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Influence Of Digital-Based Instructional Technologies Utilization On Academic Achievement Of Business Education Students In Tertiary Institutions In Delta State

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ABSTRACT

This study examined the Influence of Digital-Based Instructional Technology Utilization on the Academic Achievement of Business Education Students in Tertiary Institutions in Delta State, Nigeria. Five research questions and five null hypotheses guided the investigation. The study was anchored on the Constructivist Learning Theory and the Technology Acceptance Theory (TAT). A descriptive survey research design was adopted. The population comprised 1,117 undergraduate Business Education students drawn from five accredited tertiary institutions in Delta State, from which a proportionate stratified sample of 223 respondents was selected. Data were collected using a structured and validated questionnaire titled Utilization of Digital-Based Instructional Technologies and Academic Achievement Questionnaire (UDBITAAQ), which yielded a reliability coefficient of 0.825. Descriptive statistics (mean and standard deviation) were used to answer the research questions, while inferential statistics (t-test and ANOVA) were employed to test the hypotheses at the 0.05 level of significance. Findings revealed that students moderately utilized digital instructional technologies, with the highest levels of engagement observed in the use of recorded lecture videos and academic social media groups. The study further showed that digital tools significantly enhanced students' understanding of course content, completion of academic tasks, and overall academic preparation. Despite these benefits, notable challenges such as poor internet connectivity, high data costs, and inconsistent electricity supply hindered optimal utilization. Significant differences were found in technology usage based on gender, academic level, and age, whereas no significant differences were observed in perceived challenges or in the overall influence of digital tools when demographic factors were combined. The study concluded that digital-based instructional technologies have a positive impact on the academic achievement of Business Education students, although infrastructural constraints limit their full integration. A key contribution of this study to knowledge is the provision of contemporary empirical evidence identifying the specific digital technologies most frequently utilized by Business Education students in Delta State and demonstrating their differential influence on students' academic achievement, an area previously underexplored in the local context. The study recommended improved institutional support, targeted digital literacy training, and policy reforms to enhance equitable and effective use of digital instructional technologies in Business Education programmes.

Keywords: Business Education, Instructional Technology Utilization,

INTRODUCTION

1.1 Background to the Study

The educational landscape worldwide has undergone a profound shift in recent decades, moving away from traditional, teacher-dominated methods toward dynamic, student-centered paradigms enriched by technology. This transformation is primarily driven by the widespread adoption of digital-based instructional technologies (DBITs), which include sophisticated tools like learning management systems (LMS), virtual classrooms, interactive whiteboards, mobile learning applications, online assessment platforms, and multimedia resources (Ololube & Onasanya, 2020). These advancements are redefining educational delivery, empowering learners with greater autonomy and fostering deeper engagement. In the 21st century, education is characterized by technological integration that enhances accessibility, interactivity, and adaptability, elements critical to elevating student performance and preparing them for a digital future (Olojede & Oyeleye, 2021). DBITs address longstanding barriers in education, such as limited access to resources and rigid scheduling, by enabling personalized learning experiences that cater to diverse needs and paces.

In developed nations, higher education institutions have seamlessly incorporated DBITs into curricula, supporting models like flipped classrooms, blended learning, and fully virtual environments. This integration equips students with essential digital skills for a tech-savvy workforce, promoting innovation and self-directed learning (Al-Fraihat et al., 2020). Developing countries, including Nigeria, are following suit, with national policies emphasizing ICT infusion to build a knowledge-based economy. The Federal Republic of Nigeria's National Policy on ICT in Education (FRN, 2019) mandates the cultivation of technological proficiency in tertiary settings, ensuring graduates are competitive globally. However, Nigeria's implementation faces hurdles: inadequate infrastructure, funding shortages, unreliable internet, and gaps in digital skills among faculty and students (Adeoye & Adanikin, 2021). Despite these challenges, DBITs are gradually permeating Nigerian universities, polytechnics, and colleges, though adoption remains uneven.

Business Education, a cornerstone for nurturing managerial, entrepreneurial, and technical acumen, is particularly poised to benefit from this digital wave. In an era of rapid technological evolution, curricula must evolve beyond archaic methods to embrace digital literacy, creativity, and practical innovation (Ezeani & Eze, 2021). In Delta State, Nigeria, tertiary institutions offering Business Education programmes are urged to align with these trends, yet research reveals inconsistent integration of DBITs (Umoeshiet, 2022). Many programmes cling to conventional pedagogies, ill-suited to the digital demands of contemporary business landscapes. This disconnect jeopardizes graduates' preparedness for tech-intensive roles, highlighting the urgency to amplify DBIT adoption for enhanced teaching efficacy and student success.

DBITs unlock immense potential in Business Education by transforming abstract concepts into vivid, interactive experiences through videos, simulations, animations, and infographics. These tools heighten student interest, retention, and comprehension while fostering collaboration, immediate feedback, and real-world application, key drivers of motivation and achievement (Chikezie & Ejike, 2021; Arowolo & Omoike, 2021). In Delta State, however, barriers like deficient ICT infrastructure, erratic electricity, insufficient faculty training, resistance to change, and weak institutional backing persist (Ogungbeni, Jatto & Oluwadare, 2020). Such constraints undermine educators' ability to deliver compelling, tech-infused lessons, ultimately diminishing student outcomes. Academic achievement serves as a benchmark for educational efficacy, encompassing not just knowledge acquisition but also its practical application, problem-solving, and adaptability in Business Education. Influenced by instructional, institutional, and technological factors, achievement is markedly boosted by DBITs, which promote engagement, tailored learning, and continuous evaluation (Umoeshiet, 2023). In Delta State's resource-constrained context, investigating DBITs' role is vital to bridging performance gaps and optimizing educational experiences.

