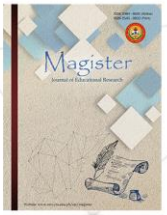

Magister
Journal of Educational Research
ISSN 2984 - 6641 (Online) ISSN 2545 - 9902 (Print)
Website: www.errc.ctu.edu.ph/ojs/magister

ERRC EDUCATIONAL RESEARCH AND RESOURCE CENTER

Received: April 2, 2025 | Revised: May 28, 2025 | Accepted: June 9, 2025 | Available Online: June 26, 2025

RESEARCH ARTICLE

Students' Attitudes toward Utilization of ICT Infrastructures in Some Selected Secondary Schools within Gombe Metropolis

[a,*]Adamu Bappah

[a]Faculty of Education, Department of Educational Foundations, National Open University of Nigeria (NOUN), Abuja, Nigeria

[*]Corresponding author: abappah@noun.edu.ng

Article citation details: Bappah A. (2025). Students' Attitude toward Utilization of ICT Infrastructures in Some Selected Secondary Schools within Gombe Metropolis. *Magister – Journal of Educational Research*, *4*(1), 01-20.

Abstract

The study investigated the attitudes of senior secondary school students in Gombe Metropolis toward the use of Information and Communication Technology (ICT) in educational settings. Anchored in the Technology Acceptance Model (TAM) and Constructivist Learning Theory (CLT), the research explores students' cognitive, affective, and behavioral orientations toward ICT utilization. Using a descriptive survey design, data were collected from a representative sample of students using a structured questionnaire. The findings revealed that students demonstrated positive cognitive attitudes, perceiving ICT as a valuable tool for enhancing knowledge acquisition and independent learning. Affective attitudes indicated students' emotional engagement and confidence in using ICT tools, while behavioral attitudes showed their consistent and proactive use of digital technologies in academic tasks. These patterns suggested that ICT is increasingly integrated into students' learning experiences. The study highlighted the need for strategic investment in ICT infrastructure and adopting constructivist pedagogies that promote learner-centered, digitally enriched environments. It concludes with practical implications for stakeholders and recommendations for further research, particularly in expanding theoretical models and evaluating inter-variable relationships statistically.

Keywords: *Constructivist Learning Theory; ICT, Nigeria; Student Attitudes; Technology Acceptance Model*

1. Introduction

Integrating Information and Communication Technology (ICT) into education has transformed teaching and learning processes globally, offering new avenues for knowledge dissemination, skill acquisition, and collaborative learning. ICT encompasses a broad range of technologies used for information processing, storage, retrieval, and communication. These include computers, the internet, educational software, interactive whiteboards, projectors, mobile devices, and other digital tools. Its application in education has been widely acknowledged to increase student engagement, improve academic performance, and enhance digital literacy. In many developed nations, ICT is no longer viewed as a supplementary instructional aid but as a core component of the educational process.

Globally, the integration of ICT into the educational landscape has been driven by the need to prepare students for participation in a knowledge-based economy, where digital skills are critical for academic and professional success. Widespread reforms in curriculum design, teacher training, assessment strategies, and resource allocation have accompanied this shift. For example, ICT is seamlessly embedded in classroom instruction, assessment, and administrative processes in Finland, Singapore, and South Korea. These countries have demonstrated that meaningful ICT integration requires not only infrastructural development but also cultural adaptation, pedagogical innovation, and continuous professional development for educators.

In Nigeria, the government has recognized ICT's pivotal role in national development, leading to several policy initiatives to embed ICT into the educational system. The National Policy on Education (NPE) and the National ICT Policy on Education (2006) underscored the need to integrate ICT in curriculum delivery and school management. This resulted in efforts to provide teachers and students with computer laboratories, internet access, and ICT training programs. Furthermore, Nigeria's Strategic Education Sector Plan (SESP) and National Broadband Plan (2020–2025) reflect a continued commitment to ICT expansion in education. These policies align with global recommendations, such as those by the World Bank (2020), emphasizing the importance of digital equity and technological inclusion in education.

Despite these efforts, the level of ICT adoption in Nigerian secondary schools varies significantly, with many schools still lacking the necessary infrastructure and training for effective implementation. Urban schools and private institutions are more likely to possess modern ICT

equipment and trained personnel than their rural and public counterparts. Economic inequalities, policy implementation gaps, and infrastructural deficits, such as unstable electricity and limited internet connectivity, exacerbate the disparity in access.

Empirical studies continue to reveal that the integration of ICT across Nigerian schools is inconsistent and often inadequate. For instance, Odey et al. (2025) found that in Nasarawa State, many secondary schools lacked trained ICT personnel and functional computer labs, which hindered practical usage. Tiba, Condy, and Tunjera (2022) identify obsolete infrastructure, unstable electricity, and inadequate teacher training as key factors hindering ICT literacy in African schools. Despite policy directives, these studies underscore the persistent challenges facing ICT adoption in Nigeria.

