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EDITORIAL

Journal of Innovations in Science Education (JISE) is a Publication of Association of Science Educators Anambra (ASEA). It is publishable both online and offline. The publication is twice a year. It embraces only on science education and innovative ideas. JIES provide an avenue for dissemination of research findings, innovative ideas and practices between researchers, science educators and policy makers in the form of original research, book review, theoretical and conceptual papers which will serve as an important reference for the advancement of teaching, learning and research in the field of science education.

We are grateful to the contributors and hope that our readers will enjoy reading these contributions.

Prof. Josephine N. Okoli
Editor-in-Chief

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IMPACT OF DIGITAL LEARNING PLATFORMS ON STUDENTS' ENGAGEMENT IN CHEMISTRY EDUCATION IN SENIOR SECONDARY SCHOOLS IN ANAMBRA STATE

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Abstract

This study investigated the impact of digital learning platforms on students' engagement in chemistry education in senior secondary schools in Anambra State. The rapid advancement of educational technology has transformed teaching and learning processes, making digital platforms an important tool in science education. However, despite the growing adoption of digital learning tools, students' engagement and performance in chemistry remain a concern in many secondary schools. The study therefore examined how the use of digital learning platforms influences students' behavioral, emotional, and cognitive engagement in chemistry lessons. The study adopted a descriptive survey research design. The population of the study comprised all the senior secondary school students offering chemistry in public secondary schools in Anambra State. A total of 400 students and 50 teachers were sampled from Anambra State. A structured questionnaire titled Digital Learning Platforms and Students' Engagement Questionnaire (DLPSEQ) was used for data collection. Data obtained were analyzed using mean and standard deviation to answer the research questions. Findings from the study revealed that digital learning platforms significantly improve students' interest, participation, collaboration, and understanding of chemistry concepts. The study also found that the use of multimedia resources, virtual laboratories, online quizzes, and interactive instructional materials enhances students' motivation and active involvement during chemistry lessons. However, challenges such as inadequate internet access, insufficient digital devices, poor electricity supply, and limited teacher competence in the use of technology hinder effective implementation. Based on the findings, the study concluded that digital learning platforms positively influence students' engagement in chemistry education in senior secondary schools in Anambra State. The study recommended that government and school administrators should provide adequate digital infrastructure, organize regular ICT training for teachers, and encourage the integration of digital learning tools into chemistry teaching to improve students' engagement and learning outcomes.

Keywords: Digital learning platform, Students' engagement

Introduction

The integration of digital learning platforms into education has transformed teaching and learning processes across the world. In the 21st century, technological advancement has significantly influenced classroom instruction, especially in science education where abstract concepts often require visualization, interaction, and practical engagement. Digital learning platforms such as virtual laboratories, educational applications, online simulations, multimedia resources, and learning management systems have become important tools for improving students' learning experiences and academic engagement in chemistry education. Chemistry is one of the core science subjects taught in senior secondary schools and serves as a foundation for careers in medicine, engineering, pharmacy, and other science-related disciplines. It is seen as an embodiment of other basic sciences (Emendu 2007). However, many students perceive chemistry as difficult because of its abstract nature, mathematical calculations, and lack of adequate practical experiences. Researchers have observed that poor teaching methods, inadequate laboratory facilities, and low student engagement contribute significantly to poor academic performance in chemistry (Wohlfart, Wangner & Wanger, 2023).

Student engagement refers to the level of students' participation, interest, attention, and emotional involvement in the learning process. Engaged students are more likely to participate actively in classroom activities, collaborate with peers, and achieve better academic outcomes. Digital learning platforms promote engagement by providing interactive instructional materials, simulations, videos, animations, and online assessments that make learning more attractive and meaningful. Studies have shown that digital technologies improve students' motivation, conceptual understanding, and participation in chemistry lessons (Ekwe, 2022).

In recent years, schools in Anambra State and other parts of Nigeria have increasingly adopted digital learning tools to improve teaching effectiveness and students' learning outcomes. The introduction of virtual laboratories and multimedia instructional resources has provided alternative methods for teaching chemistry practicals where physical laboratory facilities are inadequate. Ubabuike and Ojechi (2024) found that digital learning tools positively influence students' engagement and retention in public secondary schools in Anambra State. Similarly, Ezeuduji (2025) reported that the use

of Chemlab software enhanced students' understanding, engagement, and practical skills in chemistry education among secondary school students in Anambra State.