Globally, digital literacy is indispensable for academic and professional success. Advanced countries boast robust digital ecosystems, skilled educators, and cutting-edge tools that elevate performance. In contrast, Nigerian institutions, especially in Delta State, grapple with connectivity issues, limited

hardware, funding deficits, and faculty skill shortages (Ogungbeni et al., 2020). These impediments hinder student engagement with digital resources and stifle innovative teaching, often leading to suboptimal learning despite inherent student potential. This underscores the need for targeted research to harness DBITs for equitable, high-quality education.

This study extends beyond mere impact assessment by exploring moderating variables, gender, age, academic level, and experience, that shape DBIT perception and utilization. Gender influences tech confidence and preferences, with variations between males and females (Olatoye & Adekoya, 2021). Age affects adaptability, favoring younger users familiar with technology. Academic levels dictate exposure, differing across programmes like NCE, OND, or B.Sc. Experience among educators can either facilitate or hinder adoption, depending on professional growth (Umoeshiet, 2023). By analyzing these factors, the research offers a nuanced perspective, informing inclusive strategies. In summary, this investigation delves into DBIT application in Delta State's Business Education, evaluating usage frequency, challenges, and contextual influences on academic performance. Incorporating moderating variables ensures a comprehensive analysis, yielding insights for policy, curriculum enhancement, faculty development, and institutional reforms. The goal is to foster academic excellence, digital equity, and graduate readiness for a competitive, tech-driven world.

1.2 Statement of the Problem

The integration of digital-based instructional technologies has revolutionized education, particularly in enhancing teaching and learning. Tertiary institutions worldwide increasingly leverage Information and Communication Technologies (ICT) to improve instructional delivery. In Business Education, these digital tools, such as e-learning platforms, virtual simulations, and interactive instructional software, are essential for preparing students for modern workplace demands. However, despite the recognized benefits of these technologies, there is uncertainty regarding their actual utilization and effectiveness in Business Education programme in tertiary institutions in Delta State.

The problem this study seeks to address is the inadequate utilization of digital-based instructional technologies in Business Education and its potential impact on students' academic achievement. While digital tools are available, they are often underutilized, and their influence on student performance remains unclear. Many Business Education students still rely on traditional instructional methods, which may not equip them with the necessary digital competencies required in today's job market. Educators, on the other hand, face several challenges, including insufficient training, inadequate digital infrastructure, and resistance to change, further limiting the integration of technologies into teaching practices.

If these challenges persist, Business Education students in Delta State may face reduced academic performance, disengagement from learning, and a lack of preparedness for technology-driven industries. Likewise, lecturers who struggle to integrate digital tools may fail to align their instructional approaches with modern pedagogical standards. Despite extensive research on the role of technologies in education, there is limited empirical evidence on how digital-based instructional technologies influence the academic achievement of Business Education students in Delta State. Addressing this research gap is essential for optimizing digital learning strategies and ensuring the relevance of business education programmes to contemporary workforce demands.

1.3 Research Questions

The following research questions guided the study:

1. What types of digital-based instructional technologies are utilized by Business Education students in tertiary institutions in Delta State?
2. How does the utilization of digital-based instructional technologies influence the academic achievement of Business Education students in Delta State?
3. How does student engagement with digital-based instructional technologies affect their academic achievement in Business Education programmes in tertiary institutions in Delta State?
4. What challenges do Business Education students face in utilizing digital-based instructional technologies for their academic work in tertiary institutions in Delta State?

5. Are there significant differences in students' perceptions of the influence of digital-based instructional technologies on academic achievement based on gender, age, and academic level?

1.4 Purpose of the Study

The purpose of this study was to examine the influence of digital-based instructional technologies utilization on the academic achievement of Business Education students in tertiary institutions in Delta State, Nigeria. Specifically, the study sought to:

1. Identify the types of digital-based instructional technologies utilized by Business Education students in tertiary institutions in Delta State.
2. Examine how the utilization of digital-based instructional technologies influences the academic achievement of Business Education students.
3. Determine how student engagement with digital-based instructional technologies affects their academic achievement in Business Education programmes.
4. Investigate the challenges faced by Business Education students in utilizing digital-based instructional technologies for their academic activities.
5. Determine whether significant differences exist in students' perceptions of the influence of digital-based instructional technologies on academic achievement based on gender, age, and academic level.

1.5 Research Hypotheses

The following null hypotheses were formulated to guide the study and were tested at the 0.05 level of significance:

1. H_{01} : There is no significant difference in the mean ratings of Business Education students on the types of digital-based instructional technologies utilized, based on gender.
2. H_{02} : There is no significant difference in the mean ratings of Business Education students on the influence of digital-based instructional technologies on academic achievement, based on academic level.
3. H_{03} : There is no significant difference in the mean ratings of Business Education students on how student engagement with digital-based instructional technologies affects academic achievement, based on age.
4. H_{04} : There is no significant difference in the mean ratings of Business Education students on the challenges encountered in utilizing digital-based instructional technologies, based on gender.
5. H_{05} : There is no significant difference in students' perceptions of the influence of digital-based instructional technologies on academic achievement, based on gender, age, and academic level.

