

INTEGRATING DIGITAL TECHNOLOGIES IN EDUCATION: ENHANCING STUDENT ENGAGEMENT AND LEARNING OUTCOMES THROUGH E-LEARNING PLATFORMS

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ABSTRACT

This study examined the relationship between the integration of digital technologies in education, student engagement, and learning outcomes in selected tertiary institutions in Rivers State, Nigeria. A descriptive survey research design was adopted to collect and analyze data from a sample of 300 respondents, comprising 50 lecturers and 250 students, selected through stratified random sampling from a population of 1,200. Data were gathered using a structured questionnaire titled Digital Technologies and E-Learning Questionnaire (DTELQ), validated by experts and tested for reliability using Cronbach's alpha, which yielded a coefficient of 0.82. Descriptive statistics (mean and standard deviation) were used to answer research questions, while regression analysis and t-test were employed to test the hypotheses at a 0.05 level of significance. Findings revealed that digital technology integration was highly rated by respondents, with a cluster mean of 3.31, indicating its positive contribution to teaching effectiveness and accessibility of learning materials. Student engagement also recorded a high cluster mean of 3.45, showing that digital tools enhance participation, interest, and motivation. Similarly, learning outcomes had a cluster mean of 3.43, suggesting that digital technologies improve academic performance and conceptual understanding. Hypothesis testing indicated a significant positive relationship between digital technology integration and student engagement ($R = 0.68, p < 0.05$), as well as between e-learning platforms and learning outcomes ($R = 0.62, p < 0.05$). Furthermore, a significant difference was found between students taught with digital technologies and those taught through traditional methods ($t = 5.67, p < 0.05$), with digital learners performing better. The study concludes that digital technologies significantly enhance student engagement and learning outcomes in tertiary education.

Keywords: Digital technology integration, e-learning, student engagement, learning outcomes, tertiary institutions, academic performance.

I. INTRODUCTION

Globally, education has seen a dramatic transformation due to the quick development of digital technologies. Traditional, teacher-centered techniques have gradually given way to more participatory, learner-centered ones as a result of the use of digital resources into education. The growth of e-learning platforms as crucial elements of contemporary education has been made possible by greater access to the internet, mobile devices, and cutting-edge software.

Education used to be mostly restricted to physical classrooms and relied on in-person instruction, textbooks, and a few teaching aids. But because of the digital revolution, students may now access instructional materials at any time and from any location, extending learning beyond the confines of the classroom. By facilitating interaction, resource sharing, and real-time communication between students and instructors, e-learning platforms such as

learning management systems, virtual classrooms, and online collaboration tools support this transition and enhance the overall educational experience [1]. Increasing student engagement which is essential for academic success is a major justification for incorporating digital tools into the classroom. Students' behavioral, emotional, and cognitive involvement in educational activities is referred to as engagement. It is crucial for fostering critical thinking, memory retention, and general success. In order to provide more stimulating and engaging learning environments that cater to a variety of student demands, educational institutions are progressively implementing digital tools [2]. Numerous characteristics offered by digital technologies encourage participation. Videos, animations, and simulations are examples of multimedia resources that make learning easier and more engaging. Gamified exercises, discussion boards, and quizzes are examples of interactive tools that promote involvement and teamwork.

Furthermore, a lot of e-learning platforms have adaptive learning algorithms that customize content for each learner according to their performance, encouraging greater comprehension and better results [3]. During the COVID-19 epidemic, educational institutions all over the world quickly switched to online instruction, highlighting the significance of digital technologies in education. Digital technologies provided continuity in education throughout this time, but how well they were incorporated into teaching methods determined how effective they were. This experience brought to light the advantages and disadvantages of digital learning, highlighting the importance of careful preparation and assessment [4]. Despite their extensive use, it is still difficult to comprehend how students interact with digital devices. The concept of engagement is multifaceted and changes based on individual learner variations, technology kind, and situation. It is crucial to use complete tactics when researching and enhancing engagement in digital environments because it can be quantified by indicators like participation, interaction, and time spent on tasks [5]. Additionally, e-learning systems support inclusive and flexible education. They help students who have varied learning requirements or who live in remote places by enabling them to learn at their own pace and convenience [6]. By providing tools for group projects and communication, these platforms encourage cooperation and build a sense of community among students. Additionally, learning analytics enable educators to monitor student performance and provide targeted support where needed [7]