Despite the growing importance of digital learning platforms, many secondary schools still face challenges in their implementation. These challenges include inadequate internet connectivity, poor electricity supply, insufficient digital devices, limited ICT infrastructure, and lack of teacher competence in the use of educational technologies. Mofikoya (2024) observed that many Nigerian secondary schools lack sufficient digital devices and trained teachers needed for effective digital learning in chemistry education. Furthermore, inconsistent integration of digital platforms in classroom instruction continues to limit students' opportunities for active participation and collaborative learning.

The COVID-19 pandemic further emphasized the need for digital learning technologies in education. During school closures, many institutions adopted online and blended learning approaches to sustain teaching and learning activities. This situation highlighted the relevance of digital platforms in ensuring continuous access to education and maintaining student engagement. According to Odewumi Falade, Adewan, Akintola, Oputa and Ogumlowo (2020), virtual learning environments improve students' acquisition of chemistry concepts and support independent learning among secondary school students in Nigeria.

Furthermore, digital learning platforms align with constructivist learning theory, which emphasizes active student participation in knowledge construction through interaction and collaboration. Interactive simulations, multimedia resources, and online learning communities enable students to learn at their own pace and develop critical thinking and problem-solving skills. Abdikayumova and Madybekova (2026) noted that AI-enhanced and context-based digital approaches significantly improved students' engagement and achievement in secondary chemistry education.

Although several studies have examined digital learning in education, limited research has focused specifically on the impact of digital learning platforms on students' engagement in chemistry education in senior secondary schools in Anambra State. Therefore, this study seeks to investigate how digital learning platforms influence students' behavioral, emotional, and cognitive engagement in chemistry learning. The

study will also identify the challenges associated with the use of digital learning platforms and suggest strategies for improving technology integration in chemistry education in senior secondary schools.

Statement of the Problem

Despite the growing integration of digital learning platforms into secondary school education, student engagement in chemistry remains a major concern in many senior secondary schools. Chemistry is often perceived by students as difficult, abstract, and highly theoretical, leading to low participation, poor motivation, and reduced academic performance. Traditional teaching methods, which rely heavily on lecturebased instruction and limited practical activities, may not adequately capture students' interest or support active learning. The emergence of digital learning platforms such as virtual laboratories, educational applications, online videos, interactive simulations, and learning management systems has created new opportunities for improving teaching and learning in chemistry education. These platforms are designed to promote interactive learning, collaboration, instant feedback, and access to diverse learning resources. However, despite their increasing availability, it is still unclear to what extent these digital tools effectively enhance student engagement in chemistry among senior secondary school students. In many schools, challenges such as inadequate technological infrastructure, poor internet connectivity, limited teacher competence in the use of digital tools, and unequal access to digital devices may hinder the effective implementation of digital learning platforms. Furthermore, some students continue to show low interest and participation in chemistry lessons even when digital tools are introduced. This raises concerns about whether digital learning platforms truly influence behavioral, emotional, and cognitive engagement in chemistry education. Therefore, this study seeks to investigate the impact of digital learning platforms on student engagement in chemistry education in senior secondary schools, with the aim of determining whether the use of these platforms can improve students' interest, participation, interaction, and overall learning experience in chemistry.

Purpose of the Study

The main purpose of this study is to investigate the impact of digital learning platforms on student engagement in chemistry education in senior secondary schools.
Specifically, the study seeks to;

1. Examine the extent to which digital learning platforms are used in the teaching and learning of chemistry in senior secondary schools
2. Determine the influence of digital learning platforms on students' interest in chemistry education
3. Assess the effect of digital learning platforms on students' classroom participation and interaction during chemistry lessons
4. Investigate the impact of digital learning platforms on students' motivation and active involvement in chemistry learning
5. Identify the challenges associated with the use of digital learning platforms in chemistry education in senior secondary schools
6. Suggest possible strategies for improving the effective use of digital learning platforms to enhance student engagement in chemistry education

Research Questions

The following research questions guided the study;

