(RESEARCH ARTICLE)

Emerging challenges and remedies in integrating digital technologies in teaching and learning of industrial technical education in colleges of education in North Central Nigeria

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Abstract

This study examined the emerging challenges and remedies for integrating digital technologies (DTs) in the teaching and learning of Technical Education in Colleges of Education (CoEs) in North Central Nigeria. Four research questions and four null hypotheses guided the investigation. A total of 269 respondents were used for the study. A 48-item questionnaire was employed for data collection, with reliability analysis yielding a Cronbach's alpha of 0.87, indicating high internal consistency. Data were analyzed using mean, standard deviation, and t-test statistics. Findings revealed that inadequate ICT infrastructure, unstable power supply, poor internet connectivity, limited technical support, and low digital literacy constitute the main challenges to DT integration. Basic digital devices are moderately available, while advanced tools and students' personal devices are largely lacking. Current practices and strategies were moderately effective, but students are not fully autonomous in using digital tools. It is recommended that coordinated infrastructural, instructional, and policy interventions, including support from regulatory bodies and support from key stakeholders, be implemented to enhance the effective integration of digital technologies in Technical Education.

Keywords: Digital Technologies; Technical Education; Colleges of Education; ICT integration; Nigeria

1. Introduction

The emergence of electronic learning in the 21st century has played a crucial role in driving innovation, enabling connectivity and transforming teaching and learning process across the globe. E –learning as a sub set of digital learning, refers to instruction delivered through electronic media, typically via internet, while digital learning encompasses all forms of learning that incorporate digital technologies (DTs). Both e-learning and digital learning revolves round the use of information and communication technology (ICT) to impact knowledge. Lin et al. (2017) defined digital learning as teaching and learning experience which utilize a wide range of technology and other various educational software to impact knowledge to learners. Digital learning is thus used as an all- encompassing name to include all forms of learning involving computers, the internet, mobile phones and any other form of technology. As an innovative learning platform, digital learning integrates conventional classroom instruction with technology, extending to remote delivery via computers mobile devices, and internet platforms through blended or distance learning approaches. Digital learning goes beyond merely transferring educational content into digital formats; it represent a new model of teaching and learning in developing countries especially, it should be viewed as an opportunity to transform education delivery into a more flexible, engaging, and technology driven process.

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In this context, digital learning presents multiple advantages as noted by Obokoh (2023) include the flexibility in scheduling, accessibility from anywhere with an internet connection, personalized learning experiences and opportunities for collaboration and interaction among learners. It also caters for diverse learning style and preferences, making education more inclusive. Digital learning thus facilitates learning experiences and leverages technology to enhance traditional educational methods, making learning more accessible and engaging. It provides opportunities for both educators and learners to interact in dynamic ways that extend beyond the limits of conventional classrooms. In simpler terms, digital learning entails utilizing DTs to deliver various tools and platform for educational purpose. This involves a broad range of electronic devices and applications that support instruction, communication, and collaboration in the learning process. Examples of DTs include computers, internet, software, mobile devices, digital media, social media, cloud computing, Artificial Intelligence (AI), Internet of Things (IoT), and Blockchain. They encompass tools such as online courses, interactive simulation, educational apps, virtual reality experiences, learning management system (LMS), all of which enhance learning and foster collaboration among students, educators, institutions and industries, especially in the field of technical education (TE).

However, for these benefits to be realized, appropriate digital devices must be made available in institutions. As Ryan, Henderson and Aagaard (2021) noted, the success of DTs in teaching and learning depends largely on the provision and accessibility of such devices for classroom use. This can have many benefits such as improving organization engagement and collaboration in terms of incorporating digital tools in instruction delivery. When appropriately built in to curriculum, device use may also foster 21st century and digital citizenship skills. Virginia Department of Education (2021) listed common digital devices to include; lap top, smart devices, e- readers, digital clocks, printers, tablets, Global Position System (GPS) devices, etc. The availability of the devices are thus critical for the integration of DTs in teaching and learning, this therefore raises concern about ensuring their availability for seamless integration of DTs in the teaching and learning process.