The potential of digital technologies to enhance learning outcomes is another significant advantage. Higher levels of student participation in digital settings are frequently linked to improved academic achievement, increased motivation, and a deeper comprehension of the course material, as demonstrated by [8]. These favorable results are greatly influenced by elements like instantaneous feedback, interactive resources, and chances for self-directed learning. But there are drawbacks to integrating digital technologies. Effective implementation may be hampered by inadequate infrastructure, poor internet connectivity, restricted device access, and low digital literacy among educators and students [9]. These issues are particularly important in underdeveloped nations since unequal access to technology can exacerbate educational inequalities. Moreover, simply introducing technology does not guarantee improved outcomes; it must be meaningfully integrated into teaching practices [10]

Concerns have also been raised regarding the possible drawbacks of excessive technology use. Overuse of digital technologies can shorten attention spans, reduce in-person interactions, and lead to distractions. In order to ensure that technology complements successful pedagogy rather than replaces it, it is crucial to maintain a balance between traditional and digital teaching approaches [11]. A methodical, evidence-based strategy is required to effectively reap the benefits of digital technologies. This entails making infrastructure investments, educating teachers, and regularly evaluating the efficacy of digital tools. Active learning, teamwork, and customization should be prioritized in the design of e-learning platforms [12].

In conclusion, by facilitating interactive, adaptable, and customized learning experiences, digital technologies have significantly advanced education. While challenges remain, their effective integration can enhance student engagement and improve learning outcomes, preparing students for the demands of the modern world.

II.STATEMENT OF THE PROBLEM

Even though the use of digital technology in education is expanding, many educational institutions still find it difficult to successfully incorporate these tools into the teaching and learning processes. There is a disconnection between the availability of digital technology and their efficient use in classrooms in many developing nations, including Nigeria.

When using traditional teaching methods, which mostly rely on lecture-based instruction with little interaction, students frequently show poor levels of engagement. Academic performance has suffered as a result, and learning desire has decreased. Even though e-learning platforms provide interactive and student-centered learning opportunities, their successful implementation is still restricted because of poor institutional support, inadequate teacher training, and limited access to digital resources.

In addition, a lot of teachers lack the abilities needed to properly create and present digital learning materials. As a result, rather of being essential elements of instruction, digital technologies are either underutilized or only used as supplemental resources. The ability of e-learning systems to raise student engagement and improve learning outcomes is compromised by this. Thus, it is necessary to investigate how the use of digital technology in the classroom might improve learning outcomes and increase student engagement through e-learning platforms.

III. AIM AND OBJECTIVES OF THE STUDY

The aim of this study is to examine the integration of digital technologies in education and how it enhances student engagement and learning outcomes through e-learning platforms. Specifically, the study aims to:

1. Investigate the impact of digital technologies on student engagement in learning.
2. Examine the role of e-learning platforms in improving students' academic performance.
3. Assess the extent to which teachers effectively integrate digital technologies into teaching.

Research Questions

The following research questions will guide the study:

1. How do digital technologies influence student engagement in learning?
2. To what extent do e-learning platforms improve students' learning outcomes?
3. How effectively do teachers integrate digital technologies into their teaching practices?

Research Hypotheses

The following null hypotheses will be tested at 0.05 level of significance:

- H₀₁: There is no significant relationship between digital technology integration and student engagement in learning.
- H₀₂: E-learning platforms do not significantly influence students' academic performance.
- H₀₃: There is no significant difference in learning outcomes between students taught using digital technologies and those taught using traditional methods.

IV.METHODOLOGY

This study adopted a descriptive survey research design, which is appropriate for systematically collecting and analyzing data from respondents to

examine the relationship between the integration of digital technologies in education and student engagement and learning outcomes. The design allows for data collection from a relatively large sample, making it possible to generalize the findings to a wider population. The study was carried out in selected tertiary institutions in Rivers State, Nigeria, chosen because of their active use of digital technologies and e-learning platforms in teaching and learning processes. The population of the study consisted of approximately 1,200 respondents, including 200 lecturers and 1,000 students involved in digital learning activities. A sample of 300 respondents was selected, comprising 50 lecturers and 250 students. A stratified random sampling technique was employed to ensure proportional representation of both groups. Data were collected using a structured questionnaire titled "Digital Technologies and E-Learning Questionnaire (DTELQ)," which was divided into sections covering demographic information, digital technology integration, student engagement, and learning outcomes. The questionnaire utilized a four-point Likert scale ranging from Strongly Agree to Strongly Disagree. The instrument was validated by experts in Educational Technology and Measurement and Evaluation, whose inputs helped, improve its clarity and relevance. Reliability was established using the Cronbach Alpha method, yielding a coefficient of 0.82, which indicates high reliability. The questionnaire was administered to respondents with the assistance of research assistants, and it was retrieved after completion to ensure a high response rate. Data collected were analyzed using mean and standard deviation to answer the research questions, while a mean score of 2.50 and above was considered acceptable. The hypotheses were tested using regression analysis and t-test at a 0.05 level of significance.