1. To what extent are digital learning platforms used in the teaching and learning of chemistry in senior secondary schools
2. How do digital learning platforms influence students' interest in chemistry education
3. What effect do digital learning platforms have on students' classroom participation and interaction during chemistry lessons
4. How do digital learning platforms affect students' motivation and active involvement in chemistry learning
5. What challenges are associated with the use of digital learning platforms in chemistry education in senior secondary schools
6. What strategies can be adopted to improve the effective use of digital learning platforms for enhancing student engagement in chemistry education

Results

Research Question 1: To what extent are digital learning platforms used in the teaching and learning of chemistry in senior secondary schools

Table 1: Extent of digital learning platforms used in the teaching and learning of chemistry in senior secondary schools.

Response distribution and weighing: 2.50-4.00 is moderate extent(ME) while 0- 2.49 is little extent (LE). Number: 450

S/N	Items	$\bar{X}$	SD	Remarks
A	**To what extent do you use**			
1	Online Videos	2.80	0.56	ME
2	Virtual laboratory	2.73	0.72	ME
3	Educational applications	2.60	0.62	ME
4	Presentation software	2.55	0.72	ME
5	Learning management system	2.72	0.67	ME
	Cluster Mean	2.68	0.66	ME

Table 1 shows that digital learning platforms are used to a moderate extent in many senior secondary schools. Teachers and students utilize tools such as online videos, virtual laboratories, educational applications, presentation software, and learning management systems to support chemistry lessons. However, the level of usage varies depending on the availability of internet access, digital devices, electricity supply, and teachers' technological competence. In some schools, digital platforms are regularly integrated into classroom instruction, while in others, traditional teaching methods still dominate.

Research Question 2: How do digital learning platforms influence students' interest in chemistry education

Table 2: Influence of digital learning platform on students interest in chemistry education.

Response distribution and weighing: 2.50-4.00 is positive influence (PI); 0-2.499 slightly positive influence (SPI) measure 450.

S/N	Items	$\bar{X}$	SD	Remarks
B	**How the digital learning platform influence students**			
1	Making lesson more interactive	2.98	0.52	PI
2	Making lesson more proactive	2.80	0.66	PI
3	Engaging the students more	2.75	0.72	PI
4	Arose students curiosity	2.82	0.56	PI
5	Making the students to be attentive	3.00	0.57	PI
	Cluster Mean	2.87	0.61	PI

In Table 2, it points that digital learning platforms positively influence students' interest in chemistry education by making lessons more interactive, practical, and engaging. Through animations, simulations, videos, and virtual experiments, students are better able to understand abstract chemistry concepts. These platforms also create enjoyable learning experiences that increase students' curiosity, attention, and enthusiasm toward chemistry as a subject.

Research Question 3: What effect do digital learning platforms have on students' classroom participation and interaction during chemistry lessons

Table 3: Effect of digital learning platform on students' classroom participation and invitation chemistry

Response distribution and weighing: 2.50- 4.00, (Moderately Improved - MI). 0249(Slightly Improved – SI). Number 450.

S/N	Items	$\bar{X}$	SD	Remarks
C	**How the digital learning platform affect students interest**			
1	Helps in students discussion	2.88	0.68	MI
2	Helps in questions	2.90	0.66	MI
3	Helps in his class quizzes	3.25	0.57	MI
4	Helps in collaborating learn	2.95	0.72	MI
5	Helps in research work	2.81	0.67	MI
	Cluster Mean	2.96	0.66	MI

In Table 3, it shows digital learning platforms improve students' classroom participation and interaction during chemistry lessons. Students become more involved in discussions, group activities, quizzes, and collaborative learning tasks when digital tools are used. Interactive features such as online assessments, virtual experiments, and multimedia presentations encourage students to ask questions, share ideas, and actively participate in the learning process rather than remaining passive listeners.

Research Question 4: How do digital learning platforms affect students' motivation and active involvement in chemistry learning

Table 4: Effect of learning digital platform on students' motivation and active involvement in chemistry education.

Response: Distribution and weighing 2.50-400 (moderately motivated - MM) 0-249(slightly moderated - SM). Number 450.