ICT adoption in schools is influenced by infrastructural availability and students' attitudes toward technology. Students' attitudes are fundamental in shaping how they perceive, engage with, and utilize ICT tools for academic purposes. Attitude is typically measured across three domains: cognitive (beliefs and knowledge), affective (feelings and emotions), and behavioral (actions and intentions). Positive attitudes toward ICT have been associated with improved academic performance, increased motivation, and developing critical thinking skills. Conversely, negative perceptions may result in anxiety, resistance to innovation, and underutilization of available digital resources. However, the determinants of students' attitudes toward ICT are multifaceted. Beyond infrastructure, teachers' ICT competencies, home technology exposure, peer influence, and parental support significantly influence student attitudes (Alruthaya, Nguyen, & Lokuge, 2021). Moreover, prior experience with digital devices, accessibility to mobile technology, and engagement with social media platforms contribute to shaping students' comfort and familiarity with ICT tools. Furthermore, Ross, Morrison, and Lowther (2004) emphasize that Students who frequently engage with ICT tools outside of school often demonstrate greater confidence and independence when using digital technologies in the classroom. This insight is especially pertinent in the Nigerian context, where access to personal devices such as smartphones and tablets is increasing, even in underserved communities.

In Gombe Metropolis, located in the northeastern region of Nigeria, ICT implementation in secondary schools has become an area of growing interest. While some private and government schools have embraced digital tools, the extent to which students interact with these

technologies varies. Challenges such as low funding, inadequate teacher training, and inconsistent policy implementation continue to plague ICT integration efforts. Moreover, some schools still treat ICT as a standalone subject rather than a cross-curricular tool, which limits students' opportunities to engage with technology in meaningful ways across disciplines. Additionally, the absence of empirical data capturing student perspectives in this region highlights the need for targeted research.

Despite government interventions and donor-sponsored ICT programs, the actual use of ICT in secondary school education in Gombe has not been fully realized. The lack of localized studies examining students' experiences and perceptions represents a significant gap in educational research. Understanding students' attitudes is critical for developing effective ICT policies responsive to their needs and contextual realities. While studies exist on infrastructure development and teacher preparedness, little is known about how students in Gombe view and use ICT in their daily academic routines. For example, do students feel confident using computers for assignments? Do they perceive ICT as helpful in understanding complex subjects such as mathematics and science? Do they have regular access to digital learning platforms?

The global emphasis on technology-enhanced learning, as reflected in the Sustainable Development Goals (SDG 4), further accentuates the need for research in this area. According to UNESCO (2015), ICT in education is central to reducing educational disparities and promoting inclusive and equitable quality education. As a signatory to the SDGs, Nigeria must ensure its educational strategies leverage ICT to foster lifelong learning and bridge the digital divide. However, as Adeoye and Wentling (2007) observed, the mere provision of ICT facilities does not guarantee their practical use. Effective ICT integration requires a deep understanding of user attitudes, contextual barriers, and systemic enablers.

Contemporary studies have highlighted the transformative impact of sustained ICT training on teaching practices and student outcomes (Osakwe, 2013). These studies prove that with structured training and access to digital tools, students' attitudes can shift significantly toward increased usage, innovation, and digital fluency. The findings from such research underscore the urgent need for context-specific investigations that capture regional disparities and unique challenges.

This study explores students' attitudes toward using ICT infrastructure in selected secondary schools within Gombe Metropolis. By examining students' cognitive understanding, emotional responses, and behavioral engagement with ICT tools, the study aims to provide a comprehensive insight into the state of digital education in the region. The insights derived will be instrumental in guiding educators, policymakers, and stakeholders in designing targeted interventions that promote ICT adoption and optimize its benefits for secondary education. The study's findings will also contribute to the national discourse on ICT integration by offering a grounded, evidence-based perspective from an underserved region, thus supporting equitable educational reform and strategic digital inclusion.

2. Literature Review

Integrating ICT in secondary education has redefined pedagogical practices worldwide, including in Nigeria. As schools shift from traditional teacher-centered instruction to more dynamic, learner-centered approaches, ICT emerges as a crucial enabler of this transformation. Despite infrastructural and policy-related constraints in Nigeria, the momentum toward digital learning is growing, necessitating a deeper understanding of students' attitudes toward ICT and how these perceptions affect their academic engagement and outcomes.

This literature review presents a conceptual analysis grounded in two complementary theoretical perspectives: The Technology Acceptance Model (TAM) and the Constructivist Learning Theory (CLT). These frameworks help explore the psychological underpinnings of technology acceptance and the pedagogical dynamics of ICT-supported learning, especially in Nigerian secondary schools.

