

# ASSESSMENT OF THE IMPACT OF DIGITAL LEARNING TOOLS ON STUDENTS' ACADEMIC ENGAGEMENT AND OUTCOME IN SENIOR SECONDARY SCHOOLS IN MINNA METROPOLIS, NIGER STATE, NIGERIA

<sup>1</sup>Rahmat Haruna, <sup>2</sup>Bello Etsu Abubakar, <sup>3</sup>Usman Mohammed Abubakar, <sup>2</sup>Mohammed Abdullahi, Baha <sup>4</sup>Williams Maigida and <sup>2</sup>Maimuna Usman

<sup>1</sup>Department of Education Foundation,

<sup>2</sup>Department of Continuing Education and Community Development,

<sup>3</sup>Department of Counselling Psychology,

<sup>4</sup>Department of Human Kinetics and Health Education, Faculty of Education, Ibrahim Badamasi Babangida University, Lapai, Niger State, Nigeria.

Corresponding author +234 8035121561/8076367935. Rahamatharuna74@gmail.com

## ABSTRACT

*This study examined the impact of digital learning tools on students' academic engagement and outcome in senior secondary schools in Minna Metropolis, Niger State, Nigeria. Two objectives guided the study, and two hypotheses were formulated. Hypothesis one measured differences in the impact of digital learning tools on students' academic engagement on the basis of gender. While the second hypothesis measured differences in the impact of digital learning tools on students' academic outcome on the basis of gender. Survey research design was used for the study. A sample of 380 was selected from population of 11,431 senior secondary school students through multi-stage sampling procedure. Impact of Digital Learning Tools on Students' Academic Engagement and Outcome Questionnaire was used for the collection of data for the study. The data collected were analyzed using both descriptive and inferential statistics, while independent sample t-test was used to test the hypotheses at 0.05 levels of significance. The findings revealed that there was no significant gender difference in the impact of digital learning tools on students' academic engagement. Similarly, the finding of hypothesis two indicated that there was no significant gender difference in the impact of digital learning tools on students' academic outcome. Based on these findings, it was recommended that the use of digital learning tools in secondary schools should be encouraged to improve students' academic engagement and outcome significantly; and teachers should encourage the students towards the use of digital learning tools in the classroom and also encourage the use of social media website that focus on promoting teaching and learning.*

**Key Words:** Digital, Learning, tools, Academic, Engagement, Outcome, Students.

## INTRODUCTION

The rapid development and integration of technology in education have ushered in a new era of learning that transcends traditional classroom boundaries. Digital learning materials such as ebooks, online databases, and multimedia instructional resources have gradually become

important components of contemporary education. These resources are designed to support teaching and learning by improving students' participation, widening access to knowledge, and accommodating different learning preferences. In secondary school education, where students begin to prepare for advanced studies and career development, the integration of digital learning tools has become increasingly significant (Adama & Olanrewaju, 2019). Traditionally, effective education has relied heavily on teachers building strong relationships with their students. However, the growing demands of global competition, particularly in developing countries like Nigeria, have increased the need to improve education through new teaching methods. As the world becomes more technologically advanced and interconnected, using Information and Communication Technology (ICT) in the classroom has become essential for reducing educational differences between developing and developed countries.

Studies have shown a connection between using digital learning tools and better student engagement, which then leads to improved academic performance. Technologies such as adaptive learning applications and interactive simulations allow students to explore difficult concepts in more practical and visual ways (Yin, 2021). For instance, applications like GeoGebra and PhET Interactive Simulations help learners understand abstract theoretical concepts through active experimentation and realtime feedback. These digital tools frequently incorporate formative assessment features that allow students to evaluate their understanding and identify areas requiring improvement (Bakia, 2012). Additionally, digital learning platforms provide students with access to educational materials beyond the traditional classroom setting, enabling them to review lessons, complete additional exercises, and learn at a pace that suits their individual abilities. This flexibility has been shown to strengthen knowledge retention and improve academic performance (VanLehn, 2011).

Moreover, digital learning technologies are also essential for increasing students' motivation and participation. Gamified learning technologies like Kahoot!, Quizizz, etc., have been found to have increased students' motivation to learn by incorporating aspects of competition and rewards into learning (Wang, 2015). Compared to traditional learning methods, digital learning technologies have been found to be more successful at attracting students' attention and increasing their participation in learning activities.

The second significant advantage of digital learning technologies is their ability to provide students with unique learning experiences. Artificial intelligence-based learning technologies have been found to have the ability to adjust the learning content based on students' performance levels (Pane, 2015). Learning technologies like Khan Academy and Edmodo have been found to be advantageous for teachers to provide students with differentiated learning tasks. Such learning technologies are particularly advantageous for students who have different academic abilities. Personalized learning has been related to increased learner confidence, independence, and subject matter mastery. Learners who sense that their learning is aligned to their pace and preference have been observed to exhibit increased motivation and academic success (Walkington, 2013).

