs to be done to institutionalize creativity within VTE pedagogy.

Findings from research question 2 showed that innovative practices such as project-based learning, blended instruction, and simulation methods plays high role in the teaching and learning of VTE. This aligns with Schumpeter's (1934) innovation theory, which emphasizes that innovation emerges through the

application of new methods, technologies, or processes to existing systems. Studies by Obi & Lawal (2021) and Ogunleye (2023) also confirmed that Nigerian institutions are making progress in innovative practices, but adoption remains slow due to inadequate institutional support. The implication is that while innovation is present, its full potential is yet to be realized in transforming VTE teaching.

The study found that technology integration in VTE is still at a developing stage. Many lecturers and students use ICT tools such as computers, projectors, and online platforms, but challenges such as poor infrastructure, unstable electricity, and insufficient ICT training hinder effective use. This supports UNESCO (2022), which noted that ICT integration in African higher education is constrained by limited access to digital infrastructure. In contrast, Afolabi (2022) reported that where ICT facilities are adequate and lecturers are well-trained, technology significantly enhances teaching outcomes. Thus, while technology is acknowledged as essential, systemic barriers reduce its effectiveness in the study area.

The findings of this study also revealed that digital platforms have great influence in enhancing student engagement in the teaching and learning of Vocational and Technical Education (VTE). This aligns with Onyema et al. (2020), who highlighted that the use of technology-driven platforms fosters interactive learning environments that motivate students to actively participate in classroom activities. In this study, the incorporation of digital resources such as online learning tools, multimedia content, and interactive simulations was found to capture

Corresponding author: Aminu Musa Ningi

musaaminuningi@gmail.com

Department of Agricultural Education, Adamu Tafawa Balewa College of Education, Kangere, Bauchi State.

© 2025. Faculty of Technology Education. ATBU Bauchi. All rights reserved



students' interest and sustain their participation, thereby leading to improved engagement and academic performance. The implication is that digital platforms provide opportunities for collaborative learning, promote self-directed study, and enhance communication between lecturers and students.

Despite the benefits of digital technology integration, the study identified several barriers that hinder its effective utilization. Chief among these were inadequate infrastructure, poor internet connectivity, and lack of sufficient training for lecturers. These challenges mirror the findings of Akinyemi and Abubakar (2020), who observed that without proper facilities and technical competence, the integration of technology into classroom practice remains superficial and unsustainable. Similarly, the absence of continuous professional development programs for lecturers was identified as a limiting factor, as many educators expressed low confidence in using advanced digital tools. These barriers underscore the need for government intervention, policy support, and institutional investment in ICT infrastructure and capacity building to maximize the benefits of technology integration in education.

Summary

Creativity, innovation, technology, and digitalization are being applied in the teaching of vocational and technology education, but their adoption is at a moderate level. Some lecturers employ ICT-based strategies, multimedia presentations, and e-learning resources, while others still depend largely on traditional, teacher-centered approaches. The study found that educators encounter multiple challenges that hinder the full integration of CITD which include: Poor digital infrastructure and limited ICT facilities, lack of adequate training and professional development in digital pedagogy, unreliable electricity supply and unstable internet connectivity, limited institutional and government support for technology-driven teaching. Students exposed to creativity, innovation, technology, and digitalization in teaching showed improved engagement, motivation, and learning outcomes compared to those taught with conventional

methods. CITD integration was found to enhance students' problem-solving skills, critical thinking abilities, digital literacy, and preparedness for the demands of the modern vocational and technological workforce. The findings highlighted the necessity of developing a framework to optimize CITD integration. Such a framework should focus on: Capacity-building and training workshops for lecturers, provision of modern ICT infrastructure and facilities, government and institutional policy support for digital-driven pedagogy, collaboration between Colleges of Education and industries to ensure alignment of teaching practices with workplace requirements.

CONCLUSION

Creativity, innovation, technology, and digitalization are essential drivers of effective teaching and learning in vocational and technology education. Their integration significantly enhances student engagement, learning outcomes, and readiness for the modern workplace. Despite the growing recognition of their importance, educators face substantial challenges such as poor ICT infrastructure, inadequate training, unstable electricity, and insufficient institutional support, which limit effective integration.