RESEARCH METHOD AND PROCEDURE

This study on the influence of digital-based instructional technologies (DBITs) on academic achievement among undergraduate Business Education students in Delta State, Nigeria, employed a survey research design to gather opinions from a defined population. Conducted across five tertiary institutions, Delta State University, Abraka; University of Delta, Agbor; Federal College of Education (Technical), Asaba; College of Physical Education, Mosogar; and College of Education, Warri, the research targeted Delta State's diverse educational landscape, which faces infrastructure and digital integration challenges amid ongoing ICT reforms. The population comprised 1,117 students, from which a sample of 223 was selected using proportionate stratified random sampling at 20% per institution to ensure representation and reduce bias. Data were collected via a self-developed questionnaire, the Utilization of Digital-Based Instructional Technologies and Academic Achievement Questionnaire (UDBITAAQ), divided into demographic (Section A) and thematic items (Section B) rated on four-point scales for frequency or agreement. The instrument underwent face and content validation by experts and demonstrated reliability through a pilot study at the University of Benin, yielding a test-retest coefficient of 0.83 and an overall Cronbach's Alpha of 0.825. Questionnaires were administered directly by the researcher and assistants, achieving full retrieval from the sample. Analysis utilized SPSS version 23, applying mean and standard deviation for

research questions, with decision boundaries for response categories, and inferential statistics including t-tests, ANOVA, and univariate ANOVA for hypothesis testing at a 0.05 significance level.

PRESENTATION OF RESULTS AND DISCUSSION OF FINDINGS

The findings of the study are tabulated as follows:

Table 1: Mean and Standard Deviation of Responses on the Types of Digital-Based Instructional Technologies Utilized by Business Education Students in Tertiary Institutions in Delta State

S/N	Item	Min	Max	Mean	Std. Dev.	Remark
1	I use Learning Management Systems (e.g., Moodle, Google Classroom) for my academic work.	1	4	2.60	0.91	Often
2	I access video tutorials related to Business Education topics online.	1	4	2.95	0.72	Often
3	I utilize educational applications such as Edmodo, Kahoot, and Microsoft Teams.	1	4	2.49	0.90	Rarely
4	I participate in live virtual classes using platforms like Zoom or Google Meet.	1	4	2.28	0.87	Rarely
5	I use recorded lecture videos to study at my convenience.	1	4	3.06	0.64	Often
6	I access course materials from institutional e-learning portals.	1	4	2.82	0.75	Often
7	I take online-based quizzes and assessments in my courses.	1	4	2.41	0.88	Rarely
8	I use social media groups for academic discussions.	1	4	3.06	0.64	Often
9	I receive and submit assignments through digital platforms.	1	4	2.32	0.73	Rarely
10	I interact with lecturers and peers through digital means during learning activities.	1	4	2.39	0.79	Rarely
Grand Mean		1	4	2.64	0.43	Often

Source: Field Survey, 2025

The results presented in Table 4.1 indicate that Business Education students in Tertiary Institutions in Delta State utilize various digital-based instructional technologies to a moderate overall extent, as evidenced by the grand mean of 2.64 (SD = 0.43), which aligns with the benchmark for high extent (2.50–3.49). This finding suggests a generally positive yet inconsistent integration of these technologies into academic practices. Notably, the highest mean scores were recorded for the utilization of recorded lecture videos (M = 3.06, SD = 0.64) and social media groups for academic discussions (M = 3.06, SD = 0.64), both classified as "Often," reflecting students' inclination toward asynchronous and collaborative tools that support self-directed learning and peer interaction. Other technologies demonstrating frequent use include online video tutorials (M = 2.95, SD = 0.72) and access to course materials via e-learning portals (M = 2.82, SD = 0.75), also rated as "Often," underscoring a reliance on accessible digital resources to augment traditional instruction. Conversely, lower utilization rates were observed for participation in live virtual classes (M = 2.28, SD = 0.87), submission of assignments through digital platforms (M = 2.32, SD = 0.73), digital interactions with lecturers and peers (M = 2.39, SD = 0.79), online quizzes and assessments (M = 2.41, SD = 0.88), and educational applications (M = 2.49, SD = 0.90), all categorized as "Rarely." These subdued scores may be attributable to infrastructural constraints, such as unreliable internet or limited institutional support, which impede synchronous and interactive

applications. The standard deviations, ranging from 0.64 to 0.91, denote moderate variability in responses, potentially indicative of disparities in individual access or institutional provisioning. In aggregate, these results imply that while asynchronous and informal technologies are effectively embedded in students' routines, greater emphasis on infrastructure and training is required to optimize the adoption of synchronous and specialized tools, thereby maximizing their contribution to academic achievement in Business Education.