Developed by Davis (1989), TAM posits that two primary factors—Perceived Usefulness (PU) and Perceived Ease of Use (PEOU)—determine users' attitudes toward technology adoption. PU refers to the extent to which an individual believes that using a specific system will enhance their performance, while PEOU reflects the belief that using the system will be free of effort. These perceptions influence users' attitudes, behavioral intentions, and system usage.

TAM has been extensively used in Nigerian secondary schools to interpret students' acceptance of ICT tools. Cognitive attitudes toward ICT, which encompass beliefs about the utility of digital tools in improving academic performance, are closely aligned with PU. For instance, students who believe a learning management system improves

access to educational materials tend to demonstrate stronger engagement. Studies by Metu et al. (2022) revealed that students' belief in the practical benefits of ICT correlates with increased willingness to use digital tools.

PEOU is often mirrored in affective attitudes, students' emotional responses, and confidence in ICT tools. Students who find digital platforms easy to navigate are more likely to have positive emotions, leading to sustained engagement. Empirical studies (Odey et al., 2025) support this, showing that the perceived simplicity of tools like e-books, online libraries, and educational software predicts higher user enthusiasm and confidence.

While TAM offers insight into individual-level factors influencing ICT adoption, recent critiques argue for an expanded model that considers contextual variables such as infrastructure, teacher support, and institutional culture (Venkatesh & Bala, 2008). Hence, an integrated approach that combines TAM with pedagogical theories such as CLT provides a more comprehensive understanding of ICT use in educational settings.

Conversely, CLT, rooted in the works of Piaget (1950) and Vygotsky (1978), emphasizes the learner's active role in constructing knowledge through experience, social interaction, and reflection. Learning is not merely absorbing information but a dynamic process of meaning-making shaped by prior knowledge, context, and collaborative dialogue. ICT aligns closely with constructivist principles by offering exploration, collaboration, and problem-solving platforms. For example, simulation tools and virtual labs enable students to manipulate variables, test hypotheses, and conclude, mimicking real-world scientific inquiry. Online discussion forums and group projects on platforms like Google Classroom and Edmodo encourage peer interaction and co-construction of knowledge.

Empirical studies underscore the efficacy of CLT-based digital learning strategies. Yusuf and Afolabi (2010) demonstrated that ICT-supported project-based learning enhances motivation, creativity, and higher-order thinking among Nigerian students. CLT also conceptualizes the teacher's role from a knowledge transmitter to a facilitator of learning. Teachers guide students in navigating digital resources, posing challenging questions, and supporting collaborative problem-solving. This shift necessitates adequate training and professional development for educators, which remains challenging in many Nigerian public schools.

Integrating TAM and CLT offers a dual lens for understanding ICT usage's psychological and pedagogical dimensions. TAM provides insight into how students perceive and accept digital tools, while CLT situates these tools within learner-centered instructional strategies. When students perceive ICT as helpful and easy to use, they are more likely to engage meaningfully, especially in environments that foster active, collaborative learning. For example, perceived usefulness (TAM) may initially drive online research platforms. However, its integration into inquiry-based learning projects (CLT) deepens students' engagement and promotes long-term knowledge retention. Such a synthesis allows educators and policymakers to design interventions that improve access to technology and enhance instructional delivery quality.

2.1 Students' Attitudes toward ICT

Students' attitudes toward ICT are multidimensional, encompassing cognitive, affective, and behavioral components. Cognitive attitudes reflect beliefs about the role of technology in learning, such as its ability to simplify complex concepts and improve academic performance. Affective attitudes capture emotional responses, ranging from excitement and curiosity to anxiety and frustration. Behavioral attitudes refer to usage patterns, such as participating in online discussions, downloading educational resources, or using simulations.

Research shows that students generally exhibit positive cognitive attitudes when exposed to well-structured digital learning tools. Oye et al. (2012) found that Nigerian students appreciated the accessibility and interactivity of ICT, which encouraged independent study and deeper comprehension. Affective attitudes, meanwhile, are shaped by previous experiences, self-efficacy, and peer influence. Students confident in their digital skills are likelier to enjoy and persist in using ICT tools.

Behavioral attitudes are critical indicators of ICT integration success. When students take initiative by researching online, using educational apps, or collaborating through digital platforms, it signals acceptance and meaningful use. These attitudes are influenced by both intrinsic motivation and extrinsic factors such as teacher encouragement and institutional support (Tella, 2011).

2.2 Challenges and Barriers

Several challenges hinder effective ICT integration in Nigerian secondary schools. Infrastructure deficits remain a significant obstacle. Chukwunedum (2020) found that "lack of internet access, inadequate

electricity supply, and lack of funding by the government" are prominent challenges impeding ICT use in Nigerian public secondary schools. The resulting digital divide creates unequal opportunities for students, undermining the equity goals of ICT adoption.