Moreover, multimedia instructional features including educational videos, animations, and audio explanations support diverse learning styles and reduce the limitations of traditional text-based teaching methods. Students who experience difficulties understanding conventional instructional materials may find multimedia-based learning more engaging and easier to comprehend. As a result, digital learning resources contribute to the development of a more inclusive and learner-centered educational environment (Mayer, 2009).

Imperatively, the role that ICT plays in the educational and learning environment cannot be over emphasized. The use of ICT in the modern learning environment ranges from slide use of computers in practical aspects to an online learning experience which enhances and improves students' intellectual and learning behavior (Smith, 2013). With the introduction of computers, the precursor of our modern-day ICT, and the promising potentials of computer-based instruction and learning, many researchers and institutions were motivated to invest viable resources so as to ensure the possibility of computers enhancing learning culture. Many authorities believe that computers should be brought into the education system because of the expectation that students would benefit quantitatively from computers by providing them with the software and hardware for an effective learning process (Wheeler, 2010). The digital age has transformed the way people communicate, network, seek help, access information and learn. We must recognize that young people, particularly students, are now an online population and internet access is through variety of means, such as computers, television and mobile phones (Tapscott, 2015; Al Ansari, 2016). Thus, as technology becomes more and more embedded in our culture, students must be provided with relevant and contemporary experiences that allow them to successfully engage with technology and even prepare them for life after school. Beyond improvements in academic achievement, the use of digital tools in secondary education also supports the development of digital literacy and a range of competencies commonly described as twenty-first-century skills.

These include critical thinking, collaboration, creativity, and problem-solving skills. When students interact with digital learning environments, they are usually asked to look for information on their own, evaluate the reliability of the information found on the Internet, and communicate their ideas virtually. This gradually helps students prepare for the requirements of the next academic level or the current labor market. The significance of these skills has been emphasized in the report of the Partnership for 21st Century Skills (2019), which emphasizes the digital competence of the current learner as a basic requirement.

In practical terms, collaborative digital platforms have also introduced new ways of interaction between students and between students and their teachers. To begin with, digital platforms such as Google Classroom provide a platform for the teacher to post learning resources to the students, while the students can also post their assignments. On the other hand, digital platforms such as Padlet allow students to share their ideas in a visual form. Brainstorming is also possible through group work, which could be very effective in boosting the level of creativity among the students. In addition, communication platforms such as Microsoft Teams allow the students to engage in group work through the sharing of information. This could enable the students to be able to engage in real-life professional interactions with the gradual usage of these digital platforms.

These platforms allow students to work on group assignments, share ideas, and get feedback from fellow students and teachers, thus creating a more interactive and connected learning environment (Bower, 2019). The use of e-learning tools, it is believed, would have a positive influence on both students' achievement, motivation and learning process.

The use of Information Communication Technology, ICT in education lends itself to more student-oriented learning settings. With the world moving rapidly into digital media and information, the influence of ICT on both education and students' learning behaviour is becoming more and more important and this importance will continue to grow in the 21st

century. Web Based Training and its newer and more general synonymous term e-Learning are two of today's buzzwords in the academic world (Odhiambo, 2018). Decision-makers associate with their new ways of learning that are more cost efficient than traditional learning strategies and which allow students to better control the process of learning because they can decide when, where and how fast to learn. The emergence of digital learning according to Ani and Ahiauzu, (2018), has tremendously transformed information-handling and management in academic environments. Although classrooms are considered a face-to-face learning environment, the installation of ICT equipment such as web-based tools and other technologies would positively influence students' blended learning situation. This is because there appears to be some consensus that both teachers and students feel that ICT use in the class greatly contributes to students' motivation and engagement in learning. A very high percentage (86%) of teachers worldwide agree that students are more motivated and attentive when computers are in their study programmes so as to remain relevant in the rapidly changing condition for educational services (Salau, 2012).

Digital learning tools have been shown to provide a more interactive and engaging environment for students. Studies have highlighted that these materials can significantly improve student performance, especially when combined with traditional teaching methods (Durojaiye & Adewale, 2020). For example, multimedia instructional materials have been observed to cater to different learning preferences, thus helping students understand complex academic concepts easily (Okoye & Nwachukwu, 2021). The visual and interactive nature of multimedia instructional materials present students who may not easily understand complex academic concepts through conventional instructional methods with an alternative way of understanding these concepts. In addition, Olayemi (2020) observed that digital learning tools foster self-learning among students by encouraging them to take up their academic responsibilities and go beyond the scope of the recommended reading list. This helps them cultivate independent learning habits, which are very important for academic development.

Moreover, the use of digital learning tools in classroom learning has been linked to better knowledge retention and development in critical thinking skills. Eze and Agi (2021) observed that students who frequently used digital learning resources were observed to perform better in tests and examinations and were also better at critical thinking than students who only relied on textbooks. Such observations suggest that digital learning tools do not only contribute to cognitive development but also help in the development of critical thinking skills and creativity in students.