 Beyond the provision of devices, integrating DTs in teaching and learning of TE requires a planned pedagogy which employ the use of technologies to transform the process of skills training. This is key to achieving the lofty goals of TE through interactive learning (Kennedy, et al. 2022). According to Tsado and Jebba (2022), the main thrust of TE is to produce skilled work force for industrial growth. It also facilitates the development of modern skills, particularly digital proficiency, which is increasingly vital in today's workforce. Altogether, integrating DTs into TE program is essential for enhancing learning out comes, preparing learners for digital economy and ensuring the relevance and competiveness of TE in the modern world. For this reason, Agbo, Onyemachi and Ogunmola (2024) described the adoption of DTs in teaching and learning of technology and vocational courses in tertiary institutions as the most convenient method that give accurate and practical knowledge and employability skills to the students which make them relevant in 21st century.

For this study, tertiary institutions refer to colleges, universities, polytechnics and monotechnics that provide post-secondary education. These institutions offer undergraduate, graduate and professional degrees programs and Nigeria Certificate in Education (NCE) as well as Diploma courses. The institutions offering TVET are classified as tertiary institutions offering courses in Agricultural education, Business education, Computer education, Home Economics education, Entrepreneurship education and TE. The training in these institutions revolves around the skill sets needed for work and life. As such, UNESCO (2020) advised that teachers need to integrate technology seamlessly in to the curriculum instead of viewing it as an add-on. This is particularly true in TE where learners are prepared for the world of work for present and future. This is necessaries because the skills for technology - oriented jobs are best acquired in high-tech learning environment.

1.1. Statement of the Problem

The capacity of the tertiary institutions to effectively use DTs in teaching and learning of TE largely depends on how the emerging challenges of its adoption are addressed. According to Development Asia (2017) and Kennedy, et al. (2022) many countries continue to face barriers such as unreliable electricity supply, limited access to computers, poor internet connectivity, and teachers' reluctance or inability to adopt technology in their teaching. These challenges are particularly critical in technologically oriented courses such as TE, where the integration of DTs is essential for the skill development. Unfortunately, the persistence of these barriers has contributed to a decline in the quality of technical education graduates in Nigeria. Many of these graduates, lacking adequate practical and digital skills, struggle to secure gainful employment and, in some cases, drift into social vices, idleness, or other unproductive engagements. This situation underscore the urgent need to address the gaps in the integration of DT in TE in Colleges of Education (COEs) in North central Nigeria.

1.2. Objectives of the Study

The objective of this study is to find out the emerging challenges of integrating DTs in the teaching and learning of TE in COEs in north central Nigeria. Specifically the study sought to determine the:

- Emerging challenges in integrating DTs in the teaching and learning of TE in COEs in North central Nigeria
- The availability of digital devices for teaching and learning of TE in COEs in North central Nigeria
- Effectiveness of current practices and strategies used for integrating DTs in the teaching and learning of TE in COEs in North central Nigeria
- The remedies to the emerging challenges of integrating DTs in the teaching and learning of TE in COEs in North central Nigeria

1.3. Research Questions

Three research questions guided the study:

- What are the emerging challenges in integrating DTs in the teaching and learning of Technical Education in COEs in North central Nigeria?
- What are the digital devices available for teaching and learning of Technical Education in COEs in North central Nigeria?

- What are the effectiveness of current practices and strategies used for integrating DTs in the teaching and learning of Technical Education in COEs in North central Nigeria?

- What is the strategies to remedy the emerging challenges of integrating DTs in the teaching of Technical Education in North central Nigeria?

