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Evaluating Integration of Information and Communication Technology-Driven Pedagogies in Ekiti State Government Technical Colleges

Olubunmi Kayode Ayanwoye [1*], Nnaemeka Chijioke Okorie [1], Oluwanife Segun Falebita [1], Olaitan Titilayo Akinola [1], Amos Olusola Ogunjobi [1], Onyinye M. Okoh [1], Babatunde Ayo Yusuf Ojo [1], Bamidele V. Aremu [1]

[1] Federal University Oye-Ekiti, NIGERIA
* Correspondence: olubunmi.ayanwoye@fuoye.edu.ng

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ABSTRACT

The use of computer technology and digitalization in the classroom has grown in importance, leading to research into how these tools affect students' ability to learn. Technical and vocational education and training (TVET) is central to Nigeria's strategies for workforce development, technological innovation and poverty reduction. Globally, digital technologies and learner-centered electrical/electronic pedagogies have transformed how technical competencies are taught. However, information and communication technology (ICT) integration in electrical/electronic technology (EET) education is still at nascent stage throughout Nigeria, particularly in the government technical institutions of Ekiti State. This study therefore evaluates the pace of integrating information and communication technology-driven pedagogies in Ekiti state government technical colleges in Nigeria. Quantitative survey methodology of the descriptive type was employed. The study targeted all students enrolled in electrical and electronic technology programs at the government technical colleges in Ekiti State, and a stratified random sample technique was engaged to select 323 students. Descriptive statistics were used to answer the four research questions raised with the use of a validated questionnaire (r=0.91). The results show that ICT tools, are effectively absent from the instructional repertoire in these technical colleges; institutional integration of ICT in these technical colleges is profoundly deficient; ICT tools not only absence but also potential misalignment between tool availability and pedagogical implementation; with systemic obstacles to ICT-driven pedagogical innovation in these technical colleges. Implications of these to the government policy on ICT-driven pedagogy was discussed and swift stakeholders' interventions was recommended among others.

Keywords: electrical/electronic technology, government technical college, ICT, ICT-driven pedagogy, information and communication technology, Nigeria

INTRODUCTION

Technical and vocational education and training (TVET) is central to Nigeria's strategies for workforce development, technological innovation, and poverty reduction (Akanbi, 2017; Ayanwoye, 2024; Ayanwoye et al., 2025; Ayanwoye & Hamzat, 2022; Falebita et al., 2025a). Nigeria's formal TVET system, coordinated at federal and state levels and regulated by agencies such as the National Board for Technical Education (NBTE) (2026), is explicitly tasked with producing skilled technicians and technologists who can meet industry needs and foster entrepreneurship (NBTE, 2018). In Ekiti State, the Board for Technical and Vocational Education articulates a vision and mission that foreground innovation, employability, and entrepreneurship as the aims of state-level technical education delivery, including Government Technical Colleges (GTCs) that enroll secondary-level technical students and prepare them for industry or further studies (Ekiti State Government, 2025).

The electrical and electronic technology skill is a foundational TVET field where graduates are required in power installation and maintenance, control systems, telecommunications, renewable-energy installations, manufacturing maintenance, and many micro-business contexts (Okorie et al., 2024). Because the electrical/electronic workplace is increasingly digital and connected, competency requirements are shifting toward greater digital literacy (Ayanwoye, 2023; Okorie et al., 2024), systems thinking, troubleshooting with software/hardware tools, and familiarity with simulation, instrumentation, and control technologies (Ismail & Mohammed, 2015; ILO, 2021).

Globally, digital technologies and learner-centered pedagogies have transformed how technical competencies are taught as reflected in the integration of blended and hybrid instruction (Al Mamun et al., 2022), simulation/virtual laboratories, project-based learning (Alam & Mohanty, 2023), flipped classroom models (Al Mamun et al., 2022), augmented reality (AR) and virtual reality (VR) for hands-on skill rehearsal (Ayanwoye et al., 2025; Falebita et al., 2025b; Rafiq et al., 2024) in classroom instructions. And intelligent tutoring systems are all reshaping TVET delivery (The World Bank, UNESCO, & ILO, 2023; UNESCO, 2023). These ICT-driven pedagogies have the potential to extend access, reduce costs of consumables and equipment, and allow repeated, safe rehearsal of high-risk procedures characteristic of electrical/electronic practice (Okorie et al., 2024).

Several Nigerian empirical studies (Habibat et al., 2023; Mukhtar, 2019) document persistent competency gaps ranging from the provision of adequate infrastructure, teacher readiness and competence in digital pedagogies, curriculum alignment, to supportive policy/provision at state and institutional levels (Ait et al., 2023). These persistent competency gaps result in a mismatch between expected competency outcomes and actual graduate capabilities, an issue repeatedly reported in Nigerian TVET research (Alam & Mohanty, 2023; Okoye & Arimonu, 2016) among TVET graduates in electrical and electronic technology. Studies (Chukwuedo & Omofonmwan, 2013; Okorie et al., 2024) focused specifically on electrical/electronic education emphasize the critical importance of both technical skills and digital competencies for employability and entrepreneurship (Alio et al., 2025).