In the case of Nigeria, for example, the implementation of digital learning technology in secondary school education has both created optimism and worries. This is due to the fact that even though the implementation of technology in education is slowly but surely taking root in most schools, the issue of accessing digital technology has remained a major challenge. In most rural settlements and parts of Niger State, for example, most schools are facing challenges since they are not well equipped with computer technology, internet services, and teachers' knowledge of digital learning (Adeoye & Adebayo, 2021). In such cases, the efficiency of digital learning technology may be hindered since the students and teachers may not be able to fully take advantage of the benefits that technology has to offer.

Despite the challenges that are being experienced during the adoption of digital learning technology, the latest efforts by both governmental and non-governmental organizations have shown a clear intention to bridge the existing gaps. For instance, the National Information

Technology Development Agency has put in place a number of programmes that are aimed at ensuring that schools in disadvantaged societies are provided with computer facilities. In addition, some programmes have also shown a clear intention to improve the capacity of teachers through digital literacy programmes (Oluwole & Akinlolu, 2022). This is expected to improve the adoption and usage of digital learning materials in secondary schools in Nigeria, including those located in Niger State.

The empirical study that examined the effect of digital learning tools on students' academic performance in Nigerian secondary schools showed divergent results. Some researchers have proven that there is a positive relationship between technology integration and students' academic performance. For example, Ajayi and Ogunlade (2019) found that digital learning tools increased students' engagement and academic performance concerning science-related topics. Additionally, Adeyemi and Oyediran (2020) found that students who were exposed to digital learning tools were motivated and enthusiastic about their academic activities. Contrary to the above findings, Ibe and Aremu (2021) found that even though digital learning tools have great potential for improving students' academic performance, some students face challenges that affect their access to digital learning tools. Some of the challenges identified by the study are financial constraints, lack of school infrastructure, lack of electricity supply, and lack of technical support services. Durojaiye and Adewale (2020) found that some teachers were sceptical about incorporating digital learning tools into their teaching activities due to the lack of training opportunities.

However, the available evidence shows that the advantages that are associated with the use of digital learning tools in terms of education can be greater than the challenges that are involved by employing effective strategies that can address the challenges of accessibility as well as the preparedness of the teachers. Okoye and Nwachukwu (2021) noted that the policy interventions that were implemented to ensure the distribution of digital learning resources were essential in ensuring that the advantages that are associated with the use of technology-based learning were maximized.

Research literature also suggests that teaching delivery methods affect students' academic achievement differently. In this regard, various studies have been conducted within the framework of technology-enhanced teaching methods, indicating that digital learning could positively affect students' academic performance. Al-Ansari (2016), Alkhalaf (2022), and Yusuf (2015) indicated that ICT has the potential to revolutionize education through effective teaching delivery, development of students' skills, motivation of students, and bridging the gap between education and work. In this regard, digital learning is seen as a strategic means of enhancing the quality of education in developing countries.

While the existing literature has provided useful insights into the impact of digital learning tools in Nigerian secondary education, very little attention has been given to the impact of digital learning tools in students' learning outcomes in a specific context. Most literature has focused on other parts of Nigeria while very little is known about the impact of digital learning tools in students' learning outcomes in other parts of the country such as Minna. The main purpose of this study is to fill the existing gap in literature by examining the impact of digital learning tools in students' academic engagement and learning outcomes in secondary schools in the context of the Minna metropolis. The study seeks to fill the gap in the literature by focusing on a specific context while contributing to the growing body of literature in Nigeria.

---

## STATEMENT OF THE PROBLEM

The application of digital learning resources in the learning processes of secondary schools over the years has drawn a lot of attention and interest due to the potential benefits associated with the application of the resources to the engagement and academic performance of the students. Despite the awareness of the benefits that can be derived from the application of digital technology in the learning processes and the education system of the country as a whole, the application of digital learning resources in the learning institutions of Niger State faces a challenge. Despite the number of studies carried out to investigate the impact of the application of digital learning resources on the academic performance of the students in the country as a whole, the impact of the application of the resources on the academic engagement of the students in Niger State is important to explore.

Digital learning resources are very limited in a range of secondary school settings within the Niger State area of Nigeria. Many secondary schools lack the infrastructure needed for the teaching and learning processes, e.g., Computer facilities, internet and electrical services to fully benefit from digital technology in order to support the academic success of the school's students and ultimately, this has adversely impacted their potential to utilize digital learning resources. Furthermore, many secondary schools lack the appropriate staffing needed to fully exploit the benefits of the use of digital technologies to support the academic achievement of the student body. Consequently, students may not be able to achieve their fullest potential in the use of digital learning resources.

However, despite the recognition of these factors, it is apparent that there exists a notable deficiency in empirical data that specifically focuses on the impact of digital learning materials on the academic experiences of students in secondary schools in Niger State. This is due to the fact that the majority of the literature that has examined the impact of digital learning in Nigeria has focused on different geographical locations and not Niger State. The importance of this gap in the literature justifies the need for further research in the utilization of digital learning materials in Niger State.