S/N	Digital learning platform	$\bar{X}$	SD	Remark
D	**How digital learning platform affects students'**			
1	By providing immediate feedback	2.82	0.65	MM
2	Provide personalized large opportunities	2.78	0.56	MM
3	Provide infrastructure content	2.80	0.72	MM
4	Make to take greater responsibility	2.72	0.68	MM
5	Make students to participate in chemistry related test	2.65	0.66	MM
	Cluster Mean	2.76	0.65	MM

Table 4 shows that digital learning platforms increase students' motivation and active involvement in chemistry learning by providing immediate feedback, personalized learning opportunities, and interactive content. Students are motivated to learn when lessons are visually appealing and technology-driven. The use of games, simulations, and self-paced learning activities encourages learners to take greater responsibility for their studies and participate actively in chemistry-related tasks.

Research Question 5: What challenges are associated with the use of digital learning platforms in chemistry education in senior secondary schools

Table 5: Challenges associated with the use of digital learning platforms in chemistry education in senior secondary school.

Response distribution and weighing: 2.50-4.00(Agree -A) 0-2.49 (Disagree - DA). Number 450

S/N	Items	$\bar{X}$	SD	Remark
E	**Challenges associated with the use of digital learning platform**			
1	Inadequate access to computer	2.63	0.56	A
2	Poor interest	2.57	0.72	A
3	Invisible electricity supply	3.02	0.66	A
4	Insufficient funding	3.10	0.65	A
5	Lack of technical support	2.98	0.71	A
	Cluster Mean	2.86	.66	A

Table 5 shows that several challenges affect the effective use of digital learning platforms in chemistry education. These include inadequate access to computers and smartphones, poor internet connectivity, unstable electricity supply, insufficient funding, and lack of technical support. Other challenges include limited teacher training in the use of digital tools, resistance to technological change, and unequal access to digital resources among students.

Research Question 6: What strategies can be adopted to improve the effective use of digital learning platforms for enhancing student engagement in chemistry education

Table 6: Strategies to be adopted to improve the effective use of digital learning platform for enhancing students' engagement in chemistry education

Response distribution and weighing 2.50-4.00 (Agree - A); 0-2.49(Disagree - DA). Number 450.

S/N	Items	$\bar{X}$	SD	Remarks
F	**Strategies for improving effective use of digital learning platform**			
1	Improve through adequate computers	2.98	0.56	D
2	Improve through adequate intent factions	2.82	0.72	A
3	Improve through adequate economy supply	2.91	0.66	A
4	Teachers to resume regular training	2.80	0.65	A
5	Schools and government to provide affordable digital learning information	2.78	0.52	A
	Cluster Mean	2.86	0.62	A

Table 6 shows that Effective use of digital learning platforms can be improved through adequate provision of technological infrastructure such as computers, internet facilities, and electricity supply in schools. Teachers should receive regular training on the use of digital tools in chemistry instruction. Schools and government agencies should also provide affordable digital resources and technical support. In addition, integrating interactive and student-centered digital activities into chemistry lessons can further enhance students' engagement, participation, and learning outcomes.

Discussion

The findings of the study revealed that digital learning platforms are used to a moderate extent in the teaching and learning of chemistry in senior secondary schools. This finding indicates that although schools are gradually adopting digital technologies for instructional purposes, their integration is still limited in some learning environments due to infrastructural and technological constraints. Teachers and students make use of online videos, virtual laboratories, educational applications, and learning management

systems to facilitate chemistry instruction. This finding agrees with the study of Mishra, Matthew and Koehler (2006) explained that teachers' technological competence significantly determines the extent to which digital tools are integrated into classroom teaching.

The study further revealed that digital learning platforms positively influence students' interest in chemistry education. Students showed greater enthusiasm and curiosity toward chemistry lessons when interactive digital tools such as simulations, animations, and videos were used. This finding supports the cognitive theory of multimedia learning proposed by Richard and Mayer (2009), which states that students learn more effectively when words, pictures, and interactive media are combined during instruction. The finding is also consistent with the work of Aina (2013), who found that technology-enhanced instruction increases students' interest and understanding in science subjects by simplifying abstract concepts and making learning more engaging.