Table 2: Mean and Standard Deviation of Responses on the Influence of Digital-Based Instructional Technologies on the Academic Achievement of Business Education Students in Tertiary Institutions in Delta State

S/N	Item	Min	Max	Mean	Std. Dev.	Remark
1	Using digital tools improves my understanding of Business Education content.	1	4	3.32	0.61	Agree
2	My academic performance has increased since I started using digital resources.	1	4	2.94	0.79	Agree
3	Digital platforms help me complete assignments more effectively.	1	4	3.27	0.75	Agree
4	I score better in courses that involve the use of digital instructional technologies.	1	4	2.96	0.68	Agree
5	I study more regularly due to digital learning materials.	1	4	3.04	0.77	Agree
6	Digital tools help me prepare better for exams and presentations.	1	4	3.36	0.64	Agree
7	I am more organized academically because of digital learning platforms.	1	4	2.89	0.63	Agree
8	I can access and revisit lecture content anytime through digital resources.	1	4	3.00	0.80	Agree
9	The use of educational apps helps me retain information longer.	1	4	2.97	0.74	Agree
10	I perform better in group projects because of digital collaboration tools.	1	4	2.89	0.80	Agree
Grand Mean		1	4	3.06	0.33	Agree

Source: Field Survey, 2025

The results in Table 4.2 demonstrate that Business Education students in Tertiary Institutions in Delta State perceive digital-based instructional technologies as having a substantial positive influence on their academic achievement, with a grand mean of 3.06 (SD = 0.33), falling within the benchmark for agreement (2.50–3.49). This indicates a general consensus on the beneficial role of these technologies in enhancing learning outcomes. The highest mean scores were attributed to the use of digital tools for improved exam and presentation preparation (M = 3.36, SD = 0.64) and better understanding of Business Education content (M = 3.32, SD = 0.61), both rated as "Agree," suggesting that students value these resources for deepening comprehension and readiness. Other items with strong agreement include effective assignment completion (M = 3.27, SD = 0.75) and regular studying facilitated by digital materials (M = 3.04, SD = 0.77), underscoring the technologies' contribution to efficiency and consistency in academic routines. In comparison, lower though still affirmative mean scores were noted for increased organization via digital platforms (M = 2.89, SD = 0.63) and better performance in group projects through collaboration tools (M = 2.89, SD = 0.80), both classified as "Agree," which may reflect areas where integration is less optimized due to collaborative or structural challenges. Standard deviations ranging from 0.61 to 0.80 indicate relatively low variability, implying consistent perceptions across the sample. Collectively, these findings affirm the perceived efficacy of digital-based instructional technologies in fostering academic success, yet highlight opportunities for targeted enhancements in collaborative and organizational applications to further amplify their impact in Business Education programmes.

Table 3: Mean and Standard Deviation of Responses on How Student Engagement with Digital-Based Instructional Technologies Affects Academic Achievement in Business Education Programmes in Tertiary Institutions in Delta State.

S/N	Item	Min	Max	Mean	Std. Dev.	Remark
1	I actively participate in online forums related to my coursework.	1	4	2.83	0.72	Agree
2	I explore additional online resources to expand my understanding of topics.	1	4	3.12	0.63	Agree
3	I engage in peer discussions using digital tools after lectures.	1	4	2.83	0.75	Agree
4	I complete and submit all assignments through digital platforms.	1	4	2.27	0.85	Disagree
5	I attend virtual classes regularly and actively contribute.	1	4	2.50	0.87	Agree
6	I ask questions and seek clarification online from lecturers.	1	4	2.53	0.79	Agree
7	I take part in online academic competitions or webinars.	1	4	2.00	0.78	Disagree
8	I frequently download digital notes or slides from the lecturer.	1	4	2.49	0.87	Disagree
9	I access academic support services through online platforms.	1	4	3.19	0.57	Agree
10	I dedicate time outside of lectures to using digital resources for my learning.	1	4	2.95	0.78	Agree
Grand Mean		1	4	2.67	0.40	Agree

Source: Field Survey, 2025

The results in Table 4.3 reveal that Business Education students in Tertiary Institutions in Delta State exhibit a moderate level of engagement with digital-based instructional technologies, as reflected by the grand mean of 2.67 (SD = 0.40), which corresponds to the benchmark for agreement or high extent (2.50–3.49). This suggests an overall positive but variable involvement in digital learning activities that contributes to academic achievement. The highest mean scores were associated with accessing academic support services through online platforms (M = 3.19, SD = 0.57) and exploring additional online resources for deeper understanding (M = 3.12, SD = 0.63), both rated as "Agree," indicating proactive self-directed behaviors in leveraging digital tools for enrichment and assistance. Other items demonstrating agreement include dedicating time outside lectures to digital resources (M = 2.95, SD = 0.78), participation in online forums (M = 2.83, SD = 0.72), and peer discussions via digital means (M = 2.83, SD = 0.75), underscoring the role of these technologies in fostering collaboration and consistent study habits. Conversely, lower engagement was evident in participation in online academic competitions or webinars (M = 2.00, SD = 0.78) and completing assignments through digital platforms (M = 2.27, SD = 0.85), both classified as "Disagree," alongside frequent downloading of digital notes (M = 2.49, SD = 0.87), which may point to institutional or infrastructural limitations hindering formalized or submission-based activities. Standard deviations ranging from 0.57 to 0.87 suggest moderate response variability, likely influenced by individual access differences. In summary, these findings affirm that student engagement with digital technologies positively affects academic achievement in Business Education programmes, yet highlight the need for enhanced support in underutilized areas to maximize benefits and address disparities in adoption.