Teacher competence is another critical factor. Studies by Tella (2011) show that many educators lack adequate training in ICT integration, resulting in the underutilization of available tools. Limited professional development opportunities and inconsistent policy implementation at the institutional and government levels compound this issue.

Furthermore, attitudinal resistance among some educators and administrators impedes progress. Integration efforts falter when ICT is perceived as a threat rather than a tool for enhancement. Institutional leadership must play a proactive role in fostering a culture that values digital literacy and innovation.

3. Methodology

The study adopted a descriptive survey research design to examine students' attitudes toward using ICT infrastructures in selected secondary schools within Gombe Metropolis, Gombe State, Nigeria. This design was considered appropriate because it enables the researcher to collect quantitative data that reflects students' views, experiences, and perceptions without manipulating variables. It provides a snapshot of the existing conditions related to ICT usage in the educational environment.

The target population was 2,100 students enrolled in four science and technical secondary schools within the metropolis. These schools were purposively selected due to their relative emphasis on ICT-based instruction and availability of basic technological resources. To determine a representative sample size from the population, Yamane's (1973) opinion was employed to increase manageability and logistic constraints in field data collection, which suggested a more pragmatic sample size of 210 students representing 10% of the population. This is consistent with the widely accepted practice in educational research for large populations (Cohen et al., 2002), and is still within acceptable precision levels for descriptive surveys.

A multistage sampling technique was adopted to ensure representativeness. Initially, the schools were purposively selected; next, stratified sampling was applied based on gender and class levels; and finally, simple random sampling was used to select individual students within each stratum.

A 23-item researcher-designed questionnaire served as the primary instrument for data collection. The items were constructed to reflect the cognitive, affective, and behavioral dimensions of students' attitudes toward ICT. Two experts in educational administration and one in measurement and evaluation reviewed the instrument to ensure content and face validity. Their feedback informed revisions that improved clarity and alignment with the study objectives.

To assess the instrument's reliability, a pilot study involving 30 students (excluded from the main sample) was conducted using a test–retest approach over a two-week interval. The resulting Pearson correlation coefficient of 0.87 indicated strong temporal stability. Additionally, Cronbach's alpha coefficients for internal consistency were computed as follows: cognitive domain ($\alpha = 0.81$), affective domain ($\alpha = 0.84$), and behavioral domain ($\alpha = 0.79$), confirming that the instrument was reliable across all constructs.

Data collection was conducted by trained research assistants who administered and retrieved the questionnaires during regular school hours, minimizing disruption to academic activities. Responses were measured on a four-point Likert scale: Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1). Using a four-point scale eliminated neutral choices, encouraging more decisive responses.

Descriptive statistics, including means and standard deviations, were employed to summarize the data. A decision rule was applied whereby a mean score of 2.5 and above signified acceptance, while scores below 2.5 indicated non-acceptance of a statement. Furthermore, One-Way Analysis of Variance (ANOVA) was used to determine significant differences in student attitudes across the cognitive, affective, and behavioral domains. The statistical analyses were performed using SPSS Version 25.

4. Results

The presentation of the results is organized into the following sub-sections: descriptive results based on the research questions, hypothesis testing, and summary of the key results.

4.1 Descriptive Results by Research Question

Research question 1: What are the students' cognitive attitudes towards using ICT in some selected Senior Secondary Schools in Gombe Metropolis?

Table 1

Mean responses on the Cognitive Attitudes of Students Towards the Use of ICT in Some Selected Senior Secondary School in Gombe Metropolis

S/No.	Items	SA	A	D	SD	$\bar{x}$	s	Remarks
1	I have access to ICT tools (computers, smartphones, tablets) at school	86	92	11	13	3.24	0.87	Accepted
2	Using ICT helps me to understand complex concepts better.	106	68	15	12	3.34	0.90	Accepted
3	ICT tools and resources enhance my critical thinking skills.	96	90	8	6	3.38	0.79	Accepted
4	I believe ICT helps me develop problem-solving abilities.	150	28	14	10	3.57	0.78	Accepted
5	ICT improves my ability to recognize and structure my thoughts	147	38	11	5	3.62	0.71	Accepted
6	I find it easier to retain information when using ICT tools	128	57	9	8	3.50	0.74	Accepted
7	ICT enables me to access a broader range of information	88	97	8	9	3.31	0.77	Accepted
8	I believe ICT is essential for success in modern education	122	56	21	3	3.47	0.78	Accepted
9	ICT makes learning more interactive compared to traditional methods	115	72	7	8	3.46	0.74	Accepted

Legend: $\bar{x}$ – mean, s – sample standard deviation

Table 1 presents a grand mean score of 3.45 with a standard deviation of 0.78, indicating a strong overall agreement with the items on the questionnaire. This suggested a general acceptance and positive perception of ICT among the students. A closer examination of individual items reveals that all recorded mean scores were 2.5 or above, meeting the threshold for agreement based on the study's decision rule. Specifically, the results show that students hold a positive cognitive

attitude toward using ICT, perceiving it as a valuable and beneficial tool for enhancing their learning experiences.