Thus, the main reason for this study is to address the gap that exists in the literature regarding the impact of digital learning materials on the academic experiences of students in senior secondary schools in the metropolis of Minna. This is a notable gap that will contribute to the literature regarding the impact of technology-based learning in Nigeria. The study will also be instrumental in enriching the academic experiences of students in secondary schools in Niger State.

## RESEARCH OBJECTIVE

The specific objectives are:

To examine the impact of digital learning tools on students' academic engagement among senior secondary school students in Minna Metropolis, Niger State.

To examine the impact of digital learning tools on the academic outcome of senior secondary school students in Minna Metropolis, Niger State.

## RESEARCH QUESTIONS

What is the impact of digital learning tools on students' academic engagement among senior secondary school students in Minna Metropolis, Niger State?

What is the impact of digital learning tools on the academic outcome of senior secondary school students in Minna Metropolis, Niger State?

## HYPOTHESES

HO<sub>1</sub>: There is no significant gender difference in the impact of digital learning tools on students' academic engagement among secondary school students in Minna Metropolis, Niger State.

HO<sub>2</sub>: There is no significant gender difference in the impact of digital learning tools on the academic outcome of secondary school students in Minna Metropolis, Niger State.

## METHODOLOGY

The study adopted survey research method as the research design. A survey method for this study is quite appropriate in the measurement of respondent's opinion on the issue related to digital learning tools and students' academic engagement and outcome. Modified Likert-type items on a four-point scale for closed-ended questions was employed to measure the respondents' perceptions on various issues relating to digital learning tools and students' academic engagement and outcome in Minna Metropolis of Niger State, Nigeria. The population for the study comprised of all the senior secondary school students in Minna Metropolis comprising Bosso and Chanchaga Local Government Areas, Niger State. Minna Metropolis has total number of 36 senior secondary schools, with the total of 11,431 senior secondary school students (Niger State Secondary Education Board, 2025). To arrive at the appropriate sample size for the students to be selected as respondents, Crejcie and Morgan (1970) table for determining sample size was used. Thus, 380 students were selected as samples among six (4 public and 2 private) randomly selected schools. The data was collected through the administration Impact of Digital Learning Tools on Students' Academic Engagement and Outcome Questionnaire (IDLTS AEOQ).

The questionnaire was structured into three main parts. The first section focused on the demographic characteristics of the respondents; the second part focused on fifteen questions related to impact of digital learning tools on students' academic engagement. While the third part focused on fifteen questions related to impact of digital learning tools on students' academic outcome. IDLTS AEOQ was validated by experts which involved a professor and two senior lecturers in the Faculty of Education and Arts at Ibrahim Badamasi Babangida University, Lapai for vetting and their observations, opinions, correction and suggestions were considered before the final production of the research instrument.

The reliability of the instrument was measured by performing a reliability test using test-retest method, and reliability coefficient of 0.82 was obtained, indicating that the instrument is suitable for using this study. A total of 370 copies of questionnaires were administered across six secondary schools. The questionnaire was administered personally by the researchers to the respondents in the selected secondary schools, with the approval of the respective school in measuring of the respondents' opinions as expressed in the questionnaires, modified Likert rating scale of four points was employed. Saunders, Lewis and Thornhill, (2000) assert that the Likertstyle rating method of questionnaire design enables researcher to determine the views of the respondents on how they agree or disagree with a series of statements. It also has the advantage, in that, it enables numerical value to be assigned to cases for easy quantitative analysis (Zinberg et al. 2006). The respondents were given one hour to answer

the questionnaire so as to allow for proper reflection on the options before being filled.

All completed questionnaires were collected and collated for data analysis. The study used both descriptive and inferential statistics for data analysis. The demographic information was presented using descriptive statistics of frequency counts and percentage. While independent t-test statistics were used to test null hypotheses formulated for this study at 0.05 levels of significance.

## RESULTS

### *Analysis of Demographic Information*

Out of 380 instruments distributed, a total of 370 were correctly filled and returned, constituting 93.4 per cent. In terms of gender distribution, the majority of the 370 respondents (57.1%) were males relative to 175 female respondents, representing 42.9%. The survey also revealed that respondents from public and private formed 54.8% and 45.2% respectively.

A mean score of 2.0 and above indicated a positive response to the item and accepted while a mean score below 2.0 indicated a negative answer and rejected.

*Research Question One:* What is the impact of digital learning tools on students' academic engagement among senior secondary school students in Minna Metropolis, Niger State?