Table 4: Mean and Standard Deviation of Responses on the Challenges Faced by Business Education Students in Utilizing Digital-Based Instructional Technologies in Tertiary Institutions in Delta State

S/N	Item	Min	Max	Mean	Std. Dev.	Remark
1	I often face poor internet connectivity that affects my learning.	1	4	2.93	0.84	Agree
2	The cost of internet data limits my access to digital instructional technologies.	1	4	3.21	0.76	Agree
3	I do not have regular access to a personal smartphone or laptop.	1	4	2.47	0.79	Disagree
4	Some platforms used in teaching are not user-friendly.	1	4	2.91	0.70	Agree
5	Power outages often hinder my access to digital learning tools.	1	4	3.17	0.67	Agree
6	I lack proper training on using digital instructional platforms.	1	4	2.23	0.70	Disagree
7	I find it stressful to switch between multiple digital learning tools.	1	4	2.57	0.70	Agree
8	My school does not provide enough digital support or infrastructure.	1	4	2.71	0.75	Agree
9	Some lecturers do not effectively use digital tools for teaching.	1	4	2.90	0.70	Agree
10	The language used in some apps is difficult to understand.	1	4	2.49	0.78	Disagree
Grand Mean		1	4	2.76	0.33	Agree

Source: Field Survey, 2025

The results in Table 4.4 demonstrate that Business Education students in Tertiary Institutions in Delta State experience a moderate to high degree of challenges in utilizing digital-based instructional technologies, as evidenced by the grand mean of 2.76 (SD = 0.33), which falls within the benchmark for agreement (2.50–3.49). This indicates a prevalent acknowledgment of barriers hindering effective adoption. The most salient challenges include the high cost of internet data (M = 3.21, SD = 0.76) and frequent power outages (M = 3.17, SD = 0.67), both rated as "Agree," underscoring economic and infrastructural impediments to access. Additional agreed-upon obstacles encompass poor internet connectivity (M = 2.93, SD = 0.84), non-user-friendly platforms (M = 2.91, SD = 0.70), ineffective utilization by lecturers (M = 2.90, SD = 0.70), insufficient institutional support (M = 2.71, SD = 0.75), and stress associated with switching between tools (M = 2.57, SD = 0.70), highlighting multifaceted technical, pedagogical, and systemic issues. Conversely, lesser agreement was observed for lack of personal devices (M = 2.47, SD = 0.79), inadequate training (M = 2.23, SD = 0.70), and language barriers in applications (M = 2.49, SD = 0.78), all categorized as "Disagree," implying these are not dominant concerns. Standard deviations ranging from 0.67 to 0.84 suggest moderate variability in responses, potentially attributable to differences in institutional resources or individual circumstances. In summary, these findings underscore the imperative for strategic enhancements in affordability, infrastructure, and faculty development to alleviate challenges and optimize the role of digital technologies in fostering academic achievement within Business Education programmes.

Table 5: Mean and Standard Deviation of Responses on the Perceptions of Business Education Students Regarding the Influence of Digital-Based Instructional Technologies on Academic Achievement Based on Gender, Age, and Academic Level

S/N	Item	Min	Max	Mean	Std. Dev.	Remark
1	Both male and female students have equal ability to use digital tools effectively.	1	4	3.57	0.62	Strongly Agree
2	My age influences how I adapt to new digital instructional technologies.	1	4	2.37	0.78	Disagree
3	Higher-level students use digital learning tools more effectively than lower-level students.	1	4	2.75	0.88	Agree
4	I find it easier to use digital tools because of my early exposure to technology.	1	4	3.09	0.71	Agree
5	I believe students from urban areas perform better in digital learning than those from rural areas.	1	4	2.99	0.76	Agree
6	Gender does not affect the academic outcome of using digital tools.	1	4	3.33	0.63	Agree
7	My ability to use digital technologies improves as I progress academically.	1	4	2.97	0.63	Agree
8	I have benefited from any digital literacy training provided by my institution.	1	4	2.87	0.76	Agree
9	There should be orientation on digital tools usage for all levels of students.	2	4	3.47	0.58	Agree
10	My academic level determines the level of access I have to digital tools.	1	4	2.39	0.78	Disagree
Grand Mean		1	4	2.99	0.31	Agree

Source: Field Survey, 2025

The results in Table 4.5 illustrate that Business Education students in Tertiary Institutions in Delta State hold generally positive perceptions regarding the influence of digital-based instructional technologies on academic achievement, irrespective of gender, age, and academic level, as indicated by the grand mean of 2.99 (SD = 0.31), which aligns with the benchmark for agreement (2.50–3.49). This reflects a broad consensus on the equitable and beneficial nature of these technologies across demographic factors. The highest mean scores were recorded for the perception that both male and female students possess equal ability to use digital tools effectively (M = 3.57, SD = 0.62), classified as "Strongly Agree," and the need for orientation on digital tools for all student levels (M = 3.47, SD = 0.58), rated as "Agree," underscoring beliefs in gender parity and the value of inclusive training initiatives. Other items eliciting agreement include the irrelevance of gender to academic outcomes (M = 3.33, SD = 0.63), ease of use due to early exposure (M = 3.09, SD = 0.71), and improvements in ability with academic progression (M = 2.97, SD = 0.63), highlighting perceived fairness and developmental benefits. In contrast, lower mean scores were observed for the influence of age on adaptation to new technologies (M = 2.37, SD = 0.78) and the determination of access by academic level (M = 2.39, SD = 0.78), both categorized as "Disagree," suggesting minimal perceived disparities in these areas. Standard deviations ranging from 0.58 to 0.88 denote moderate variability, potentially attributable to individual experiences or institutional differences. Collectively, these findings affirm a favorable perceptual landscape toward digital technologies' role in academic achievement, while emphasizing the potential for enhanced institutional support, such as universal orientations and literacy training, to further mitigate any subtle demographic influences and promote inclusive utilization in Business Education programmes.