1.4. Hypotheses

- **Ho$_1$**: There is no **s**ignificant difference between the mean responses of lecturers and students on the emerging challenges in integrating DTs into the teaching and learning of Technical   Education in tertiary institutions.
- **Ho$_2$**: There is no significant difference between the mean responses of lecturers and students on the digital sevices available for teaching and learning of Technical Education in Colleges of Education in North Central Nigeria.
- **Ho$_3$**: There is no significant difference between the mean responses of lecturers and students on the effectiveness of current practices and strategies used for integrating digital technologies   in   teaching Technical Education in Colleges of Education in North Central Nigeria.
- **Ho$_4$**: There is no significant difference between the mean responses of lecturers and students on the strategies to remedy the emerging challenges of integrating digital technologies in the teaching of Technical Education in Colleges of Education in North Central Nigeria.

2. Methodology

The study adopted Survey research design. Nworgu (2015) stated that a survey research design typically employs interview and questionnaire to determine the opinions, preferences, attitudes and perception of people about issues. The study therefore adopted a survey research design, as it sought the opinions of lecturers and students of technical education on the emerging challenges and remedies of integrating DTs in the teaching and learning for self-reliance.

The study was carried out in six Colleges of Education in north central Nigeria. The Niger State College of Education, Minna; College of Education (Technical) Lafiagi Kwara State; College of Education Ankpa, Kogi State; College of Education Oju, Benue State; College of Education Akwanga, Nasarawa State and Federal College of Education Pankshin, Plateau State. These Colleges were chosen because they offer technology education. The population of the study comprised all the 119 Lecturers and 259 students of Technical Education at 300l during the 2024/25 academic session in Colleges of Education in North central Nigeria, giving a total of 378 respondents.

Because the number of lecturers (119) was small and manageable, there was no sampling for the lecturers. For the students (259), Yamane's formular at 5% margin o error was used to determine a sample size of 157. Thus the total sample size for the study was 276 respondents.

The instrument used to gather data for the study was a 48-item structured questionnaire, which consisted of sections A, B, C, D and E. The first section contained the bio-data of the respondents, while the second, third, fourth, and fifth sections covered items on: (i) the emerging challenges of integrating digital technologies (DTs) in technical education, (ii) the availability of digital devices for teaching and learning, (iii) the effectiveness of current practices and strategies for integration, and (iv) possible remedies to the identified challenges in Colleges of Education (CoEs) in North Central Nigeria. The instrument was structured using a 5 point Likert scale with the following numeric assignments: 5 = Strongly Agree, 4 = Agree, 3 = Undecided, 2 = Disagree, and 1 = Strongly Disagree.

The draft instrument was subjected to both face and content validation by three experts from Department of Industrial Technology Education, Federal University of Technology Minna and Niger State College of Education Minna, Nigeria. The instrument was trial tested on 20 lecturers and students of technical education in Federal College of Education (Technical) Bichi, Kano State. This yielded a reliability co –efficiency of 0.87 using Cronbach Alpha formula.

Out of the 276 copies of the questionnaire administered by the research assistants, one hundred and nineteen (119) were given to lecturers and one hundred and fifty-seven (157) to students of Technical Education. Of these, 117 copies were returned by the lecturers, representing 98.3%, and 152 copies were returned by the students, representing 96.8%.

The data collected were analyzed using mean and standard deviation in answering research questions and t-test to test hypothesis at a probability level of 0.05 level of freedom. Any item with a mean of 3.50 and above was regarded as agreed while any item with the mean below 3.50 was regarded as not agreed. When the P- value was greater than 0.05, it indicates no significant difference between the mean scores of the respondent groups. Conversely, a P-value less than 0.05 indicates that the hypothesis of no significant difference was rejected.