Besides, ICT-mediated learning can expand opportunities for students in resource-limited settings to practice and master skills without the full costs of new physical consumables. Moreover, the COVID-19 era also revealed that TVET providers with stronger digital strategies adapted faster, as systematic digitalization planning can build institutional resilience and modernization of technical curricula. The study's findings will then inform Boards for Technical and Vocational Education and international regulatory bodies in aligning curriculum, teacher development, and infrastructure investments toward ICT-enabled competency outcomes.

LITERATURE REVIEW

Studies recommend curricular and pedagogic reorientation to include simulation, hands-on application of ICT, and exposure to contemporary technologies (e.g., renewable energy installations). A large body of literature (Ismail & Mohammed, 2015; Johnson & Folahan, 2020; Okoye, 2016; Okoye & Arimonu, 2016; Thang et al., 2017) on Nigerian TVET documents chronic systemic challenges: underfunding, inadequate facilities, weak teacher training, poor industry linkage, and curriculum-obsolescence (ILO, 2021; The World Bank, UNESCO, & ILO, 2023). Several state-level studies (Akanbi, 2017; NBTE, 2018) have called for policy reforms in funding, curriculum updates, teacher production, and stronger industry partnerships. For Ekiti State specifically, the Board for Technical and Vocational Education publicly articulates commitment to innovative TVET, but on-the-ground GTC reports and academic analyses indicate variability in infrastructure and resource allocation across colleges (Ekiti State Government, 2025).

A recent focused analysis of GTCs in Ekiti State explored ICT-driven pedagogies and concluded that while stakeholders recognize the potential of ICT for enhancing competency, practical constraints (infrastructure, teacher e-readiness, and limited continuous professional development) hinder large-scale adoption (Okorie et al., 2024). That Ekiti-focused work serves as a primary empirical anchor for the present study and points to the need for systems-level interventions to enable pedagogical innovation. According to Macazana Fernández et al. (2025), there is a favorable correlation between universal learning and instrumental, didactic, disciplinary, and personal distinct forms of mediation. These results demonstrate the strong correlation between widespread learning and different types of pedagogical strategies. Besides, the study supports the idea that digital technologies help to enhance universal learning among students and highlights the useful function that ICTs play in improving pedagogical mediation.

International studies (ILO, 2021; Thang et al., 2017) on TVET and ICT report that blended approaches can improve conceptual understanding and allow for more efficient use of workshop time (Kennedy et al., 2022; Khalid et al., 2023). The World Bank, UNESCO, and ILO (2023) review after the COVID-19 disruptions also reports that blended modalities were the most widely feasible approach for TVET institutions attempting continuity. Besides, reviews (Al Mamun et al., 2022) in engineering education show positive effects of flipped learning on engagement and in-class problem solving; however, effects on psychomotor skill acquisition are mixed and often contingent on how the in-class activities are organized (i.e., whether they truly provide repeated guided practice). A systematic review in engineering education identifies flipped learning as promising but still under-researched, specifically for hands-on trades (Al Mamun et al., 2022; Alam & Mohanty, 2023).

Moreover, meta-analyses and reviews in engineering education show that virtual laboratories can produce learning gains comparable to traditional laboratories in conceptual understanding and sometimes enhance procedural learning, especially when used in blended models (Li & Liang, 2024). However, purely virtual approaches may not fully substitute for tactile skill development important for wiring or soldering tasks (Rafiq et al., 2024). Early research indicates AR/VR's potential for enhancing spatial understanding and procedural memory, but cost, teacher capacity, and infrastructure are the chief constraints in low-resource contexts (Veza et al., 2022). Small controlled studies show increased engagement and retention, but large-scale cost-effectiveness studies are still emerging (Falebita et al., 2025a). It is reported that project-based learning (PBL) situates learning around authentic, industry-relevant tasks, designing a simple control panel, installing a solar micro-system, or building a communications circuit, thus integrating theory, practice, and soft skills (Kennedy et al., 2022). When complemented with digital collaboration tools, PBL can include remote mentorship, digital documentation, and iterative design. PBL is consistently associated with the development of higher-order thinking and applied competencies. When digital tools are used for documentation, simulation, and remote collaboration, PBL can mirror industry workflows and increase employability. However, teacher facilitation skills and assessment alignment are crucial (Veza et al., 2022).

A focused review of studies (across Nigerian states and institutions) (Akanbi, 2017; Ayanwoye, 2023; Okoye & Arimonu, 2016) yields recurring findings relevant to this study. Research across Enugu, Kano, Northeast polytechnics, and other Nigerian states consistently underscores the growing need for digital skills in electrical/electronic curricula, from solar installation competencies to the use of open educational resources and simulation tools for laboratories (Alio et al., 2025; Habibat et al., 2023; Mukhtar, 2019). These studies recommend explicit curriculum updates and integration of ICT into skill standards. Investigations of digital technological tools in Nigerian TVET institutions show uneven availability and utilization. A Southeast university study found moderate availability but low interactive use; other studies in polytechnics documented limited access to simulation software and inconsistent internet connectivity (Alio et al., 2025; Habibat et al., 2023; Mukhtar, 2019). The NBTE's initiatives (NBTE, 2018) point to institutional efforts to improve standards, but progress is uneven. Nigerian studies (e.g., Ogbu et al., 2024) reveal that technical teachers often lack formal training in digital pedagogy despite being competent in content. Studies recommend structured PD, ICT unit support, and incentives to build digital production, communication, and safety competencies. The Ekiti-focused analysis on ICT-driven pedagogies for electrical/electronics competency provides direct local evidence: stakeholders acknowledge the value of ICT but point to dependency on basic ICT, variable infrastructure, and the need for state-level prioritization of ICT resources to promote hands-on learning (Ekiti State Government, 2025). This local work is particularly valuable because it situates the national challenges within Ekiti State's institutional realities.