Research Question 2: What are students' attitudes towards ICT use in some selected Senior Secondary Schools in Gombe Metropolis?

Table 2

Mean responses on the Affective Attitudes of Students Towards the Use of ICT in Some Selected Senior Secondary Schools in Gombe Metropolis

S/No.	Items	SA	A	D	SD	$\bar{x}$	s	Remarks
10	I feel excited about integrating ICT tools in my academic activities	114	48	27	13	3.30	0.87	Accepted
11	I experience a positive emotional response when using ICT tools during learning.	112	72	11	7	3.48	0.75	Accepted
12	The idea of using ICT motivates me to participate in academic tasks	109	68	7	6	3.46	0.73	Accepted
13	I find a sense of joy in exploring and learning with ICT resources.	90	87	14	11	3.31	0.81	Accepted
14	ICT makes learning more interesting and fun.	111	78	7	6	3.36	0.73	Accepted
15	Using ICT in my school makes me feel more engaged in my studies	122	56	21	3	3.47	0.77	Accepted
16	I feel happy when ICT tools are used in class.	91	90	13	8	3. 37	0.80	Accepted

Legend: $\bar{x}$ – mean, s – sample standard deviation

Table 2 shows a grand mean of 3.39 with a standard deviation of 0.78, indicating a consensus among respondents in favor of the items presented. According to the decision rule, all items with mean scores of 2.5 or above are considered accepted, and each item in the table meets this criterion. This outcome reflects a strong positive attitude among students toward using ICT.

Research Question 3: What are the Behavioral Attitudes of Students towards the use of ICT in Some Selected Senior Secondary schools in Gombe Metropolis?

Table 3

Mean responses on the behavioral attitudes of students towards the use of ICT in some selected Senior Secondary Schools in Gombe Metropolis

S/No.	Items	SA	A	D	SD	$\bar{x}$	s	Remarks
17	When faced with a challenge, I regularly refer to ICT for solutions	99	87	11	5	3.39	0.76	Accepted
18	The use of ICT has positively influenced my time management skills	152	43	2	5	3.69	0.63	Accepted
19	I make an effort to improve my ICT skills for learning/	131	39	12	20	3.39	0.84	Accepted
20	My behavior demonstrates a proactive engagement with ICT in my academic life.	86	92	11	13	3.24	0.86	Accepted
21	I consistently participate in ICT-based lessons in school.	115	72	7	8	3.46	0.75	Accepted
22	I follow school rules regarding the use of ICT devices.	122	69	7	4	3.53	0.70	Accepted
23	I often help my classmates with ICT-related tasks.	125	61	11	5	3.51	0.74	Accepted

Legend: $\bar{x}$ – mean, s – sample standard deviation

Table 3 presents a grand mean of 3.46 with a standard deviation of 0.75, indicating a general acceptance of all the items included in the questionnaire. Each item recorded a mean score of 2.5 or higher, signifying that respondents consistently affirmed the behavioral statements related to ICT usage. These findings reveal that students in senior secondary schools within Gombe Metropolis exhibit highly positive behavioral attitudes toward using ICT. This suggests that students value ICT and actively engage with it in their academic practices, demonstrating willingness and readiness to integrate technology into their learning routines.

4.2 Hypotheses Testing

A One-Way ANOVA was conducted to compare the mean attitude scores among three constructs, cognitive, affective, and behavioral, to determine if there are significant differences in students' attitudes toward ICT in selected senior secondary schools in Gombe Metropolis.

Null Hypothesis (H_0): There is no significant difference in students' attitudes toward ICT across cognitive, affective, and behavioral constructs.

Table 4

One-Way ANOVA for the mean attitude scores among three constructs, cognitive, affective, and behavioral attitudes.

Source	SS	Df	MS	F	p-value
Between Groups	0.197	2	0.0985	1.61	0.216
Within Groups	1.647	20	0.0823		
Total	1.844	22			

The ANOVA results showed that F (2, 20) = 1.61, p = 0.216. Since the p-value is greater than the significance level of 0.05, we fail to reject the null hypothesis. This indicated no statistically significant difference in students' attitudes toward ICT across the cognitive, affective, and behavioral constructs.