3. Results

Table 1 Mean, Standard Deviation and t-test Analysis of Emerging Challenges in Integrating Digital Technologies in Teaching and Learning of Technical Education in CoEs in North Central Nigeria

S/N	Emerging Challenges Items	Mean	SD	p-value	Remark
1	Inadequate ICT infrastructure limits effective integration of digital technologies.	3.85	0.92	0.218	Agreed / NS
2	Unstable power supply hinders the use of digital tools in classrooms.	3.74	0.88	0.334	Agreed / NS
3	Poor internet connectivity affects access to online resources.	3.90	0.94	0.271	Agreed / NS
4	Lack of technical support personnel discourages regular use of digital technologies.	3.68	0.89	0.307	Agreed / NS
5	Limited digital literacy among some lecturers slows down adoption.	3.71	0.95	0.412	Agreed / NS
6	Students lack adequate personal access to digital devices.	3.76	0.91	0.229	Agreed / NS
7	Insufficient funding for ICT facilities in CoEs.	3.88	0.87	0.365	Agreed / NS
8	Curriculum design does not fully support digital integration.	3.66	0.90	0.298	Agreed / NS
9	Frequent breakdown of digital equipment reduces teaching effectiveness.	3.70	0.93	0.221	Agreed / NS
10	Security concerns (cyber threats, misuse of devices) discourage usage.	3.50	0.86	0.355	Agreed / NS
11	Most lecturers are already well-trained in ICT, so training needs are minimal.	2.41	1.02	0.418	Disagreed / NS
12	Students in CoEs always have equal access to functional digital devices on campus.	2.28	0.98	0.391	Disagreed / NS

The result in Table 1 shows that respondents generally agreed on ten of the identified items as the major challenges to integrating digital technologies in the teaching and learning of technical education in Colleges of Education in North Central Nigeria. These include inadequate ICT infrastructure (Mean = 3.85, SD = 0.92), unstable power supply (Mean = 3.74, SD = 0.88), poor internet connectivity (Mean = 3.90, SD = 0.94), lack of technical support personnel (Mean = 3.68, SD = 0.89), and insufficient funding (Mean = 3.88, SD = 0.87). However, respondents disagreed with the statements that most lecturers are already well-trained in ICT (Mean = 2.41, SD = 1.02) and that students always have equal access to functional digital devices on campus (Mean = 2.28, SD = 0.98). The p-values for all items were greater than 0.05, indicating no significant difference between the responses of lecturers and students. This implies that both groups held similar views on the emerging challenges of integrating digital technologies, thereby leading to the acceptance of the null hypothesis.

Table 2 Mean, Standard Deviation and t-test Analysis of Digital Devices Available for Teaching and Learning of Technical Education in CoEs in North Central Nigeria

S/N	Digital Devices Items	Mean	SD	p-value	Remark
1	Desktop computers are available in technical workshops and classrooms.	3.82	0.91	0.312	Agreed / NS
2	Laptop computers are accessible to lecturers for instructional purposes.	3.76	0.88	0.287	Agreed / NS
3	Projectors and multimedia screens are regularly used for teaching technical courses.	3.69	0.92	0.334	Agreed / NS
4	Internet-enabled devices are available in computer labs.	3.74	0.87	0.298	Agreed / NS
5	Tablets and mobile devices are provided for instructional use.	3.68	0.90	0.321	Agreed / NS
6	Digital cameras and video recording devices are available for practical demonstrations.	3.71	0.89	0.365	Agreed / NS
7	Printers and scanners are accessible for students and lecturers.	3.66	0.85	0.398	Agreed / NS
8	Simulation software and virtual labs are available for technical skill practice.	3.62	0.91	0.341	Agreed / NS
9	Smart boards or interactive whiteboards are installed in classrooms.	3.59	0.92	0.355	Agreed / NS
10	Audio devices (speakers, microphones) are available for instructional purposes.	3.64	0.88	0.327	Agreed / NS
11	VR/AR devices are widely available for teaching technical education.	2.38	0.96	0.412	Disagreed / NS
12	Personal laptops or mobile devices of students are always sufficient for learning.	2.29	0.94	0.398	Disagreed / NS