However, frequent themes in Nigerian and low- and middle-income country literature include unreliable power supply, limited internet connectivity, shortage of devices, and obsolete equipment (The World Bank, UNESCO & ILO 2023). For electrical/electronic training, these constraints translate into fewer supervised practice hours, an inability to access cloud-based simulators, and limited use of open educational resources. Ekiti State's policy statements emphasize innovation, but implementation requires targeted budgetary allocations to infrastructure and maintenance (Ekiti State Government, 2025). While national studies and a few Ekiti analyses exist, there is limited large-scale, rigorously controlled evidence on the state of integrating information and communication technology-driven pedagogies in Ekiti State government technical colleges. This study, therefore, evaluates the state of integrating information and communication technology-driven pedagogies in Ekiti State government technical colleges in Nigeria.

STATEMENT OF THE PROBLEM

The rapid development of technology in the contemporary digital era has led to a demand for highly skilled professionals who can understand complex technical fields like Electrical/Electronic Technology (EET). In many developed countries, information and communication technology (ICT) has revolutionized technical education by enabling immersive, hands-on learning experiences that better equip students with business-relevant skills. However, ICT integration in EET education is still restricted, particularly in the government technical institutions of Ekiti State.

This state of integrating information and communication technology-driven pedagogies in Ekiti State government technical colleges and the impacts of ICT-driven pedagogies on actual competency outcomes among GTC students are the subject of a few large-scale, rigorously controlled studies. Thus, this study assesses how well information and communication technology-driven pedagogies are integrated at Nigeria's Ekiti State Government Technical Colleges.

Research Questions

The following research questions were addressed in the study:

1. What is the current state of the use of ICT tools in teaching electrical/electronic technology?

2. What is the current state of ICT integration in electrical/electronic education in government technical colleges in Ekiti State?
3. What are the effective ICT tools used for teaching and learning electrical/electronic subjects in government technical colleges in Ekiti State?
4. What are the challenges and barriers to the effective integration of ICT in electrical/electronic technology education in government technical colleges in Ekiti State?

METHOD

This study used a quantitative survey methodology of the descriptive type in order to fully examine and assess the developing competency in electrical and electronic technology using creative ICT-driven pedagogies at government technical institutions in Ekiti State, Nigeria. Using a descriptive survey technique, this study aims to provide a comprehensive and empirical knowledge of the ICT-driven pedagogies in electrical and electronic technology in government technical institutions in Ekiti State.

Population and Sample

The study's target population consists of students enrolled in the electrical and electronic technology program at the government technical colleges in Ekiti State. A stratified random sample technique was employed to select 323 students to ensure coverage across several colleges and teaching positions, as well as to offer a diverse perspective on the state of integrating information and communication technology-driven pedagogies in Ekiti state government technical colleges, across a range of demographics. The sampled students as shown on **Table 1** comprised of 155 (48%) male and 168 (52%) female students, with the age ranges of 57 (22%), below 15 years; 186 (58%), within 15 to 17 years; 48 (16%), within 18 to 20 years, and 32 (0.40) above 20 years. 128 (10%) of the participants are in their first year; 109 (38%), in second year, and 86 (52%), in third year. The sample size, which was determined using Krejcie and Morgan's (1970) method for sample determination to ensure statistical power, consisted of 323 students from all technical institutions in Ekiti State.

Data Collection Instrument

The ICT-Driven Pedagogy Inventory (IDPI) (Okorie et al., 2024; r=0.89), was adapted to measure the state of integrating information and communication technology-driven pedagogies in Ekiti state government technical colleges. The questionnaire consisted of five sections with closed-ended questions on a 4-point Likert scale from 'Strongly Disagree' to 'Strongly Agree.' Basic participant information was documented in the demographics area in section A, including gender, age, study year, etc. The state of integrating information and communication technology-driven pedagogies in Ekiti state government technical colleges is evaluated across four sections (B to E) on the present state of ICT-driven pedagogies in government technical colleges.

Table 1. Demographic attributes of the Respondents

		Freq.	%
Gender	Male	155	48.00
	Female	168	52.00
	Total	323	100.00
Age	Below 15 Years	57	22.00
	15 – 17 Years	186	58.00
	18 – 20 Years	48	16.00
	Above 20 Years	32	0.40
	Total	323	100.00
Level	First Year	128	10.00
	Second Year	109	38.00
	Third Year	86	52.00
	Total	323	100.00

Students' opinions on the usage of ICT tools in teaching Electrical/Electronic technology were assessed in section B, with eight items, ranging from, 'You have computers in your School', to 'Your School uses video as instructional tool'. Students' perceptions on the state of ICT integration in Electrical/Electronic education were assessed in section C, with seven items, ranging from 'Your school is conscious about ICT training for students', to 'Your school is adequately staffed with trained teachers capable of effective ICT integration'. Section D, with eighteen items, ranging from 'Computers', to 'Scanner' identified the effective ICT tools used for teaching and learning Electrical/Electronic subjects in government technical colleges.