V.RESULTS

Research Question 1: How do digital technologies influence student engagement in learning?

Table 1.1: Mean Responses on Digital Technology Integration

S/N	Item Statement	Mean	SD	Decision
1	Digital tools improve teaching effectiveness	3.42	0.71	Agree
2	E-learning platforms enhance access to learning materials	3.55	0.66	Agree
3	Digital technologies support flexible learning	3.38	0.73	Agree
4	ICT tools are regularly used in teaching	2.89	0.8	Agree
	Mean	3.31		Agree

The results in Table 1.1 show that digital technologies have a positive influence on student engagement in learning. All the item statements recorded mean scores above the acceptable benchmark of (2.50), indicating general agreement among respondents. Specifically, respondents agreed that digital tools improve teaching effectiveness (Mean = 3.42) and enhance access to learning materials through e-learning platforms (Mean =

3.55). They also acknowledged that digital technologies support flexible learning (Mean = 3.38). Although the use of ICT tools in teaching had the lowest mean (2.89), it still fell within the agreement range, suggesting moderate utilization. The overall mean score of 3.31 indicates that digital technology integration significantly enhances student engagement.

Research Question 2: To what extent do e-learning platforms improve students' learning outcomes?

Table 1.2: Mean Responses on Student Engagement

S/N	Item Statement	Mean	SD	Decision
1	Students participate more in digital learning environments	3.40	0.69	Agree
2	Multimedia improves students' interest in learning	3.60	0.65	Agree
3	Online discussions enhance interaction	3.35	0.70	Agree
4	E-learning increases student motivation	3.45	0.68	Agree
	Mean	3.45		Agree

Table 1.2 reveals that e-learning platforms substantially improve students' learning outcomes through increased engagement. Respondents agreed that students participate more actively in digital learning environments (Mean = 3.40) and that multimedia resources improve students' interest (Mean = 3.60), which recorded the highest mean.

Online discussions were also found to enhance interaction (Mean = 3.35), while e-learning increases student motivation (Mean = 3.45). The overall mean of 3.45 suggests a strong positive perception that e-learning platforms contribute meaningfully to improved learning outcomes.

Research Question 3: How effectively do teachers integrate digital technologies into their teaching practices?

Table 1.3: Mean Responses on Learning Outcomes

S/N	Item Statement	Mean	SD	Decision
1	Digital learning improves academic performance	3.50	0.67	Agree
2	E-learning helps students understand concepts better	3.42	0.70	Agree
3	Online assessments improve learning feedback	3.30	0.74	Agree
4	Students perform better with digital instruction	3.48	0.66	Agree
	Mean	3.43		Agree

The findings in Table 1.3 indicate that teachers effectively integrate digital technologies into their teaching practices. All items recorded mean values above 3.00, reflecting agreement among respondents. Digital learning was perceived to improve academic performance (Mean = 3.50) and enhance students' understanding of concepts (Mean = 3.42). Online

assessments were also recognized for improving feedback (Mean = 3.30), while students were found to perform better with digital instruction (Mean = 3.48). The overall mean of 3.43 confirms that teachers are effectively utilizing digital technologies, leading to improved learning outcomes.

Hypotheses

H₀₁: There is no significant relationship between digital technology integration and student engagement.

Table 1.4: Regression Analysis

Variable	R	R ²	F-value	p-value	Decision
Digital Tech → Engagement	0.68	0.46	112.34	0.000	Reject H ₀₁

The result shows a strong positive relationship (R = 0.68) between digital technology integration and student engagement. The p-value (0.000) is less than 0.05, indicating a significant relationship. Therefore, the null hypothesis is rejected.

H₀₂: E-learning platforms do not significantly influence learning outcomes.

Table 1.5: Regression Analysis

Variable	R	R ²	F-value	p-value	Decision
E-learning → Outcomes	0.62	0.38	95.20	0.000	Reject H ₀₂

There is a significant positive relationship between e-learning platforms and learning outcomes. The null hypothesis is rejected, indicating that e-learning significantly influences academic performance.

H₀₃: There is no significant difference in learning outcomes between students taught with digital technologies and those taught without.

Table 1.6: Independent t-test

Group	N	Mean	SD	t-value	p-value	Decision
Digital Learning	140	3.52	0.64	5.67	0.000	Reject H ₀₃
Traditional Learning	140	2.98	0.70			

The t-test shows a significant difference between the two groups (p = 0.000). Students taught using digital technologies performed better than those taught using traditional methods. Therefore, the null hypothesis is rejected.

VI. DISCUSSION OF FINDINGS

Research Question 1: How do digital technologies influence student engagement in learning?