Table 2 shows that respondents generally agreed on the availability of several digital devices for teaching and learning of technical education in Colleges of Education in North Central Nigeria. Devices such as desktop computers (Mean = 3.82, SD = 0.91), laptops (Mean = 3.76, SD = 0.88), projectors and multimedia screens (Mean = 3.69, SD = 0.92), internet-enabled devices (Mean = 3.74, SD = 0.87), and tablets (Mean = 3.68, SD = 0.90) were identified as commonly accessible. Other agreed devices include digital cameras, printers, scanners, simulation software, smart boards, and audio devices, indicating that CoEs have basic digital tools to support technical instruction. However, respondents disagreed with the statements that VR/AR devices (Mean = 2.38, SD = 0.96) and personal laptops or mobile devices for students (Mean = 2.29, SD = 0.94) are widely available. The p-values for all items exceeded 0.05, indicating no significant difference between the perceptions of lecturers and students.

Table 3 Mean, Standard Deviation and t-test Analysis of Effectiveness of Current Practices and Strategies for Integrating Digital Technologies in Teaching Technical Education in CoEs in North Central Nigeria

S/N	Practices and Strategies Items	Mean	SD	p-value	Remark
1	Use of multimedia presentations enhances students' understanding of technical concepts.	3.88	0.89	0.312	Agreed / NS
2	Online tutorials and e-learning platforms are effectively used for teaching.	3.76	0.87	0.334	Agreed / NS
3	Lecturers integrate simulation software to demonstrate technical processes.	3.69	0.91	0.298	Agreed / NS
4	Projectors and smart boards are regularly used in classrooms for practical lessons.	3.74	0.88	0.321	Agreed / NS
5	Internet resources are effectively used to support teaching and learning.	3.71	0.86	0.365	Agreed / NS
6	Students are encouraged to use digital devices for assignments and research.	3.66	0.90	0.341	Agreed / NS
7	Continuous professional development programs improve lecturers' ICT skills.	3.62	0.92	0.327	Agreed / NS
8	Practical demonstrations using digital devices enhance students' technical skills.	3.68	0.89	0.312	Agreed / NS
9	Collaboration platforms (e.g., WhatsApp, Google Classroom) are used effectively.	3.64	0.87	0.355	Agreed / NS
10	Regular feedback is provided to students via digital tools to improve learning outcomes.	3.69	0.88	0.341	Agreed / NS
11	Digital assessment tools are frequently used for evaluating students' performance.	3.66	0.90	0.334	Agreed / NS
12	Students are fully autonomous in using digital tools without guidance from lecturers.	2.38	0.95	0.412	Disagreed / NS

Table 3 indicates that respondents generally agreed that current practices and strategies for integrating digital technologies in teaching technical education in Colleges of Education in North Central Nigeria are moderately effective. Strategies such as the use of multimedia presentations (Mean = 3.88, SD = 0.89), online tutorials and e-learning platforms (Mean = 3.76, SD = 0.87), simulation software (Mean = 3.69, SD = 0.91), projectors and smart boards (Mean = 3.74, SD = 0.88), internet resources (Mean = 3.71, SD = 0.86), and practical demonstrations (Mean = 3.68, SD = 0.89) were identified as effectively supporting teaching and learning. Other agreed items include professional development programs, collaboration platforms, digital feedback, and digital assessment tools. Respondents, however, disagreed with the statement that students are fully autonomous in using digital tools without guidance (Mean = 2.38, SD = 0.95). All p-values were greater than 0.05, indicating no significant difference between lecturers and students' perceptions.