Section E evaluated the challenges and barriers to the successful integration of ICT in electrical and electronics education in those institutions, with four main items, ranging from 'Lack of ICT facilities', to 'Lack of qualified manpower in ICT'. A comprehensive developmental approach was used during the instrument's construction to provide measures that are valid for the intended applications and that elicit valid responses from the respondents. This strategy comprised strict adherence to educational and technological testing standards, suggestions for best practices in the development and evaluation of measures, and a comprehensive review of the relevant literature. Through peer-to-peer reviews, the instrument was validated by experts in educational technology and psychometrics to ensure content validity and relevance.

The instrument was pilot-tested to guarantee reliability before being approved by educational technology and psychometrics specialists. The measures' Cronbach's alpha reliability values were 0.92, 0.91, 0.90, and 0.91, respectively, in relation to the study's sections. These suggest that the measurement is reliable and internally consistent.

Data Collection Procedure

After obtaining the necessary ethical clearances and permits from the college administration and educational authorities, data were collected during a four-week period. At a few selected colleges (Government Technical College, Ado-Ekiti, Government Technical College, Otun-Ekiti, Government Technical College, Ijero-Ekiti, and Government Technical College, Igbara-Odo,). The questionnaire was administered by the trained research assistants to facilitate on-site completion and address any participant inquiries. After being made aware of the study's objectives, participants voluntarily consented to take part. Participants were encouraged to fill out the questionnaire at the end of the lectures in order to increase the response rate. Strict adherence to anonymity and confidentiality standards was maintained throughout the process.

Data Analysis

Descriptive statistics were employed to assess the collected data using SPSS-25 software. Descriptive statistics (such as simple frequency count, mean, standard deviation, skewness, and kurtosis) were used to answer the study questions and summarize participant responses.

Ethical Considerations

Ethical guidelines were strictly followed during the inquiry. The participants' permission was obtained using informed consent forms that described the objectives, procedures, and voluntary nature of the study. The privacy and security of all data were guaranteed, and participants were able to depart at any moment without incurring any penalties.

RESULTS

Research Question One: What is the Current State of the Use of ICT Tools in Teaching Electrical/Electronic Technology?

Table 2 shows how students rated the eight ICT tools on how frequently they perceive each to be used in teaching their electrical/electronic technology courses. Despite global norms of computer-assisted instruction, nearly 88% of students report virtually no computer availability for their courses. Instructional animation models of circuits or charge flow remain a rarity, with 87.9% of students disagreeing to their use.

Table 2. Electrical/Electronic students' perceptions of the current state of the use of ICT tools in teaching Electrical/Electronic technology

		Freq.	%	Mean	SD
You have computers in your School	Strongly Disagree	77	23.8		
	Disagree	207	64.1		
	Agree	26	8.0	1.92	0.69
	Strongly Agree	13	4.0		
	Total	323	100.0		
Your School uses instructional animations in teaching	Strongly Disagree	52	16.1		
	Disagree	232	71.8		
	Agree	26	8.0	2.00	0.64
	Strongly Agree	13	4.0		
	Total	323	100.0		
Your School uses slide show in teaching	Strongly Disagree	141	43.7		
	Disagree	143	44.3		
	Agree	26	8.0	1.72	0.78
	Strongly Agree	13	4.0		
	Total	323	100.0		
Your School uses films(video, CD, DVD etc., in teaching	Strongly Disagree	64	19.8		
	Disagree	220	68.1		
	Agree	26	8.0	1.96	0.66
	Strongly Agree	13	4.0		
	Total	323	100.0		
Your School uses Computer – Projector system as instructional tool	Strongly Disagree	90	27.9		
	Disagree	207	64.1		
	Agree	13	4.0	1.84	0.68
	Strongly Agree	13	4.0		
	Total	323	100.0		
Your School uses Television as instructional tool	Strongly Disagree	65	20.1	2.00	0.70
	Disagree	206	63.8		
	Agree	39	12.1		
	Strongly Agree	13	4.0		
	Total	323	100.0		
Your School uses Slide projector as instructional tool	Strongly Disagree	103	31.9	1.84	0.73
	Disagree	181	56.0		
	Agree	26	8.0		
	Strongly Agree	13	4.0		
	Total	323	100.0		
Your School uses video as instructional tool	Strongly Disagree	78	24.1	1.99	0.80
	Disagree	194	60.1		
	Agree	26	8.0		
	Strongly Agree	25	7.7		
	Total	323	100.0		

Table 3. Descriptive statistics of: (i) Electrical/Electronic students' perception of the current state of the use of ICT tools; (ii) Electrical/Electronic Students' perception of the current state of ICT integration in Electrical/Electronic education; (iii) Electrical/Electronic Students' perception of the effective ICT tools used; (iv) Electrical/Electronic Students' perception of the challenges and barriers to the effective integration of ICT in Electrical/Electronic technology education in government technical colleges in Ekiti state

	Mean	Std. Err. of Mean	SD	Skewness	Std. Err. of Skewness	Kurtosis	Std. Err. of Kurtosis
i.	15.29	0.11	1.89	-0.89	0.14	-0.37	0.27
ii.	11.81	0.12	2.20	0.85	0.14	0.39	0.27
iii.	33.61	0.20	3.68	0.30	0.14	0.03	0.27
iv.	13.79	0.10	1.88	-0.91	0.14	0.05	0.27

Besides, the infrastructure, projectors linked to computers, is rarely leveraged (92.0%), and basic presentation software like slide shows is perceived as largely (88.0%) unused by instructors. Video demonstrations of laboratory procedures or equipment remain infrequently used (87.9%). Even educational TV remains underutilized (83.9%) as a medium for technical instruction, legacy overhead-transparency technology is similarly dormant (87.9%), and standalone videos see little (15.7%) instructional use.