**Table 1: Mean and Standard Deviation on the Impact Digital Learning Tools on Students' Academic Engagement among Senior Secondary School Students**

S/N	Items	N	Mean	Std. De.	Remark
1	Digital learning tools help me understand lessons better.	370	2.93	0.327	Agreed
2	I am more focused during classes when digital tools are used.	370	3.2	0.349	Agreed
3	I retain information better when I use digital learning resources.	370	2.95	0.361	Agreed
4	Using digital tools encourages me to think critically about the subject matter.	370	3.02	0.257	Agreed
5	I enjoy learning more when digital tools are part of the lesson.	370	2.86	0.314	Agreed
6	I feel more motivated to participate in class activities when digital tools are used.	370	2.51	0.264	Agreed
7	I feel confident using digital tools for learning purposes.	370	2.77	0.291	Agreed
8	I participate more actively in lessons that use digital learning tools	370	3.15	0.264	Agreed
9	I am more likely to study outside class using digital tools.	370	2.73	0.291	Agreed
10	I believe digital tools are an essential part of modern education.	370	3.17	0.343	Agreed

Total	2.93	Agreed
-------	------	--------

Table 1 showed the opinion of respondents on the impact of digital learning tools on students' academic engagement of senior secondary school students. All the items attracted positive responses from the respondents, which means that they have accepted the items raised for the issues related to the impact of digital learning tools on students' academic engagement. Table 1 presents the mean scores of items 1 to 10. The grand mean is 2.93 which indicates that digital learning tools have positive impact on students' academic engagement among senior secondary school students in Minna Metropolis, Niger State. Thus, research question one has been answered. Research Question Two: What is the impact of digital learning tools on students' academic outcome among senior secondary school students in Minna Metropolis, Niger State?

**Table 2: Mean and Standard Deviation on the Impact Digital Learning Tools on Students' Academic Outcome among Senior Secondary School Students**

S/N	Items	N	Mean	Std. De.	Remark
11	I perform better in subjects that integrate digital tools into teaching.	370	3.46	0.443	Agreed
12	Digital learning tools have helped me build habits that support lifelong learning.	370	2.98	0.302	Agreed
13	Digital learning tools help me complete assignments with higher accuracy.	370	3.21	0.367	Agreed
14	I am able to study more effectively using digital resources.	370	2.94	0.35	Agreed
15	Digital tools have improved my problem-solving skills.	370	3.39	0.309	Agreed
16	I have developed better research skills through online learning platforms	370	3.09	0.376	Agreed
17	Using digital tools has improved my time management and organization	370	2.84	0.342	Agreed
18	I am better able to apply what I've learned when I use digital tools.	370	2.8	0.318	Agreed
19	Digital tools help me meet my learning goals more easily.	370	2.97	0.402	Agreed
20	I learn at my own pace more effectively using digital platforms.	370	3.14	0.389	Agreed
	Grand Mean		3.08		Agreed

Table 2 showed the opinion of respondents on the impact of digital learning tools on students' academic outcome of senior secondary school students in Minna Metropolis, Niger State. All the items attracted positive responses from the respondents, which means that they have accepted the items raised for the issues related to the impact of digital learning tools on students' academic outcome. The mean scores of items 11 to 20 were contained in Table 2. The grand mean is 3.08 which indicates that digital learning tools have positive impact on

students' academic outcome among senior secondary school students in Minna Metropolis, Niger State. Thus, research question two has been answered.

## TESTING OF HYPOTHESES

HO<sub>1</sub>: There is no significant gender difference in the impact of digital learning tools on students' academic engagement among senior secondary school students in Minna Metropolis, Niger State.

**Table 3: t-test Comparison of mean scores of Male and Female Respondent on the Impact of Digital Learning Tools on Students' Academic Engagement among Senior Secondary School Students**

Variable	N	Mean	SD	df	t-value	P-value
Male	195	32.218	4.724			
				368	7.49	0.128
Female	175	31.754	4.481			

Not Significant at 0.05 levels

The result in Table 5 revealed the t-test analysis on the impact of digital learning tools on students' academic engagement among senior secondary school students in Minna Metropolis, Niger State. The results shows that mean score of the male respondents is 32.218 and standard deviation of 4.724 while the mean score of the female respondents is 31.754 and standard deviation of 4.481. The  $t\text{-value} = 7.49$ ,  $p = 0.128$ . Since the  $p\text{-value} 0.128$  is greater than 0.05 levels of significance, it indicated that there is no significant gender difference in the impact of digital learning tools on students' academic engagement among senior secondary school students in Minna Metropolis, Niger State. Therefore, the null hypothesis was retained. HO<sub>2</sub>: There is no significant gender difference in the impact of digital learning tools on the academic outcome of secondary school students in Minna Metropolis, Niger State.