The findings also indicated that digital learning platforms improve students' classroom participation and interaction during chemistry lessons. Students became more actively involved in discussions, online quizzes, collaborative tasks, and practical activities when digital tools were integrated into instruction. This finding aligns with the constructivist learning theory of Lev Vygotsky (1978), which emphasizes active participation and social interaction in the learning process. The finding is equally supported by Bonwell, James and Eison (1991), who argued that interactive teaching strategies enhance student engagement and participation in classroom learning activities.

Furthermore, the study showed that digital learning platforms positively affect students' motivation and active involvement in chemistry learning. Students were more motivated when lessons involved visually appealing and technology-based activities that provided immediate feedback and opportunities for self-paced learning. This finding is in agreement with the self-determination theory developed by Edward, Deci, Richard and Ryan (2000), which emphasizes that learning environments that support autonomy, competence, and interaction increase learners' intrinsic motivation. The finding also corroborates the study of Muhammad (2018), who reported that digital instructional tools promote active learning and encourage students to take responsibility for their academic progress.

However, the study identified several challenges associated with the use of digital learning platforms in chemistry education. These challenges include poor internet connectivity, inadequate digital devices, unstable electricity supply, insufficient funding, and lack of teacher training. This finding agrees with the report of United Nations Educational, Scientific and Cultural Organization (2021), which noted that many developing countries face infrastructural and technological limitations that hinder effective digital learning implementation in schools. Similarly, Adebayo and Oyelekan (2016) found that inadequate ICT facilities and limited teacher competence negatively affect the successful integration of digital technologies in science education.

Finally, the findings suggested that effective use of digital learning platforms can be improved through adequate provision of technological infrastructure, regular teacher training, technical support, and increased access to affordable digital resources. The study also emphasized the importance of integrating interactive and student-centered learning activities into chemistry lessons. This finding is consistent with the view of Seymour Papert (1993), who maintained that technology enhances meaningful learning when students actively interact with digital resources. In addition, Organisation for Economic Co-operation and Development (2020) emphasized that investment in digital infrastructure and teacher professional development is essential for improving students' engagement and learning outcomes in technology-supported education.

Recommendations

Based on the findings of the study on the impact of digital learning platforms on students' engagement in chemistry education in senior secondary schools, the following recommendations are made:

1. Government should provide adequate digital infrastructure such as computers, tablets, projectors, and reliable internet facilities in secondary schools to support effective digital learning in chemistry education.
2. School administrators should encourage the integration of digital learning platforms into chemistry teaching and learning processes in order to improve students' participation, interest, and understanding of chemistry concepts.
3. Chemistry teachers should receive regular training and workshops on the use of digital learning tools, virtual laboratories, multimedia resources, and online instructional platforms to enhance effective classroom delivery.

4. Teachers should adopt interactive digital teaching methods such as educational videos, simulations, online quizzes, and virtual experiments to increase students' engagement and motivation in chemistry lessons.
5. Parents and guardians should support students by providing access to digital devices and monitoring the effective use of online learning resources at home.

Conclusion

Based on the findings of the study on the impact of digital learning platforms on student engagement in chemistry education in senior secondary schools, it can be concluded that digital learning platforms play a significant role in enhancing students' engagement in chemistry. The study revealed that although the use of digital learning tools is only moderate in many schools due to infrastructural and technological challenges, their integration into chemistry instruction has positively influenced students' interest, participation, motivation, and interaction during lessons. The findings further indicate that digital learning platforms such as simulations, virtual laboratories, educational videos, and learning management systems make chemistry concepts more understandable, practical, and engaging. This has helped to improve students' curiosity and enthusiasm toward the subject. In addition, the use of these platforms has encouraged active learning by increasing classroom participation and promoting collaborative learning experiences among students. However, the study also established that several challenges limit the effective use of digital learning platforms in chemistry education. These include inadequate technological infrastructure, poor internet connectivity, unstable electricity supply, limited funding, and insufficient teacher training. These constraints reduce the level of integration of digital tools in some schools and hinder their full educational benefits.

Overall, the study concludes that digital learning platforms are valuable tools for improving student engagement in chemistry education when properly implemented. Their effectiveness largely depends on the availability of resources, teacher competence, and institutional support. Therefore, strengthening infrastructure, improving teacher training, and ensuring equal access to digital learning resources are essential for maximizing the benefits of digital learning in senior secondary school chemistry education.

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