Across all categories, the mean scores hover just below 2.0, well under the neutral midpoint of 2.5. This starkly demonstrates that ICT tools widely recognized as foundational to modern pedagogy are perceived as absent or dormant in these colleges.

According to **Table 3**, the aggregate mean of 15.29 of students' perception of the current state of the use of ICT tools equates to roughly 47.8% of the maximum possible endorsement. A negative skew (–0.89) indicates a tail toward the lower end of perceptions, most students clustered on the 'Disagree' side, and the modest kurtosis (–0.37) suggests a fairly flat distribution, confirming wide-ranging but predominantly negative views.

The data unequivocally show that ICT tools, from basic office-suite presentations to dynamic simulation animations, are effectively absent from the instructional repertoire in these technical colleges. The *current state of the use of ICT tools in teaching electrical/electronic technology* indicates that, students do not perceive these tools as being in current use. This deficit not only contradicts modern pedagogical standards but also leaves students unprepared for technology-rich work environments in the electrical/electronic sectors.

Research Question Two: What is the Current State of ICT Integration in Electrical/Electronic Education in Government Technical Colleges in Ekiti State?

Table 4 shows that, 87.9% of students believe their school lacks awareness or prioritization of ICT training for students. A mean under 2.0 confirms that institutional consciousness is perceived as virtually nonexistent. Over 87.9% report no ongoing training for students, indicating that even if initial ICT orientations occur, they are not maintained as a continuous professional development activity. 92% of students feel no motivational support, such as incentives, recognition, or embedding ICT tasks into graded coursework, which further hampers uptake. Moreover, every student (92.0%) report that training did not improve their ICT skills, signaling either training ineffectiveness or absence of relevant, hands-on practice that translates to skill gains. Over 91.9% perceive severe shortages in hardware, software, or network infrastructure, confirming that any aspirational ICT integration is undermined by resource scarcity. A combined 91.9% denial illustrates that co-curricular ICT clubs, coding workshops, or laboratory sessions are virtually absent, eliminating crucial experiential learning opportunities. With 87.9% disagreeing, it is clear that schools are poorly staffed with trained teachers capable of effective ICT integration.

Table 4. Electrical/Electronic Students' perception of the current state of ICT integration in Electrical/Electronic education in government technical colleges in Ekiti state

		Freq.	%	Mean	SD
Your school is conscious about ICT training for students	Strongly Disagree	77	23.8	1.92	0.69
	Disagree	207	64.1		
	Agree	26	8.0		
	Strongly Agree	13	4.0		
	Total	323	100.0		
Your school regularly provides continuous ICT training for students	Strongly Disagree	51	15.8	2.00	0.63
	Disagree	233	72.1		
	Agree	26	8.0		
	Strongly Agree	13	4.0		
	Total	323	100.0		
Your school motivate you to partake in ICT training initiatives	Strongly Disagree	141	43.7	1.68	0.73
	Disagree	156	48.3		
	Agree	13	4.0		
	Strongly Agree	13	4.0		
	Total	323	100.0		
Your ICT integration ability increased through training given by your school	Strongly Disagree	208	64.4	1.48	0.76
	Disagree	89	27.6		
	Agree	13	4.0		
	Strongly Agree	13	4.0		
	Total	323	100.0		
Your school has enough ICT tools and facilities to support ICT-integrated pedagogy	Strongly Disagree	182	56.3	1.56	0.76
	Disagree	115	35.6		
	Agree	13	4.0		
	Strongly Agree	13	4.0		
	Total	323	100.0		
Your school undertake ICT/computer related activities for the students	Strongly Disagree	233	72.1	1.40	0.75
	Disagree	64	19.8		
	Agree	13	4.0		
	Strongly Agree	13	4.0		
	Total	323	100.0		
Your school is adequately staffed with trained teachers capable of effective ICT integration	Strongly Disagree	129	39.9	1.76	0.77
	Disagree	155	48.0		
	Agree	26	8.0		
	Strongly Agree	13	4.0		
	Total	323	100.0		

Table 3 also shows that, the composite mean of 11.81 out of 28 of students' perceptions of the current state of ICT integration in Electrical/Electronic education corresponds to roughly 42.2% endorsement of institutional ICT integration. A pronounced positive skew (+0.85) shows most students cluster at the low end of perceived integration., and the standard deviation of 2.20 indicates some students have marginally better experiences, perhaps in better-equipped colleges, but the overall picture is one of inadequate integration as the integration indicators reveal a profoundly underprepared institutional environment for ICT-driven pedagogy. Even if individual instructors are willing, systemic deficits, lack of training programs, motivational support, infrastructure, and staffing, render any grassroots ICT application unsustainable. The high proportion disagreement responses underscore that integration is not merely nascent; it is functionally absent.

Institutional integration of ICT in these technical colleges is profoundly deficient. Students perceive no meaningful ICT integration in Electrical/Electronic education in government technical colleges in Ekiti state. Without systemic awareness, structured training, adequate facilities, and competent staffing, any attempts at integrating ICT into pedagogy will remain superficial at best.