4.3 Summary of findings

1. Students have a positive cognitive attitude towards the utilization of ICT in senior secondary schools in Gombe Metropolis
2. Students have a strong positive attitude toward using ICT in senior secondary schools in Gombe Metropolis.
3. Students have higher behavioral attitudes towards using ICT in senior secondary schools in Gombe Metropolis.

5. Discussion

The study findings reveal that senior secondary school students in Gombe Metropolis exhibit highly positive cognitive, affective, and behavioral attitudes toward using Information and Communication Technology (ICT) in education. When interpreted through the dual

theoretical lenses of the Technology Acceptance Model (TAM) and Constructivist Learning Theory (CLT), these attitudes offer meaningful insights into students' adoption and use of ICT tools in learning environments.

The first significant finding showed students' positive cognitive attitude, which reflects their recognition of ICT's value in enhancing their academic experiences. This corresponds with perceived usefulness (PU) in TAM (Davis, 1989), where students acknowledge that ICT enables access to diverse resources such as educational videos, online databases, and multimedia platforms, which enrich their learning beyond traditional classroom instruction. This finding supports the results of Odey et al. (2025), who observed that perceptions of ICT usefulness and supportive instructional environments significantly predicted student engagement. From the perspective of CLT, these cognitive attitudes also illustrate active and independent learning, as students use digital tools to explore, construct, and apply knowledge with core elements of learner-centered instruction (Piaget, 1950; Vygotsky, 1978).

The second key finding revealed students' affective attitudes, demonstrating high emotional engagement and confidence in using ICT. This aligns with perceived ease of use (PEOU) in TAM, suggesting that students find ICT tools convenient, strengthening their intention to use them. Their emotional attachment to technology is evident in their enthusiasm and willingness to use ICT for academic purposes. These affective dispositions also resonate with CLT's emphasis on positive emotional climates that support student learning. When students feel confident and motivated, they are more likely to engage in peer collaboration and reflect deeply on academic tasks, enhancing meaningful learning experiences.

The third finding indicated students' positive behavioral attitudes, which revealed regular and intentional use of ICT for learning activities such as completing assignments, conducting research, and collaborating with peers. Within TAM, this outcome reflects the successful internalization of perceived usefulness and ease of use, resulting in sustained behavioral engagement. The behavioral patterns reported in this study mirror findings by Fraillon, Schulz, and Ainley (2024), who found that when teachers and students hold positive attitudes toward technology, ICT gets used more frequently in educational settings. Moreover, the students' willingness to support peers in ICT-related tasks and to engage in group digital learning projects aligns with CLT's social

constructivist principles, where learning is co-constructed through collaboration and context-rich interactions (Vygotsky, 1978).

These findings suggest a synergistic interplay between students' perceptions of ICT and their actual learning behaviors, as explained by TAM and CLT. While TAM provides a framework for understanding students' technology adoption based on perceived benefits and usability, CLT frames ICT as a medium for facilitating authentic, student-centered learning. In this context, ICT is a tool and a transformative agent that fosters active inquiry, digital collaboration, and deeper knowledge construction.

Though this study used the theoretical models descriptively, future research could benefit from quantitative modeling of these relationships. Structural Equation Modeling (SEM), for instance, could empirically test whether perceived usefulness predicts behavioral engagement or whether ease of use mediates the relationship between cognitive and behavioral attitudes. Incorporating qualitative insights, such as classroom observations or student interviews, could also enrich the application of CLT by highlighting how digital learning environments support or constrain constructivist practices.

The discussion highlights how students' attitudes toward ICT are shaped by their beliefs about its usefulness and usability (TAM) and their experiences in learning environments that support exploration, collaboration, and knowledge construction (CLT). Integrating these theoretical perspectives offers a comprehensive understanding of how ICT can be leveraged to create more effective, engaging, and learner-driven educational experiences in Nigerian secondary schools.

The ANOVA result indicated the absence of statistically significant differences among the cognitive, affective, and behavioral components of students' attitudes toward ICT, suggesting a relatively uniform disposition toward digital technology use across psychological domains. This finding implies that students in Gombe Metropolis demonstrate a balanced attitude toward ICT; they not only recognize its value (cognitive) but also exhibit positive emotional responses (affective) and are willing to engage with it (behavioral).

This uniformity could indicate a shared exposure to ICT, possibly influenced by school-wide policies, peer dynamics, or informal learning experiences outside the classroom. It also reflects a potentially strong foundational belief in the relevance of technology in education, regardless of emotional or behavioral variations.

From a policy and pedagogical perspective, the findings reinforce the need for comprehensive ICT integration strategies that simultaneously address all three attitude components. Since no single domain stands out as a weakness, interventions should be holistic, providing technical infrastructure and pedagogical support while fostering emotionally engaging ICT learning environments.