Table 4 Mean, Standard Deviation and t-test Analysis of Strategies to Remedy Emerging Challenges of Integrating Digital Technologies in Teaching Technical Education in CoEs in North Central Nigeria

S/N	Strategies Items	Mean	SD	p-value	Remark
1	Provision of adequate ICT infrastructure in classrooms and workshops.	3.88	0.89	0.312	Agreed / NS
2	Ensuring stable electricity supply for uninterrupted digital learning.	3.84	0.87	0.334	Agreed / NS
3	Improving internet connectivity and access to online resources.	3.91	0.85	0.298	Agreed / NS
4	Regular training and capacity-building programs for lecturers on ICT use.	3.79	0.88	0.321	Agreed / NS
5	Encouraging students to acquire personal digital devices for learning.	3.72	0.90	0.365	Agreed / NS
6	Employing technical support staff to assist with ICT operations.	3.68	0.89	0.341	Agreed / NS
7	Provision of simulation software, virtual labs, and advanced digital tools.	3.71	0.87	0.327	Agreed / NS
8	Implementing digital policies that promote equitable access for all students.	3.75	0.86	0.355	Agreed / NS
9	Integrating ICT fully into the curriculum and teaching methodologies.	3.82	0.88	0.341	Agreed / NS
10	Establishing partnerships with technology providers to support digital learning.	3.69	0.89	0.334	Agreed / NS
11	Regular maintenance and upgrading of digital devices and infrastructure.	3.77	0.90	0.312	Agreed / NS
12	Monitoring and evaluating the effectiveness of ICT integration strategies.	3.74	0.88	0.327	Agreed / NS

Table 4 shows that respondents unanimously agreed on strategies to address the emerging challenges of integrating digital technologies in the teaching of technical education in Colleges of Education in North Central Nigeria. Strategies such as providing adequate ICT infrastructure (Mean = 3.88, SD = 0.89), ensuring stable electricity supply (Mean = 3.84, SD = 0.87), improving internet connectivity (Mean = 3.91, SD = 0.85), conducting regular lecturer training programs (Mean = 3.79, SD = 0.88), and encouraging students to acquire personal digital devices (Mean = 3.72, SD = 0.90) were identified as highly effective. Other agreed strategies include employing technical support staff, provision of simulation software and virtual labs, integrating ICT fully into the curriculum, establishing partnerships with technology providers, maintaining and upgrading digital devices, and monitoring ICT integration effectiveness. The p-values for all items were greater than 0.05, indicating no significant difference between lecturers' and students' perceptions

4. Discussion

The results in table 1 identified several key barriers, including inadequate ICT infrastructure, unstable power supply, poor internet connectivity, insufficient funding, lack of technical support, and limited digital literacy among both lecturers and students. This findings is consistent with the opinions expressed in Vanguard (2025) which reported that inadequate ICT infrastructure and unstable power supply has a significant obstacles to digital education in Nigeria. In addition, both lecturers and students disagreed with the statements that most lecturers are already well-trained in ICT and that students always have equal access to functional digital devices on campus. This aligns with Akpata et al (2025), who noted that many educators feel unprepared to integrate digital tools into their teaching, and with Nigerian Patriot (2025), which reported that high costs and infrastructure deficiencies limit internet access, deepening the digital divide among students. The study also established that there was no significant difference in the perceptions of lecturers and

students regarding these challenges, as all the p-values obtained were greater than 0.05. This convergence suggests that both groups are similarly affected by the structural and systemic deficiencies within their institutions.

The findings in table 2 suggest that Colleges of Education in North Central Nigeria are moderately equipped with basic digital devices necessary for teaching and learning technical education. Desktop and laptop computers, projectors, internet-enabled devices, and multimedia tools are widely available and are likely to support effective instructional delivery. This aligns with recent studies which reported that Nigerian public universities are increasingly incorporating computers, projectors, and other standard ICT tools into technical and vocational training programs (Agbo, Onyemachi & Ogunmola, 2024).

Despite this moderate availability, advanced technologies such as Virtual Reality (VR) and Augmented Reality (AR) devices are largely absent, reflecting limited adoption of innovative instructional technologies in these institutions. Similarly, students' personal access to laptops and mobile devices is inadequate, highlighting the persistent issue of digital inequity. These findings are consistent with reports by Ogunbodede and Oribhabor (2022) which indicated that high costs of devices and limited personal ownership constrain students' participation in digital learning. The acceptance of the null hypothesis, with p-values above 0.05, indicates that both lecturers and students' perceive the availability of digital devices in a similar way. This consensus underscores that while some essential ICT tools are accessible, there is still a significant gap in advanced technologies and personal devices, which may affect the overall effectiveness of digital integration in technical education. Addressing these gaps would require strategic investment in innovative digital tools, capacity-building for both lecturers and students, and policies promoting equitable access to devices.