Research Question Three: What are the Effective ICT Tools Used for Teaching and Learning Electrical/Electronic Subjects in Government Technical Colleges in Ekiti State?

Table 5 asks students to rate different tools on perceived effectiveness for learning electrical/electronic concepts. Despite their ubiquity elsewhere, computers are not (87.9%) seen as enhancing technical understanding, likely because when available, they are not properly configured with relevant software or integrated into lessons. Physical instrumentation, though essential to laboratories, may be obsolete or insufficiently maintained, hence undercutting (91.9%) perceived value.

Table 5. Electrical/Electronic Students' perception of the effective ICT tools used for teaching and learning Electrical/Electronic subjects in government technical colleges in Ekiti state

		Freq.	%	Mean	SD
Computers	Strongly Disagree	77	23.8	1.92	0.69
	Disagree	207	64.1		
	Agree	26	8.0		
	Strongly Agree	13	4.0		
	Total	323	100.0		
Electrical/Electronic gadgets	Strongly Disagree	115	35.6	1.76	0.71
	Disagree	182	56.3		
	Agree	13	4.0		
	Strongly Agree	13	4.0		
	Total	323	100.0		
Internet facilities	Strongly Disagree	78	24.1	1.92	0.69
	Disagree	207	64.1		
	Agree	25	7.7		
	Strongly Agree	13	4.0		
	Total	323	100.0		
Overhead projector	Strongly Disagree	91	28.2	1.84	0.68
	Disagree	206	63.8		
	Agree	13	4.0		
	Strongly Agree	13	4.0		
	Total	323	100.0		
Radio	Strongly Disagree	115	35.6	1.89	0.86
	Disagree	156	48.3		
	Agree	26	8.0		
	Strongly Agree	26	8.0		
	Total	323	100.0		
Film projector	Strongly Disagree	65	20.1	1.96	0.67
	Disagree	219	67.8		
	Agree	26	8.0		
	Strongly Agree	13	4.0		
	Total	323	100.0		
Tape recorder	Strongly Disagree	130	40.2	1.80	0.85
	Disagree	154	47.7		
	Agree	13	4.0		
	Strongly Agree	26	8.0		
	Total	323	100.0		
Printer	Strongly Disagree	141	43.7	1.68	0.73
	Disagree	156	48.3		
	Agree	13	4.0		
	Strongly Agree	13	4.0		
	Total	323	100.0		
TV set	Strongly Disagree	77	23.8	1.96	0.78
	Disagree	207	64.1		

	Agree	13	4.0		
	Strongly Agree	26	8.0		
	Total	323	100.0		
Cassette recorder	Strongly Disagree	77	23.8	2.00	0.79
	Disagree	195	60.4		
	Agree	26	8.0		
	Strongly Agree	25	7.7		
	Total	323	100.0		
Smart Boards	Strongly Disagree	128	39.6	1.81	0.85
	Disagree	156	48.3		
	Agree	13	4.0		
	Strongly Agree	26	8.0		
	Total	323	100.0		
Flash Drive	Strongly Disagree	129	39.9	1.72	0.72
	Disagree	168	52.0		
	Agree	13	4.0		
	Strongly Agree	13	4.0		
	Total	323	100.0		
Digital Camera	Strongly Disagree	129	39.9	1.68	0.68
	Disagree	181	56.0		
	Strongly Agree	13	4.0		
	Total	323	100.0		
Bulletin Board	Strongly Disagree	26	8.0	2.88	0.91
	Disagree	78	24.1		
	Agree	128	39.6		
	Strongly Agree	91	28.2		
	Total	323	100.0		
Software programs	Strongly Disagree	91	28.2	1.84	0.68
	Disagree	206	63.8		
	Agree	13	4.0		
	Strongly Agree	13	4.0		
	Total	323	100.0		
Interactive teaching box	Strongly Disagree	142	44.0	1.68	0.74
	Disagree	155	48.0		
	Agree	13	4.0		
	Strongly Agree	13	4.0		
	Total	323	100.0		
Laptops	Strongly Disagree	194	60.1	1.59	0.89
	Disagree	91	28.2		
	Agree	13	4.0		
	Strongly Agree	25	7.7		
	Total	323	100.0		
Scanner	Strongly Disagree	143	44.3	1.68	0.74
	Disagree	154	47.7		
	Agree	13	4.0		
	Strongly Agree	13	4.0		
	Total	323	100.0		

The Internet's potential for online tutorials and collaborative projects goes unrealized (88.2%) due to connectivity issues or a lack of guided integration. Transparencies and printed slides remain largely unseen (92.0%), suggesting they are either stored away or lecturers default to chalk. Educational radio broadcasts, while low-tech, may exist locally but are not (83.9%) synchronized with classroom instructions. Lack (87.9%) of film libraries or projector maintenance keeps video projection dormant. Audio capture of lectures or podcasts is rare (87.9%) and unvalued. While printing laboratory instructions is helpful, students (88.0%) do not see printers as learning enhancers.