Moreover, the consistency across constructs presents an opportunity for educators to leverage students' attitudes by introducing more advanced and interactive ICT tools to sustain and deepen engagement. Efforts to improve ICT adoption should thus emphasize increasing access and enhancing the quality and relevance of digital content to meet students' learning needs.

Future studies could further investigate whether this attitudinal consistency is sustained across different socio-economic backgrounds, school types (urban vs rural), or subjects of study, providing more nuanced insights into the dynamics of ICT adoption in Nigerian secondary schools.

6. Policy and Pedagogical Implications

To overcome challenges and optimize ICT integration, several policy and pedagogical measures are recommended:

1. Infrastructure Development: Governments and stakeholders must invest in reliable ICT infrastructure, particularly in underserved areas.
2. Teacher Capacity Building: Continuous professional development programs should focus on pedagogical use of ICT, not just technical skills.
3. Curriculum Redesign: Embedding ICT use in curriculum delivery will promote active learning and skill development.
4. Inclusive Strategies: Special attention should be paid to gender, socio-economic, and geographic disparities in ICT access and usage.
5. Monitoring and Evaluation: Regular assessment of ICT programs can identify gaps and inform evidence-based policy decisions.

The integration of ICT in Nigerian secondary education holds transformative potential, particularly when guided by robust theoretical frameworks like TAM and CLT. Educators can foster more engaging, equitable, and effective learning environments by understanding and addressing students' attitudes (cognitive, affective, and behavioral).

However, realizing this potential requires systemic investment in infrastructure, teacher training, and inclusive policies that bridge existing gaps.

7. Conclusion

This study investigated the attitudes of senior secondary school students in Gombe Metropolis toward the use of Information and Communication Technology (ICT) in education. Guided by the Technology Acceptance Model (TAM) and Constructivist Learning Theory (CLT), the research explored students' cognitive, affective, and behavioral dispositions toward ICT integration in learning. The descriptive survey design was employed, and data were gathered using a structured questionnaire administered to a sample of students across selected schools in the metropolis.

The findings revealed three major patterns. First, students exhibited a positive cognitive attitude toward ICT, perceiving it as a valuable tool for accessing diverse academic resources and enhancing independent learning. This aligns with the perceived usefulness construct in TAM, where students recognize ICT as instrumental in improving learning outcomes. Second, students demonstrated a strong affective attitude, indicating emotional engagement, confidence, and enjoyment in using digital tools. This reflects perceived ease of use within TAM, suggesting that students find ICT tools accessible and user-friendly. Third, students reported a positive behavioral attitude, consistently using ICT for academic tasks such as research, assignments, and collaboration. These behaviors illustrate TAM's prediction of actual technology use and CLT's emphasis on learner-centered, active engagement.

Theoretically, these results confirm the relevance of TAM and CLT in understanding how attitudes influence ICT adoption and usage. While TAM explains the students' willingness to use technology based on its perceived utility and usability, CLT provides pedagogical grounding by highlighting the importance of active, social, and contextual learning experiences. Together, the frameworks demonstrate that positive attitudes toward ICT can foster deeper learning, increased autonomy, and enhanced digital literacy among secondary school students.

Practically, the findings have several implications for educational stakeholders. First, the widespread positive attitudes among students suggest that efforts to integrate ICT in classrooms are likely to be well-received, provided that appropriate infrastructure and support are in place. Schools should prioritize continuous investment in ICT facilities

and ensure teachers are equipped to facilitate digital learning. Second, students' emotional and behavioral enthusiasm highlights the need for constructivist-aligned instructional strategies, such as collaborative digital tasks, inquiry-based learning, and student-led exploration. These approaches can capitalize on students' attitudes and embed ICT into meaningful academic practice.

8. Limitations of the Study

Despite its contributions, this study has several limitations. First, using self-reported data may introduce bias, as students might overestimate or misrepresent their attitudes or ICT usage. Second, the sampling technique was limited to selected schools within Gombe Metropolis, reducing the generalizability of the findings to other regions or educational contexts in Nigeria. Third, while the study explored attitudes descriptively, it did not employ inferential statistical models such as Structural Equation Modeling (SEM) that could examine causal relationships among constructs. Finally, the study faced constraints in achieving a high response rate, which may have limited the sample's representativeness.

Future research should address these limitations by adopting mixed-methods approaches, expanding the sample to include diverse regions, and employing multivariate statistical techniques to test hypotheses derived from TAM and CLT. Additionally, longitudinal studies could provide insights into how students' attitudes toward ICT evolve over time and in response to specific interventions or policy changes.