Table 6: To test the hypothesis that there is no significant difference in the utilization of digital-based instructional technologies among Business Education students based on gender, an independent samples t-test was conducted. The results are presented below.

Gender	N	Mean	SD	df	A	p-value	Decision
Male	58	2.76	0.454	148	0.05	0.004	Reject H ₀
Female	92	2.56	0.395				

Source: Field Survey, 2025

The result of the independent samples t-test indicates that the p-value (0.004) is less than the 0.05 level of significance. Therefore, the null hypothesis (H₀) is rejected. This means there is a statistically significant difference in the utilization of digital-based instructional technologies between male and female Business Education students in Tertiary Institutions in Delta State. Specifically, male students reported a higher mean score (M = 2.76) than female students (M = 2.56), indicating greater utilization of digital-based instructional technologies.

A one-way ANOVA was conducted to test the hypothesis that there is no significant difference in Business Education students' perceptions of how digital-based instructional technologies influence their academic achievement, based on their academic level. The results are presented in the tables below.

Table 7: Descriptive Statistics for Academic Levels

Academic Level	N	Mean	SD
NCE 1	31	2.95	0.324
NCE 2	33	3.07	0.404
NCE 3	31	2.98	0.403
100 Level	13	3.05	0.218
200 Level	14	3.24	0.140
300 Level	14	3.18	0.181
400 Level	14	3.21	0.154
Total	150	3.06	0.332

Source: Field Survey, 2025

Table 8: ANOVA Results

Source of Variance	SS	Df	MS	F	Sig.	Decision
Between Groups	1.562	6	0.260	2.511	.024	Reject H ₀
Within Groups	14.824	143	0.104			
Total	16.386	149				

P = 0.05

Source: Field Survey, 2025

The result of the one-way ANOVA shows that the p-value (0.024) is less than the significance level ($\alpha = 0.05$). Therefore, the null hypothesis (H₀) is rejected. This indicates that there is a statistically significant difference in Business Education students' perceptions of how digital-based instructional technologies influence academic achievement based on their academic level. This implies that academic level has a notable effect on how students perceive the impact of digital tools on their academic performance.

A one-way ANOVA was conducted to test the hypothesis that there is no significant difference in Business Education students' engagement with digital-based instructional technologies based on age. The results are presented in the tables below.

Table 9: Descriptive Statistics for Age Groups

Age Group	N	Mean	SD
16–20 years	50	2.62	0.400
21–25 years	76	2.64	0.372
26 years and above	24	2.85	0.464
Total	150	2.67	0.403

Source: Field Survey, 2025

Table 10: ANOVA Results

Source of Variance	SS	df	MS	F	Sig.	Decision
Between Groups	0.983	2	0.491	3.115	.047	Reject H₀
Within Groups	23.192	147	0.158			
Total	24.175	149				

P = 0.05

Source: Field Survey, 2025

The result of the one-way ANOVA shows that the p-value (0.047) is less than the significance level ($\alpha = 0.05$). Therefore, the null hypothesis (H_0) is rejected. This implies that there is a statistically significant difference in students' engagement with digital-based instructional technologies across the different age groups. Specifically, students aged 26 years and above reported higher levels of engagement, suggesting that age plays a role in the extent to which students utilize digital tools for academic purposes.

To test the hypothesis that there is no significant difference in the challenges faced by Business Education students in utilizing digital-based instructional technologies based on gender, an independent samples t-test was conducted. The results are presented in the table below.

Table 11: Independent Samples t-test Results on Gender Differences in Challenges Faced

Gender	N	Mean	SD	Df	α	p-value	Decision
Male	58	2.77	0.334	148	0.05	0.801	Retain H₀
Female	92	2.75	0.327				

Source: Field Survey, 2025

The result of the independent samples t-test shows that the p-value (0.801) is greater than the significance level ($\alpha = 0.05$). Therefore, the null hypothesis (H_0) is retained. This indicates that there is no statistically significant difference between male and female Business Education students regarding the challenges they face in utilizing digital-based instructional technologies. Both groups reported similar levels of challenges in their use of digital tools for academic purposes.

To test the hypothesis that there is no significant difference in the perceptions of Business Education students regarding the influence of digital-based instructional technologies on academic achievement based on gender, age, and academic level, a Univariate Analysis of Variance (UNIANOVA) was conducted. The results are presented in the table below.

Table 12: UNIANOVA Summary of Gender, Age, and Academic Level on Perceptions

Factor	F-value	Sig. (p-value)
Gender	0.753	0.387
Age	0.639	0.530
Academic Level	0.366	0.899
Gender * Age	0.054	0.948
Gender * Academic Level	0.465	0.833
Age * Academic Level	0.385	0.951
Gender * Age * Academic Level	0.854	0.557

Model

$R^2 = 0.179$, Adjusted $R^2 = -0.073$

Summary

Source: Field Survey, 2025

The results of the UNIANOVA indicate that none of the independent variables, gender, age, or academic level, produced statistically significant effects on students' perceptions of the influence of digital-based instructional technologies on academic achievement, as all p-values exceeded the 0.05 significance threshold. Moreover, all interaction effects among the variables (e.g., Gender * Age, Gender * Academic Level, and Age * Academic Level) also failed to reach statistical significance. The model's R^2 value of 0.179 suggests that the independent variables account for only 17.9% of the variance in student perceptions, while the negative adjusted R^2 (-0.073) implies that the model does not meaningfully explain the variability. Based on these findings, the null hypothesis is retained. This implies that gender, age, and

academic level do not significantly influence Business Education students' perceptions of the impact of digital-based instructional technologies on their academic achievement in the sampled tertiary institutions in Delta State.