Besides, TVs in classrooms, even if present, are underutilized (87.9%) for technical content. Audio review of lessons via cassettes is better than nothing, but still not available (84.2%). Interactive whiteboards, despite being modern, are effectively absent (87.9%) from these settings. Portable storage devices are not (91.9%) seen as pedagogical enhancers, likely because students lack digital materials to transfer. Capturing laboratory setups or student work digitally is not (95.9%) practiced. Over two-thirds (67.8%) endorse bulletin boards as an effective information-sharing medium. Simulation and design tools, though powerful for conceptual understanding, are not (92.0%) integrated. Modular teaching devices are not (92.0%) being used. Personal or school-provided laptops are not (88.3%) deployed as classroom tools. Digitizing handwritten diagrams or student work through scanner is not (92.0%) standard practice.

The composite mean (**Table 3**) of 33.61 out of 72 of students' perceptions of the effective ICT tools used for teaching and learning Electrical/Electronic subjects in government technical colleges indicates overall skepticism regarding ICT tools' pedagogical value. A slight positive skew suggests a minority of students, likely those with better exposure, rated some tools more favorably.

With the sole exception of bulletin boards, every tool falls below the neutral threshold. Even foundational digital assets like computers, simulation software, or internet resources are rated as ineffective by the students. These perceptions reveal not only absence but also potential misalignment between tool availability and pedagogical implementation. When tools exist, they may be under-resourced, poorly maintained, or employed without clear instructional design, leading students to view them as non-functional or irrelevant. Traditional, low-technology bulletin boards are the only effective ICT tools used for teaching and learning Electrical/Electronic subjects in government technical colleges in Ekiti state.

Research Question Four: What are the Challenges and Barriers to the Effective Integration of ICT in Electrical/Electronic Technology Education in Government Technical Colleges in Ekiti State?

Table 6 shows an overwhelming (91.9%) consensus of severe lack of ICT facilities such as computer laboratories, projectors, networking equipment, and other essential hardware. Virtually all (96.0%) respondents cite inadequate financial resources as a fundamental barrier. Without budgetary allocations for procurement, maintenance, or upgrades, ICT initiatives cannot be sustained. 298 (92.3%) of students perceive insufficient policy support, incentives, or strategic direction from state or federal education authorities. This reflects a gap between national ICT-in-education mandates and local implementation. A substantial majority (87.9%) identify the dearth of trained ICT educators, technicians, and support staff as a barrier. Even when equipment exists, the absence of personnel who can install, maintain, and integrate it pedagogically renders that equipment unusable.

Table 3 shows the composite mean of 13.79 out of 16 of the challenges and barriers to the effective integration of ICT in Electrical/ Electronic technology education in government technical colleges, equating to an 86.2% overall endorsement of these barriers. A pronounced negative skew (–0.91) indicates that most students rate barriers at the high end. Low kurtosis (+0.05) suggests that student opinions are widely but consistently clustered around that high-barrier consensus. Systemic factors, especially inadequate budgets, infrastructure shortages, weak policy frameworks, and staffing deficits, constitute the principal obstacles to ICT-driven pedagogical innovation in these technical colleges. Any sustainable strategy must confront these macro-level barriers head-on.

Table 6. Electrical/Electronic Students' perception of the challenges and barriers to the effective integration of ICT in Electrical/Electronic technology education in government technical colleges in Ekiti state

		Freq.	%	Mean	SD
Lack of ICT facilities	Strongly Disagree	13	4.0	3.56	0.76
	Disagree	13	4.0		
	Agree	78	24.1		
	Strongly Agree	219	67.8		
	Total	323	100.0		
Poor funding	Strongly Disagree	13	4.0	3.60	0.70
	Agree	91	28.2		
	Strongly Agree	219	67.8		
	Total	323	100.0		
Low encouragement from government	Strongly Disagree	13	4.0	3.48	0.75
	Disagree	12	3.7		
	Agree	104	32.2		
	Strongly Agree	194	60.1		
	Total	323	100.0		
Lack of qualified manpower in ICT	Strongly Disagree	13	4.0	3.15	0.73
	Disagree	26	8.0		
	Agree	182	56.3		
	Strongly Agree	102	31.6		
	Total	323	100.0		

DISCUSSION

The state of integrating information and communication technology-driven pedagogies in technical colleges in the developing world and the impacts of ICT-driven pedagogies on actual competency outcomes among the students are the subject of a few large-scale, rigorously controlled studies. The study has revealed a unanimous disagreement pattern in the current state of the use of ICT tools in teaching Electrical/Electronic technology. These results are not merely a lack of cutting-edge resources but a near-total absence of even basic digital or multimedia instruction. In an era where global best practices for technical education, particularly in electrical and electronics technology, rely on simulation software, virtual laboratories, and online collaboration, this deficit starkly contrasts with international norms.

This finding of near-total absence of even basic digital or multimedia instruction is in agreement with the findings (Ogbu et al., 2024; Okorie et al., 2024; Ekiti State Government, 2025) from Nigerian contexts highlighting technical college teachers' readiness to use ICT tools in teaching Electrical/Electronic technology (Ogbu et al., 2024; Okorie et al., 2024; Ekiti State Government, 2025), but with a near-total absence of even basic digital or multimedia instruction to relate with. This corroborates Okorie et al. (2024) findings that, many technical teachers have strong domain content knowledge but limited resources in digital pedagogies, simulation software, and online instructional design.