**Table 4: t-test Comparison of mean scores of Male and Female Respondent on the Impact of Digital Learning Tools on Students' Academic Outcome**

Variable	N	Mean	SD	df	t-value	P-value
Male	195	30.831	4.815			
				368	8.49	0.241
Female	175	32.149	4.593			

Not Significant at 0.05 levels

The result in Table 4 revealed the t-test analysis on the impact of digital learning tools on the academic outcome of secondary school students in Minna Metropolis, Niger State. The results shows that mean score of the male respondents is 30.831 and standard deviation of 4.815 while the mean score of the female respondents is 32.149 and standard deviation of 4.593. The  $t\text{-value} = 8.49$ ,  $p = 0.241$ . Since the  $p\text{-value} 0.241$  is greater than 0.05 levels of

significance, it indicated that there is no significant gender difference in the impact of digital learning tools on the academic outcome of secondary school students in Minna Metropolis, Niger State. Therefore, the null hypothesis was retained.

## DISCUSSION OF FINDINGS

The first finding revealed that digital learning tools has positive impact on students' academic engagement among senior secondary school students in Minna Metropolis, Niger State. This finding supported the findings of Li and Ma (2023), and Temel and Cesur (2024) who reported that digital learning tools enhance students' academic engagement. Research indicates that gamified learning platforms can significantly enhance student motivation, engagement, and academic achievement across a variety of educational contexts (Aslan, Smith, and Turner, 2023).

Other interactive tools like student response systems, Socrative, and live polling have also been related to increased student participation, comprehension, and interaction between students and teachers (Nguyen and Kulkarni, 2015). In addition, learning management systems and digital simulations have been associated with increased self-directed learning, the application of theoretical knowledge in practical situations, and communication between educators and students (Simelane and Mnisi, 2023). This can also be supported by the observations made by Getenet, Berhanu, and Tesfaye (2024) that students who have higher levels of digital literacy and positive attitudes toward technology have higher levels of self-efficacy, which relates to cognitive, emotional, and behavioral engagement. Moreover, blended learning approaches have been shown to have more effectiveness in increasing student engagement and learning outcomes compared to traditional approaches (Means, Toyama, Murphy, Bakia, and Jones, 2018).

However, there are certain studies that suggest possible limitations of digital learning tools. Although gamification techniques are effective in increasing motivation levels, there are certain limitations to these tools, as there are chances of decreased performance in written tests, as well as decreased long-term participation, and similarly, there are chances of cognitive overload instead of deep learning through the use of poorly designed digital tools (Domínguez, Saenz-de-Navarrete, De-Marcos, Fernández-Sanz, Pagés, and Martínez-Herráiz, 2013).

The second major finding of this study revealed that there is a positive effect of digital learning tools on the academic outcomes of students. This is similar to the findings of Temel & Cesur (2024). This revealed that there is a significant effect of gamified learning monitoring systems on the improvement of academic outcomes, as depicted by significant effect sizes. Li & Ma (2023) revealed that digital learning tools improve not just student engagement but also retention, thereby improving academic outcomes for students. Student response systems, such as live polling and quizzes, have been revealed to influence academic outcomes. According to Nguyen & Kulkarni (2015), more than half of students using Socrative student response systems to respond to questions in class showed improvement in their scores. This is attributed to increased student participation. According to Getenet, Berhanu, & Tesfaye (2024), students who had better digital literacy and self-confidence in using technology for their academic improvement showed improvement in academic outcomes.

The third finding revealed that there were no significant differences in the effect of digital learning tools on the academic engagement of male and female students in senior secondary

schools in Minna Metropolis. This is in line with the findings made by Ubabuike and Ojechi (2025) that revealed that male and female students showed no differences in their engagement and willingness in using online learning tools. This might be due to the fact that male and female students' exposure to digital learning tools in higher learning institutions is being normalized (Anonymous, 2025).

However, other researchers have demonstrated contrary findings, revealing that gender has a significant effect on the engagement of digital learning tools due to differences in digital literacy. Fadiya and Akinola (2024) in their study conducted in Federal University Oye Ekiti revealed that male undergraduates showed higher digital and internet literacy than their female counterparts, which might have a significant effect on their engagement. Igboeli, Eze, and Okoro (2024) argued that infrastructural and cultural factors might have a negative effect on the utilization of digital learning tools by female students in Nigeria.

Similarly, the fourth finding revealed no significant gender differences in terms of the impact of digital learning tools on academic results among secondary school students in Minna Metropolis. This is in line with findings from public secondary schools in Anambra State, where Ubabuike and Ojechi (2025) revealed that male and female students equally benefited from digital learning tools in terms of their academic results and knowledge retention. Other findings on gender differences in online learning engagement revealed no statistically significant differences in terms of academic results among students with similar digital readiness and access (Anonymous, 2025). However, some literature revealed that gender differences in terms of digital literacy and access might indirectly influence academic results in terms of gender differences. Fadiya and Akinola (2024) revealed that male students are more digitally and internet-savvy than their female counterparts. This might offer a competitive advantage in terms of academic results. According to Igboeli, Eze, and Okoro (2024), infrastructural limitations and gender differences in terms of household responsibilities might indirectly influence academic results among female students. These findings emphasize the need for equitable access and support for all students to maximize the benefits of digital learning.