The study affirms that students exposed to CITD-driven teaching approaches demonstrate higher problem-solving skills, creativity, and digital literacy compared to those in conventional classrooms. For Colleges of Education in North-East Nigeria to remain relevant and meet global standards, a comprehensive framework that combines policy support, lecturer training, ICT facilities, curriculum innovation, and monitoring is required.

RECOMMENDATIONS

Government and educational authorities should modernize Colleges of Education by providing ICT facilities such as computer labs, digital platforms, stable internet, and multimedia tools. Regular workshops should be organized to train lecturers in digital pedagogy, innovative methods, and creative classroom practices. The vocational and technology education curriculum



needs restructuring to emphasize practical, technology-based, and industry-relevant learning.

Clear policies should guide and monitor the integration of creativity, innovation, technology, and digitalization (CITD), with incentives for lecturers who effectively apply these approaches. Collaboration between colleges, industries, and vocational centers is crucial to provide students with hands-on experience and employability skills. Government investment in alternative energy sources and reliable internet will help address power and connectivity issues. Lecturers should adopt student-centered, problem-solving approaches rather than traditional methods. Finally, a structured framework should be established to systematically integrate, monitor, and evaluate CITD implementation in vocational and technology education.

REFERENCES

- Amabile, T. M. (2020). *Creativity in context: Update to the social psychology of creativity*. Routledge.
- Aminu, M. (2022). *Research Methods in Education: Principles and Applications*. Kaduna: Academic Press.
- Akinyemi, A., & Abubakar, H. (2020). *Integration of technology in teaching: Challenges and prospects in Nigerian higher education*. *Journal of Educational Technology and Innovation*, 15(2), 45–56.
- Ezeugwu, O.L., & Okafor, J.U. (2025). Innovative approaches to developing entrepreneurial skills through vocational and technical education in universities in South East Nigeria. *Journal of Centre for Technical Vocational Education, Training and Research*, 7(1), 174–89.
- Fadipe, E. O., Obiana, U. V., & Zangina, A. M. (2023). *Creativity and Innovation Through Technical and Vocational Education for Sustainable Family Survival in Nigeria*. *European Journal of Training and Development Studies*, 10(1), 1-9.
- Federal Ministry of Education, Nigeria. (2023). *National Digital Learning Policy*. <https://education.gov.ng/wp-content/uploads/2023/08/MM-National-Digital-Learning-Policy-Final-Draft-2.0.pdf>
- Jackson, E.O., Ekong, M.O., & George, W.K. (2024). Advancing digital literacy in Nigerian TVET: Leveraging generative AI as enabling technology. *International Journal of Education and Evaluation*, 10(4), 297–311.
- Mohammed, A. (2018). Digitization of Educational Technology Centres for Teaching Electrical and Electronics Technology in Colleges of Education in North Eastern Nigeria. *Academic Journal of Interdisciplinary Studies*, 7(3), 199–206.
- Okoye, K. R. E., & Okwelle, P. C. (2022). Technical vocational education and training (TVET) as a tool for sustainable development in Nigeria. *Journal of Education and Practice*, 5(14), 20–26.
- Okoye, K. R. E., & Okwelle, P. C. (2017). Technical vocational education and training (TVET) in Nigeria: Issues, challenges, and the way forward. *Journal of Education and Practice*, 8(32), 65–69.
- Onyema, E. M., Nwafor, C. E., Ezeanya, C. U., Eziokwu, P. N., & Ukamaka, A. E. (2020). Impact of e-learning platforms on students' interest and academic achievement in a Data Structure course. *CCU Journal of Science*, 1(1), 1–16.
- Umoru, M.L., Ibanga, I.J., & Sunday, P. (2024). Integrating Digital Skills Competencies into Professional Diploma in Education Curriculum in Vocational and Technical Education in North-East Nigeria. *Jurnal AISysTech*, 2(3), 206–226.

Corresponding author: Aminu Musa Ningi

✉ musaaminuningi@gmail.com

Department of Agricultural Education, Adamu Tafawa Balewa College of Education, Kangere, Bauchi State.

© 2025. Faculty of Technology Education. ATBU Bauchi. All rights reserved