DISCUSSION OF FINDINGS

This section interprets the study's empirical results, connecting them to research questions, hypotheses, theoretical frameworks, conceptual models, and prior literature. It highlights patterns, implications, alignments, and divergences, contributing to educational technology discourse in Business Education, particularly in resource-limited Nigerian contexts like Delta State. Organized by research questions with hypothesis cross-references, the discussion weaves evidence into theoretical and practical insights for advancing digital integration.

Analysis of Table 4.1 reveals moderate utilization of digital-based instructional technologies (DBITs) among Business Education students in Tertiary Institutions in Delta State, with a grand mean of 2.64 (SD = 0.43), indicating "often" usage per the 2.50–3.49 benchmark. Asynchronous tools dominate, such as recorded lecture videos and social media groups for discussions (both $M = 3.06$, $SD = 0.64$), reflecting preferences for flexible, self-paced, and collaborative learning that accommodates diverse schedules and fosters peer interaction. Online video tutorials ($M = 2.95$, $SD = 0.72$) and e-learning portals ($M = 2.82$, $SD = 0.75$) also score highly, emphasizing reliance on supplementary digital content to deepen business concept comprehension. In contrast, synchronous tools like live virtual classes ($M = 2.28$, $SD = 0.87$) and online quizzes ($M = 2.41$, $SD = 0.88$) show lower adoption, categorized as "rarely," likely due to infrastructural challenges including unreliable internet, power instability, and limited institutional resources. Moderate standard deviations (0.64–0.91) suggest response variability influenced by access disparities, digital literacy, and institutional differences between universities and colleges.

These patterns align with Constructivist Learning Theory (Piaget, 1929; Vygotsky, 1978), where collaborative tools like social media enable knowledge construction through peer scaffolding in the Zone of Proximal Development. Technology Acceptance Theory (TAT; Davis, 1989) explains uneven adoption, as perceived ease of use (PEOU) and usefulness (PU) falter amid technical barriers in Nigerian settings (Adeoye & Adanikin, 2021). Empirically, findings echo Okonkwo and Osuagwu (2022) on asynchronous resource prevalence for flexibility, Aina and Adedoja (2020) on social media as educational hubs, and Eze et al. (2018) on infrastructural limits to real-time engagement. Divergences from Bates and Poole (2003) highlight Delta State's nascent digital transformation, revealing sub-national gaps in developing economies (Ogungbeni et al., 2020). Conceptually, this extends ICT and e-learning frameworks (Rajaraman, 2022; Horton, 2023), stressing multimedia preferences (Mayer, 2014) while noting barriers to m-learning (Crompton, 2017). The results advocate policy interventions in infrastructure and training to promote balanced DBIT integration, filling region-specific empirical voids and informing strategies for academic enhancement in Business Education.

Table 4.2 findings indicate strong perceptions of DBITs' positive influence on academic achievement, with a grand mean of 3.06 (SD = 0.33), aligning with the agreement benchmark. High scores for exam preparation ($M = 3.36$, $SD = 0.64$) and content understanding ($M = 3.32$, $SD = 0.61$) underscore DBITs' role in deepening comprehension and readiness. Effective assignment completion ($M = 3.27$, $SD = 0.75$) and regular studying ($M = 3.04$, $SD = 0.77$) further affirm structured learning benefits, while moderate agreement on organization ($M = 2.89$, $SD = 0.63$) and group projects ($M = 2.89$, $SD = 0.80$) suggests untapped collaborative potential. Low standard deviations (0.61–0.80) imply consistent views across the sample. Resonating with Constructivist Theory, DBITs facilitate interactive knowledge building (Vygotsky, 1978), while TAT attributes perceptions to high PU in accessible resources (Davis, 1989). Conceptually, this aligns with e-learning benefits like personalization (Horton, 2023; Picciano, 2019), though challenges temper collaboration (Means et al., 2020). Empirically consistent with Adeoye and Wentling (2007) on retention gains, Tella (2011) on performance links, and Alabi et al. (2020) on efficiency, yet echoing Ajadi et al. (2008) on access variability. Divergences from international studies (Smith & Johnson, 2021) highlight infrastructural contrasts (Williams & Green, 2022). The insights

emphasize investments in training and inclusivity, providing Delta State-specific data to advance policy in Nigerian tertiary education.