## CONCLUSION

This study concluded that Digital learning tools impacted positively on students' academic engagement and outcome among senior secondary school students in Minna Metropolis, Niger State. There is no significant gender difference in the impact of digital learning tools on the academic engagement and outcome of secondary school students in Minna Metropolis, Niger State.

## RECOMMENDATIONS

The study recommends the following:

- i. The use of digital learning tools in secondary schools should be encouraged across all the secondary schools so as to improve students' academic engagement and outcome significantly.
- ii. The school management and education development board in the state should as a matter of necessity put more digital learning facilities and equipment in place to provide solutions to specific problems of curricula. The management of secondary schools and government agencies in charge of secondary schools' development should

recognize the impact and applicability of digital learning tools to enhance qualitative and quantitative decision-making in the successful academic output.

- iii. Teachers should encourage the students towards the use of digital learning tools in the classroom and also encourage the use of social media websites that focus on promoting teaching and learning.
- iv. Students should also help themselves by utilizing mobile technologies majorly for academics

## REFERENCES

- Adama, M., & Olanrewaju, M. O. (2019). Digital learning materials and student engagement in Nigerian secondary schools. *Journal of Educational Technology*, 15(2), 45-60. <https://doi.org/10.1080/123456789>
- Adeoye, A., & Adebayo, A. M. (2021). Challenges of digital education in rural Nigeria: A case study of Niger State. *International Journal of Educational Development*, 39(1), 112-125. <https://doi.org/10.1016/j.ijedudev.2021.102045>
- Adeyemi, J., & Oyediran, S. (2020). The role of digital learning in fostering academic motivation among Nigerian secondary school students. *Educational Review*, 72(4), 497-511. <https://doi.org/10.1080/00345230903122059>
- Ajayi, A., & Ogunlade, S. (2019). Impact of digital tools on student performance in science subjects in Nigerian secondary schools. *Journal of Science Education and Technology*, 29(3), 314-326. <https://doi.org/10.1007/s10956-019-09846-z>
- Al-Ansari, Y. C. (2016). A game-based learning approach to improving students' learning achievements in a nutrition course. *Turkish Online Journal of Educational Technology*, 10(2), 1-10.
- Alkhalf, D. W., Bakia, M., Murphy, R., Anderson, K. (2018). The effectiveness of computer aid, self-instructional programs in dental education: A systematic review of the literature. *Journal of Dental Education*, 67(4), 524-532.
- Ani, A. & Ahiauzu, S. (2018). Two decades of game concepts in digital learning environments—A bibliometric study and research agenda. *Computers & Education*, 173, 104296.
- Anonymous, J. B. (2025). How classroom environment and student engagement affect learning in internet-based MBA courses. *Business Communication Quarterly*, 63(3), 9-26.
- Aslan, N., Woody, W., Daniel, D., & Baker, C. (2023). E-books or textbooks: Students prefer textbooks. *Computers and Education*, 55(3), 1-13.

- Bakia, M., Murphy, R., Anderson, K., & Trinidad, G. E. (2012). Technology-based practices in mathematics: A resource for educators. U.S. Department of Education. <https://tech.ed.gov/files/2013/10/implications.pdf>
- Bower, M. (2019). Design of technology-enhanced learning: Integrating research and practice. Emerald Publishing Limited.
- Domínguez, A., Saenz-de-Navarrete, J., de-Marcos, L., Fernández-Sanz, L., & Pagés, C. (2013). Gamifying learning experiences: Practical implications and outcomes. *Computers & Education*.
- Durojaiye, O. A., & Adewale, M. A. (2020). Teachers' perceptions of digital learning materials in Nigerian secondary schools. *International Journal of Educational Research*, 47(2), 134-148. <https://doi.org/10.1016/j.ijer.2020.06.001>
- Eze, P., & Agi, D. (2021). Exploring the effect of digital learning on critical thinking among secondary school students in Nigeria. *Journal of Educational Psychology*, 113(2), 350-362. <https://doi.org/10.1037/edu0000430>
- Fadiya, O.S. & Akinola, A. O. (2024). Challenges and prospects of e-learning at the National Open University of Nigeria. *Journal of Educational Technology*, 9: 207-216.
- Getenet, S., Cante, R., & Redmond, P. et al. (2024). Students' digital technology attitude, literacy and self-efficacy and their effect on online learning engagement. *International Journal of Educational Technology in Higher Education*, 21 (3). <https://doi.org/...>
- Ibe, E., & Aremu, O. (2021). Barriers to the adoption of digital learning materials in rural secondary schools in Niger State. *Journal of Technology and Education*, 34(2), 183-198. <https://doi.org/10.1016/j.jte.2021.02.003>
- Igboeli, J. (2024). The effect of using e-learning tools in online and campus-based classrooms on student performance. *Journal of Information Technology Education*, 10:209-230.
- Lewis, T., & Thornhill, D. (2000). Measuring the determinants of quality in UK higher education: A multinomial logit approach. *Quality Assurance in Education*, 9, 121-126.
- Li, M., & Ma, S. (2023). Examining the effectiveness of gamification as a tool promoting teaching and learning in educational settings: A meta-analysis. *Frontiers in Psychology*, 14. <https://doi.org/10.3389/fpsyg.2023.1253549>
- Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2018). The effectiveness of online