The study shows that students in Gombe Metropolis are positively inclined toward using ICT in education. Their cognitive, emotional, and behavioral engagement with digital tools reflects a readiness for technology-enhanced learning and a shift toward more interactive, student-centered pedagogical practices. Leveraging these attitudes effectively requires strategic investments in infrastructure, teacher training, and curriculum design that align with technological and constructivist learning principles.

9. AI Use Declaration

The author used Generative Artificial Intelligence (GenAI) to improve language fluency and readability. All content generated with the assistance of the tool was subsequently reviewed and edited by the author, who assumes full responsibility for the final version of the published article.

References

Adeoye, B. F., & Wentling, R. M. (2007). The relationship between national culture and the usability of an e-learning system. *International Journal on E-learning, 6*(1), 119–146.4000

Alruthaya, A., Nguyen, T.-T., & Lokuge, S. (2021). The application of digital technology and the learning characteristics of Generation Z in higher education. arXiv. https://arxiv.org/abs/2111.05991

Chukwunedum, D. (2020). Challenges facing the use of ICT in teaching computer studies in public secondary schools in Awka South L.G.A. [Preprint]. Educa-tional Research. Retrieved from AfricArXiv.

Cohen, L., Manion, L., & Morrison, K. (2002). Research methods in education (8th ed.). Routledge.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340.

Federal Ministry of Education. (2006). National policy on ICT in education. Federal Government of Nigeria.

Federal Ministry of Education. (2006). National policy on ICT in education. Federal Government of Nigeria

Federal Republic of Nigeria. (2013). National policy on education (6th ed.). Nigerian Educational Research and Development Council (NERDC).

Federal Republic of Nigeria. (2013). National policy on education (6th ed.). Nigerian Educational Research and Development Council (NERDC

Fraillon, J., Schulz, W., & Ainley, J. (2024). Technology use at school and students' learning outcomes. OECD Publishing. Retrieved from OECD iLibrary

Metu, I. C., Eleje, L. I., Ezenwosu, N. E., Ezeugo, N. C., & Mbelede, N. G. (2022). The use of information and communication technology to teach: Assessment of secondary school students' perceptions. *Asian Journal of Education and Social Studies, 26*(3), 71-77.

Metu, I. C., Eleje, L. I., Ezenwosu, N. E., Ezeugo, N. C., & Mbelede, N. G. (2022). The Use of Information and Communication Technology to Teach: Assessment of Secondary School Students' Perceptions.

Odey, J. E., Onyema, S. C., Hudu, S. M. A., Taiwo, A. J., & Otsonu, S. A. (2025). Extent of Information and Communication Technology Integration in the Teaching and Learning Process among Secondary School Teachers and Students in Nasarawa State. *African Journal of Educational Research and Library Practice, 7*(8)

Oye, N. D., Iahad, N., & Ab. Rahin, A. (2012). Behavioral intent to accept and use ICT in public university: Integrating quantitative and qualitative data. 1), 957–968. .

Piaget, J. (1950). The Psychology of Intelligence. Routledge & Kegan Paul.

Ross, S. M., Morrison, G. R., & Lowther, D. L. (2004). Educational technology research past and present: Balancing rigor and relevance to impact school learning. *Educational Technology Research and Development, 52(*1), 77–87. https://doi.org/10.1007/BF02504866

Tella, A. (2011). Teacher factors influencing classroom use of ICT in Sub-Saharan Africa. *Itupale Online Journal of African Studies, 2(*1), 39–54.

Tiba, C., Condy, J., & Tunjera, N. (2022). Educational technology challenges in sub-Saharan Africa: *A systematic review. Education and Information Technologies, 27(*1), 123–147. https://doi.org/10.1007/s10639-021-10732-w

UNESCO. (2015). Leveraging information and communication technologies to achieve the Post-2015 Education goal: Report of the International Conference on ICT and Post-2015 Education (Qingdao Declaration). UNESCO. Retrieved from https://unesdoc.unesco.org

Venkatesh, V., & Bala, H. (2008). Technology Acceptance Model 3 and a research agenda on interventions. *Decision Sciences, 39(*2), 273–315. https://doi.org/10.1111/j.1540-5915.2008.00192.x

Vygotsky, L. S. (1978). Mind in Society: The Development of Higher Psychological Processes. *Harvard University Press.*

World Bank. (2020). Digital Economy for Africa (DE4A) Initiative

Yamane, T. (1973). Statistics: An introductory analysis.

Yusuf, M. O., & Afolabi, A. O. (2010). Effects of Computer Assisted Instruction (CAI) on Secondary School Students' Performance in Biology. *Turkish Online Journal of Educational Technology-TOJET*, *9*(1), 62-69.

Osakwe, R. (2013). The Impact of information and communication technology (ICT) on teacher education and its implication for professional development in Nigeria. *International Journal of Learning & Development*, *3*(2).