The study's conclusions showed that students' learning engagement is greatly increased by digital technologies. The high mean scores from the questionnaire items show that when students use digital tools, they engage with the material more effectively, participate more actively in class, and demonstrate greater curiosity.

This result is in line with the assertion made by [13] that digital technologies foster active learning by promoting student engagement, interaction, and teamwork. In a similar vein, [14] highlighted the importance of cognitive, social, and teaching presence in online learning settings for student engagement. In a similar [15] discovered that using technology-rich learning environments boosts student participation in class activities, which raises academic engagement levels. The study emphasized that interactive tools encourage students to spend more time on task and participate more actively in their learning process.

In a different study, [16] found that by encouraging communication and teamwork among students, the usage of digital tools like social media and online discussion platforms can enhance student involvement and academic achievement. This supports the notion that technology improves communication both within and outside of the classroom. According to the findings of [17], using interactive information, online forums, and multimedia makes learning more engaging and learner-centered, which boosts student motivation and involvement. This demonstrates how important digital tools are for converting passive learning into active participation.

Research Question 2: To what extent do e-learning platforms improve students' learning outcomes?

The results showed that students' learning outcomes are greatly enhanced by e-learning platforms. The high cluster mean scores demonstrate that students who use e-learning resources do better academically, retain material better, and comprehend concepts better.

This result corroborates the findings of [18], who described how multimedia learning enhances comprehension by fusing verbal and visual information, therefore improving knowledge retention. Similarly, [19] observed that interactive learning settings and feedback, which are frequently offered via e-learning platforms, had a significant favorable impact on student progress. Using the Cognitive Theory of Multimedia Learning, [20] discovered that children learn better when information is provided using words and graphics rather than just text. This lends credence to the notion that e-learning platforms, which frequently include multimedia components, improve comprehension and memory.

In a similar vein, [21] found that students in blended and online learning contexts typically outperform those in conventional face-to-face settings. Their meta-analysis demonstrated that by giving students control over the speed and order of their learning, the use of digital tools encourages deeper learning. The implication of this finding is that e-learning platforms provide learners with flexible access to resources, immediate feedback, and opportunities for self-paced learning. These features contribute to improved academic outcomes and deeper understanding of subject matter.

Research Question 3: How effectively do teachers integrate digital technologies into their teaching practices?

The results showed that teachers incorporate digital technologies into their lesson plans to a moderate extent. Although the mean scores show agreement that ICT tools are used in the classroom, there is still potential for improvement as the level of usage is not yet ideal.

This result is consistent with the observation made by [22] that many instructors do not fully employ digital technologies despite their availability because they lack the necessary training and have limited digital abilities. In a similar vein [23] stressed that institutional support and capacity training are just as important for successful technology integration as having access to tools.

According to [24], despite the fact that many teachers have access to technology; their integration is frequently shallow because of pedagogical assumptions and a lack of confidence in their ability to use technology successfully. They underlined that second-order barriers like attitudes and beliefs have a big impact on how technology is used in schools. In a similar vein, [25] found that institutional support and teacher professional development play a major

role in the successful incorporation of digital technology. According to their research, teachers typically use technology for routine teaching activities rather than for creative or student-centered learning when they don't receive ongoing training and support. The result implies that although some teachers are integrating digital tools into their teaching, challenges such as lack of training, insufficient infrastructure, and resistance to change may limit effective implementation. Therefore, continuous professional development and adequate support systems are necessary to enhance teachers' competence in using digital technologies effectively.

VII.CONCLUSION

According to the study's findings, integrating digital devices into the classroom greatly raises student engagement and improves learning outcomes. According to the study, using digital tools and e-learning platforms raises students' interest in learning, encourages active engagement, and enhances their comprehension of the material. The results also showed that e-learning platforms offer adaptable, interactive, and student-centered learning environments that enhance academic achievement. Additionally, even while educators are working to include digital technologies into their lesson plans, the degree of integration is still minimal and can be raised with the right assistance and training. The study comes to the overall conclusion that while digital technologies are useful instruments for enhancing teaching and learning procedures, their full potential can only be achieved with the provision of sufficient infrastructure, institutional support, and training.

VIII. RECOMMENDATIONS

Based on the conclusion, the following recommendations were made:

1. Educational institutions should provide training for teachers and ensure access to adequate ICT infrastructure to support effective use of digital technologies.
2. Government and school administrators should implement policies and provide continuous support to promote the effective integration of e-learning tools in education.
3. Teacher education programmes should place greater emphasis on practical application of instructional design models and ICT integration skills, ensuring that pre-service teachers are well-equipped to design, implement, and evaluate technology-enhanced learning experiences effectively.

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