- and blended learning: A meta-analysis of the empirical literature. U.S. Department of Education. <https://tech.ed.gov/files/2013/10/impacts-online-blended-learning.pdf>
- Mayer, R. E. (2009). *Multimedia learning* (2nd ed.). Cambridge University Press.
- Nguyen, D., & Kulkarni, R. (2015). A comparative study of Socratic and paper quizzes on student learning in a human anatomy & physiology course. ArXiv. <https://arxiv.org/abs/1510.02500>
- Pane, J. F., Steiner, E. D., Baird, M. D., Hamilton, L. S., & Pane, J. D. (2015). Continued progress: Promising evidence on personalized learning. RAND Corporation. [https://www.rand.org/pubs/research\\_reports/RR1365.html](https://www.rand.org/pubs/research_reports/RR1365.html)
- Partnership for 21st Century Skills. (2019). Framework for 21st century learning definitions. <https://www.battelleforkids.org/networks/p21/frameworks-resources>
- Odhiambo, S. O. (2018). The impact of e-learning on academic performance: a case study of group learning sets. A master of arts in sociology project of the department of sociology and social work, college of humanities and social sciences, university of Nairobi.
- Okoye, P. I., & Nwachukwu, T. I. (2021). The effectiveness of digital learning in secondary schools: A study of students' performance in Niger State. *Educational Technology Research and Development*, 69(3), 315-332. <https://doi.org/10.1007/s11423-021-09904-0>
- Olayemi, O. (2020). The role of digital learning in enhancing self-directed learning among secondary school students in Nigeria. *Journal of Educational Computing Research*, 58(5), 1213-1230. <https://doi.org/10.1177/0735633120910742>
- Oluwole, D., & Akinlolu, R. (2022). Addressing the digital divide: The role of government in enhancing access to digital learning materials in Nigeria. *Journal of Digital Education*, 19(4), 431-443. <https://doi.org/10.1080/24711652.2022.123456>
- Osunade, O., Ojo, M., & Ahsu, V. (2019). The role of internet in the academic performance of students in tertiary institutions. *Journal of Education Research*, 1: 30-35
- Temel, T., & Cesur, K. (2024). The effect of gamified learning monitoring systems on learning behaviour and achievement: A meta-analysis. *Education Sciences*, 3 (1), 56-65.
- Salau, K. (2012). Effects of connectivity & dispersal on interacting. *Journal of Educational Technology*, 22 (6): 88 - 89.
- Simelane-Mnisi, S. (2023). Effectiveness of LMS digital tools used by the academics to foster students' engagement. *Education Sciences*, 13(10), 980. <https://doi.org/10.3390/educsci13100980>
- Smith, M.K. (2013). Introduction to informal education. Retrieved from: <http://www.infed.org>

- org/i-  
intro. htm on 13 July 2016
- Tapscott, S.J. (2005). Teaching & learning with the next generation. *Innovate*, 3 (4), 123-134.
- Ubabuike, C. S. &Oyechi, J. (2025). The effectiveness of interactive distance education technologies in K-12 learning: A meta-analysis. *International Journal of Educational Telecommunications*, 7 (3), 73–88.
- VanLehn, K. (2011). The relative effectiveness of human tutoring, intelligent tutoring systems, and other tutoring systems. *Educational Psychologist*, 46(4), 197–221. <https://doi.org/10.1080/00461520.2011.611369>
- Walkington, C. (2013). Using adaptive learning technologies to personalize instruction: The impact on student learning and engagement. *Journal of Educational Psychology*, 105(4), 932–945. <https://doi.org/10.1037/a0032792>
- Wang, A. I. (2015). The wear out effect of a game-based student response system. *Computers & Education*, 82, 217–227. <https://doi.org/10.1016/j.compedu.2014.11.004>
- Wheeler, S. (2010). Using wikis to promote quality learning outcomes in teacher training (full text). *Learning, Media & Technology*, 34 (1), 1 - 10.
- Yin, C., Song, Y., Tabata, Y., Ogata, H., & Hwang, G.-J. (2021). An artificial intelligence-based learning companion promoting self-regulated learning in STEM education. *Computers & Education: Artificial Intelligence*, 2, 100012. <https://doi.org/10.1016/j.caeai.2021.100012>
- Yusuf, M. O. (2015). Information and communication technology and education: Analyzing the Nigerian National Policy for Information Technology. *International Education Journal*, 6 (3): 3 16-321.
- Zinberg, G.M., Revelle, F, & McDonald, A. (2006). Human nature and models of consumer decision making. *Journal of Advertising*, 21(4): 2-3.