Besides, building on the minimal tool usage, the results of this study depict institutional readiness as alarmingly deficient. Students overwhelmingly report no conscious emphasis on ICT integration in Electrical/Electronic education in government technical colleges in Ekiti state. Without institutional structures, policy frameworks, budget allocations, training programs, and human resources, digital pedagogies cannot move beyond pilot initiatives or donor-driven workshops.

This verdict is in consonance with the focused review of Nigerian empirical studies (across states and institution types) (Akanbi, 2017; Ayanwoye, 2023; Okoye & Arimonu, 2016) yields recurring concern of growing need for digital skills in electrical/electronic curricula, from solar installation competencies to use of open

educational resources and simulation tools for laboratories. This corroborates the findings of Mukhtar (2019), Habibat et al. (2023), and Alio et al. (2025), who lamented that investigations of digital technological tools in Nigerian TVET institutions show uneven availability and utilization, as their study found moderate availability but low interactive use; limited access to simulation software and inconsistent internet connectivity. This is a confirmation of the findings of Ogbu et al. (2024), where it was revealed that technical teachers often lack formal training in digital pedagogy despite being competent in content.

Paradoxically, while institutions lack infrastructure and integration, the sole pedagogical medium students deem effective is the low-tech bulletin board. All digital and electronic tools are rated below the neutral midpoint, with the majority of students rejecting each as pedagogically valuable. This finding conveys a crucial insight: the efficacy of a tool is inseparable from its integration and support. Even where tools exist, they may be present but unusable, lacking software licenses, data connectivity, maintenance, or aligned instructional design, leading students to view them as mere props rather than transformative learning aids. This corroborates the World Bank, UNESCO, and ILO (2023) report that, frequent themes in Nigerian and low- and middle-income country include unreliable power supply, limited internet connectivity, shortage of devices, and obsolete equipment as these constraints translate into fewer supervised practice hours, inability to access cloud-based simulators, and limited use of open educational resources which made Ekiti State's policy statements to emphasize innovation but implementation requires targeted budgetary allocations to infrastructure and maintenance (Ekiti State Government, 2025).

Besides, the study has shown agreement that the core systemic factors raised are substantial barriers. It is clearly shown that these are not peripheral or perceived obstacles; they are foundational. Without adequate budgets, policy support, infrastructure, and human capacity, any effort to improve tool usage, institutional integration, or perceived effectiveness is destined to falter. This justifies the finding of the large body of literature (Ismail & Mohammed, 2015; Johnson & Folahan, 2020; Okoye, 2016; Okoye & Arimonu, 2016; Thang et al., 2017) on Nigerian TVET, which documents chronic systemic challenges ranging from underfunding, inadequate facilities, weak teacher training, poor industry linkage, and curriculum-obsolescence (ILO, 2021; The World Bank, UNESCO & ILO, 2023), which has made several state-level studies (Akanbi, 2017; NBTE, 2018) call for policy reforms in funding, curriculum updates, teacher production, and stronger industry partnerships. This is in validation of Johnson and Folahan (2020) and ILO (2021) proclamations that, financing digital TVET requires creative models: state budget lines, national donor support, industry partnerships (equipment donations and apprenticeships), cost-sharing with communities, and income-generating activities by colleges (testing centers, service workshops), in agreement with the assertions of Ismail and Mohammed (2015) and Ayanwoye (2024) that public-private partnerships (PPPs) and industry advisory bodies are essential for aligning curricula and providing equipment access.

CONCLUSION

This study has unraveled the state of integrating information and communication technology-driven pedagogies in technical colleges and the impacts of ICT-driven pedagogies on actual competency outcomes among the students in the developing world. Although government policy in Nigeria has long advocated ICT in education, these technical colleges exemplify the gulf between policy rhetoric and classroom practice. Students' categorical rejection of digital tool usage and institutional integration confirms that ICT-driven pedagogies remain aspirational rather than operational. Even motivated instructors or tech-savvy students cannot surmount systemic barriers. Hardware shortages, funding gaps, policy inertia, and staffing deficits combine to create an ecosystem where digital pedagogies cannot be effectively deployed or sustained. The endorsement of bulletin boards signals an adaptive response; in the absence of digital tools, low-technology, high-visibility platforms fill the informational gap. While useful for announcements, they cannot substitute for dynamic, interactive learning experiences afforded by ICT. Piecemeal efforts, donor-driven equipment

donations or one-off training workshops are insufficient. A holistic strategy that simultaneously addresses infrastructure, funding, policy, and human capital is imperative to transform technical education and align it with global best practices.

RECOMMENDATIONS

To transit from the current ICT desert to a digitally-enabled learning ecosystem, a coordinated, multi-stakeholder approach is required. The following recommendations target each dimension of the digital pedagogy continuum:

- Provision of external funding and grants specifically aimed at vocational and technical education technology upgrades, ensuring alignment with national development plans.
- The teacher recruitment plan should require all technical instructors to attain a recognized ICT pedagogy certification, with workshops integrated into annual in-service training programs.
- Provision of performance-based incentives for instructors who effectively integrate ICT into their courses, as evidenced by student feedback and digital artifacts.
- Revision of the electrical/electronic curriculum to embed digital literacy and ICT competencies as explicit learning outcomes.
- Other studies should conduct a multi-year study tracking students exposed to incremental ICT infrastructure and training upgrades, measuring impacts on technical competencies, graduation rates, and employment outcomes in electrical/electronic fields.
- Compare Nigerian colleges with counterpart institutions in more ICT-advanced countries.

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