From Table 4.3, student engagement with DBITs is moderate to high (grand mean 2.67, SD = 0.40), reflecting interactive learning's role in achievement. Top engagements include online academic support (M = 3.19, SD = 0.57) and supplementary resources (M = 3.12, SD = 0.63), indicating proactive enrichment. Forum participation (M = 2.83, SD = 0.72) and peer discussions (M = 2.83, SD = 0.75) highlight collaboration, while lower scores for webinars (M = 2.00, SD = 0.78) and submissions (M = 2.27, SD = 0.85) reveal barriers. Variability (SD 0.57–0.87) stems from proficiency and access differences. Aligning with Constructivist Theory's emphasis on interaction (Piaget, 1929), and TAT's PU in support services (Davis, 1989), findings enrich e-learning concepts (Horton, 2023; Pardo et al., 2021) on motivation. Empirically, they match Ifinedo (2017) on engagement-success links, Kuh (2009) on collaboration, but diverge from Lin and Zhang (2023) due to Nigerian barriers (Ajadi et al., 2008). This calls for infrastructural reforms, offering nuanced insights for equitable digital ecosystems.

Table 4.4 shows moderate to high challenges (grand mean 2.76, SD = 0.33), with internet costs (M = 3.21, SD = 0.76) and power outages (M = 3.17, SD = 0.67) predominant. Connectivity (M = 2.93, SD = 0.84) and platform usability (M = 2.91, SD = 0.70) follow, while device access (M = 2.47, SD = 0.79) is lesser. Variability (SD 0.67–0.84) reflects contextual differences.

TAT explains low PEOU (Davis, 1989), limiting constructivist benefits (Vygotsky, 1978). Conceptually, this reinforces DBIT barriers (Adeoye & Adanikin, 2021), empirically mirroring Okoye and Nwajiuba (2021) on infrastructure. Divergences from UNESCO (2020) suggest evolving access, addressing gaps in sub-regional analyses (Adeyemi & Adetunji, 2023). Recommendations include subsidies and training for transformative impact.

Table 4.5 indicates affirmative perceptions across demographics (grand mean 2.99, SD = 0.31), with gender-neutral proficiency (M = 3.57, SD = 0.62) and orientation needs (M = 3.47, SD = 0.58) strong. Age (M = 2.37, SD = 0.78) and level (M = 2.39, SD = 0.78) are downplayed. Variability (SD 0.58–0.88) arises from experiences. Harmonizing with Constructivist inclusivity and TAT's training role, findings align with Agbatogun (2010) on parity, diverging from Olayemi and Adedayo (2020) due to contextual factors. This advocates equitable programmes, bridging perceptual gaps in Nigerian studies.

Hypothesis one shows significant gender differences in utilization, with males being higher, aligning with Kay et al. (2018), implying tailored training. Hypothesis two reveals that academic level impacts perceptions; seniors are more positive (Alabi & Bello, 2020). Hypothesis three finds older students are more engaged, supporting Helsper and Eynon (2010). Hypothesis four shows no gender differences in challenges (Osang et al., 2013). Hypothesis five indicates no demographic influences on perceptions (Okai & Owolabi, 2022). Overall, demographics affect utilization and engagement, but systemic barriers dominate, urging policies for access, training, and effectiveness in Business Education.

CONCLUSION

The findings of this study have unequivocally shown that digital-based instructional technologies play a pivotal role in enhancing the academic achievement of Business Education students in tertiary institutions in Delta State. The results revealed that students moderately to highly utilize various digital tools such as recorded lecture videos, social media platforms, LMS, and educational applications, which significantly support their learning processes, foster deeper understanding, and improve their academic performance.

The study further established that student engagement with digital technologies positively influences their academic success, although certain aspects, such as participation in webinars and digital assignment submissions, require improvement. Despite these positive outcomes, students face substantial challenges, including high internet costs, erratic power supply, and limited access to personal digital devices, factors that must be addressed to ensure equitable and effective utilization of digital resources.

Moreover, the study uncovered meaningful differences in utilization and engagement based on gender, age, and academic level, signifying that demographic factors do shape the way digital tools are adopted and perceived. However, students across all categories generally agree on the benefits of digital

instruction, highlighting a widespread recognition of its value in contemporary education. The integration of digital-based instructional technologies is no longer optional but essential in preparing Business Education students for academic excellence and global relevance. For these technologies to fully realize their potential, institutional support, digital infrastructure, and equitable access must be prioritized. The future of Business Education depends on the successful harmonization of pedagogy and technology to drive student achievement in a digital age.

5.3 RECOMMENDATIONS

Based on the findings and conclusions of the study, the following recommendations are made to enhance the utilization of digital-based instructional technologies and improve the academic achievement of Business Education students in tertiary institutions in Delta State:

1. **Provision of Institutional Digital Infrastructure:** Tertiary institutions should invest in stable internet connectivity, uninterrupted power supply, and campus-wide access to digital learning platforms. This will reduce the technological barriers identified and create a conducive environment for digital learning.
2. **Capacity Building and Digital Literacy Training:** Regular workshops and orientation programmes should be organized for students and lecturers to enhance their digital competencies. These trainings should focus on the effective use of LMS, virtual classrooms, educational apps, and online collaboration tools.
3. **Subsidized Internet and Device Accessibility:** School management in collaboration with the government or private tech partners should provide affordable internet data packages and facilitate access to digital devices such as tablets and laptops, especially for students from underprivileged backgrounds.
4. **Curriculum Integration and Policy Reform:** Digital-based instructional technologies should be deliberately integrated into the Business Education curriculum. Policymakers should develop clear guidelines and enforce the use of digital tools as part of pedagogical delivery across all academic levels.
5. **Lecturer Engagement and Accountability:** Lecturers should be mandated and encouraged to utilize digital instructional technologies in their teaching. Institutional monitoring systems should be established to evaluate lecturer compliance and effectiveness in digital delivery methods.

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