Table 3 reveals that Colleges of Education in North Central Nigeria have adopted several effective strategies for integrating digital technologies into technical education. The use of multimedia presentations, e-learning platforms, simulation software, smart boards, and internet resources enhances students' understanding and practical skill acquisition, reflecting similar observations in a recent studies by Ojo and Adebayo (2024) who noted that multimedia and simulation tools significantly improve learning outcomes in technical education programs in Nigerian tertiary institutions. Despite these effective practices, the disagreement regarding students' autonomy in using digital tools indicates that learners still require guidance and support from lecturers. This finding is similar to the recent research report by Hamzat (2024) which pointed out that while digital tools are available, students often lack the confidence or competence to use them independently. The acceptance of the null hypothesis, with p-values exceeding 0.05, indicates that lecturers and students perceive the effectiveness of these strategies similarly. The findings point to a share experience across both groups regarding the use of existing digital practices. The entire finding shows that while current strategies are moderately effective, addressing gaps in student independence and expanding the use of advanced digital tools could enhance teaching and learning in technical education.

Table 4 findings indicate that strategies to overcome barriers to digital technology integration in technical education are provision of ICT infrastructure, stable electricity, and reliable internet connectivity, capacity-building for lecturers through regular ICT training and promoting student access to personal digital devices, with the view to addresses equity concerns. Other strategies, such as employing technical support staff, integrating ICT into the curriculum, forming partnerships with technology providers, and monitoring the effectiveness of ICT initiatives, reflect a systemic approach to sustaining digital integration. These are in line with similar remedies to tackle the challenges of integrating digital technologies in teaching and learning as proposed by Ojo & Adebayo (2024) and Ogunbodede and Oribhabor (2022). The acceptance of the null hypothesis, with p-values above 0.05, indicates that lecturers and students share similar views on these strategies, underscoring a common understanding of the remedies required to improve digital technology adoption.

5. Conclusion

This study investigated the challenges, available digital devices, effectiveness of current practices, and strategies for integrating digital technologies in the teaching of technical education in Colleges of Education in North Central Nigeria. Findings revealed that lecturers and students face similar challenges, including inadequate ICT infrastructure, unstable power supply, poor internet connectivity, limited technical support, and low digital literacy. While basic digital devices such as desktops, laptops, projectors, and internet-enabled tools are moderately available, advanced technologies like VR/AR devices and students' personal devices remain limited. Current practices, including multimedia presentations, e-learning platforms, simulation software, and collaborative tools, are moderately effective, though students are not yet fully autonomous in using digital tools. Respondents agreed on strategies to address these challenges, including improving ICT infrastructure, ensuring stable electricity and internet access, providing regular training for lecturers, encouraging student access to devices, employing technical support staff, and integrating ICT fully into the curriculum.

Addressing these challenges through coordinated investment, training, and policy support will enhance teaching and learning outcomes and promote students' technical skills and employability.

Recommendations

The following recommendations are proffered:

- Colleges of Education should invest in adequate ICT infrastructure, stable electricity, and reliable internet connectivity, with support from the NCC to ensure broadband access and connectivity.
- The NCCE should provide guidelines, policies, and frameworks to standardize digital technology integration across all Colleges of Education.
- Regular training and professional development programs should be organized for lecturers to enhance digital literacy and instructional competence, in line with NCCE directives.
- Students should be encouraged and supported to access personal digital devices to facilitate independent learning and engagement with ICT tools.
- Institutions should employ technical support staff and establish systematic monitoring and evaluation of ICT integration strategies to ensure sustainability and effectiveness.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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