THE INFLUENCE OF DIGITAL TOOLS IN TEACHING AND LEARNING MATHEMATICS IN SECONDARY SCHOOLS IN OVIA-NORTH EAST LOCAL GOVERNMENT AREA OF EDO STATE

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FACULTY OF EDUCATION

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A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF CURRICULUM AND INSTRUCTIONAL TECHNOLOGY, FACULTY OF EDUCATION, UNIVERSITY OF BENIN, IN PARTIAL FULFILMENT OF THE REQUIRMENT FOR THE AWARD OF BACHELOR OF B.Sc. (Ed) MATHEMATICS DEGREE IN EDUCATION

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CERTIFICATION

We the undersigned, certify that this research work was carried out by **Peter OGHENERUEMU** with the matriculation number **EDU2001451** in the Department of Curriculum and Instructional Technology, Faculty of Education, University of Benin, Benin City, Nigeria in partial fulfilment for the award of B.Sc. Degree in Mathematics Education.

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DEDICATION

This project is dedicated to God Almighty for His unfailing mercies and love and to my parents and loved ones for their unrelenting support throughout my academic journey in the University of Benin, Benin City.

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ABSTRACT

This research study was carried out to examine the influence of digital tools in teaching and learning mathematics in Ovia-North East Local Government Area of Edo State, Benin city. The population size comprises of all students across 174 secondary schools in Ovia-North East Local Government Area, Edo State. The sample size used comprises of 100 respondents across different secondary schools who were validated. Self-constructed and validated questionnaire was used to for data collection. The collected and validated questionnaire were analyzed using mean and standard deviation with the benched score 2.50.

The result of the findings reveals that, students use digital tools such as calculators, GeoGebra, photomath, and watch videos for learning mathematics. The results also revealed that digital tools increase group work and motivate students to engage more in mathematics practices. The research also showed that student's choice of digital tools is greatly influence by the availability of free tools, ease of use, fun and teacher's recommendations. Students also face challenges such as poor internet connection, finding the right digital tools to use, and teacher's level of guidance while using digital tools to learn mathematics.

Government, curriculum planners and stakeholders therefore, must ensure to work collectively with school authorities to provide current and relevant digital tools and free internet connection for learning mathematics in secondary schools. Teachers also should recommend, encourage and assist students using digital tools to learn mathematics.

CHAPTER ONE

INTRODUCTION

Background of the Study

The teaching and learning of mathematics in secondary schools in Ovia North, Edo State, present significant challenges. Many students find mathematics difficult, which is reflected in the high failure rates in exams like the West African School Certificate Examination (WASSCE). Research indicates that digital tools, such as educational software and online resources, can greatly improve student engagement and comprehension. However, integrating these tools into local schools is hindered by issues like inadequate infrastructure, limited teacher training, and insufficient access to technology. These barriers create a gap between students and the practical uses of mathematics, leading to lower motivation and performance. Therefore, investigating the impact of digital tools on mathematics education is crucial for identifying effective strategies to enhance learning outcomes and encourage a more positive attitude toward the subject among students.

Digital tools are defined as “software, programs, applications, platforms, and (online or offline) resources that can be used with computers, mobile devices or other digital devices” that help people complete a task (Smith, 2020,). Digital tools can also be defined as "technological applications that facilitate the collection, analysis, and dissemination of information, enhancing the efficiency and effectiveness of research and educational practices", Adetomiwa, A. (2021). These tools have become important to various fields, particularly in education, where they facilitate teaching and learning processes. Secondary school teachers are using digital tools more and more to enhance mathematics teaching and learning. This change could help address challenges like limited resources and varied student engagement. Interactive whiteboards are important because they allow teachers to show

mathematics concepts visually, making it easier for students to understand. Tools like Google Classroom help organize lessons, share assignments, and improve communication between teachers and students. Online platforms and local resources like EduNigeria offer students with instructional videos and practice exercises that follow the curriculum, allowing students to learn at their own pace in areas like algebra, geometry, and calculus. Software like GeoGebra is also becoming popular, helping teachers demonstrate geometric ideas and boost students' problem-solving skills. Mobile apps are crucial since many students have smartphones, enabling them to practice mathematics anytime and anywhere, which encourages learning outside of school.

Several factors facilitate the effective use of digital tools in learning mathematics. Access to technology, including computers, tablets, and smartphones, ensures that students can engage with these tools anytime and anywhere, while reliable internet connectivity enables the utilization of online resources and virtual classes. Teacher training programs that enhance educators' confidence and ability to integrate technology into their teaching practices are crucial. Furthermore, when digital tools are embedded within the mathematics curriculum, it encourages their use and demonstrates relevance to students. Interactive and gamified learning experiences increase student motivation and participation, making mathematics more appealing, while adaptive learning features allow for personalized instruction that caters to individual needs. Collaborative learning opportunities provided by online discussion forums promote peer interaction and collective problem-solving. The availability of diverse online resources, such as videos and practice exercise, supports various learning styles, and immediate feedback mechanisms on assessments help students identify areas for improvement. Lastly, parental support through digital communication tools can reinforce students' motivation and commitment to their studies. By addressing these factors, educational institutions can create an environment that effectively supports the integration of digital tools in mathematics learning.

According to Adeyemo D.A and Adeyemo A.A (2019), students face several challenges when using digital tools to learn mathematics. These challenges include inadequate access to technology and the internet, which limits their ability to engage with digital resources effectively. Many students also struggle with insufficient digital literacy skills, making it difficult for them to navigate and utilize these tools efficiently. Additionally, the lack of structured guidance and support from teachers can leave students feeling overwhelmed and uncertain about how to approach complex concepts. Other challenges include internet and home or environmental distractions and difficulties in maintaining motivation and focus while learning online. These factors collectively hinder students' ability to fully benefit from the potential of digital tools in mathematics education.

The use of digital tools positively influences students' academic performance in mathematics by enhancing engagement and facilitating a deeper understanding of mathematical concepts. These tools provide interactive and visually stimulating environments that capture students' attention and make learning more enjoyable. By offering personalized learning experiences, digital resources allow students to progress at their own pace, thereby addressing individual learning needs and fostering mastery of challenging topics. Additionally, the immediate feedback and assessment features of digital tools enable students to identify their strengths and weaknesses, promoting self-directed learning. Furthermore, the integration of technology in mathematics education contributes to improved academic outcomes, as students become more motivated and confident in their mathematical abilities.

Digital tools significantly enhance collaborative learning in mathematics by providing platforms that encourage interaction, communication, and joint problem-solving among students. Tools like online discussion forums, collaborative whiteboards, and shared document editors (such as Google Docs) allow students to work together, fostering a sense of community and promoting peer-to-peer learning through

the exchange of ideas and strategies. Educational platforms often facilitate group assignments and projects, making it easier for students to tackle complex mathematical problems collaboratively. Video conferencing tools, like Zoom or Microsoft Teams, further support this collaboration by enabling virtual face-to-face discussions, screen sharing, and live demonstrations of problem-solving processes. Many digital tools include immediate feedback mechanisms that allow students to receive prompt input from peers and teachers, promoting iterative learning and a deeper understanding of mathematical concepts. In addition, the collaborative features of digital could tools enrich the learning experience and help develop skills such as teamwork, communication, and critical thinking, which are crucial for success in mathematics and beyond.

Despite various studies (e.g., NCTM, 2021; Forgasz and Prince, 2022; UNESCO, 2022; Kunar, 2022) demonstrating the clear advantages of integrating digital tools into mathematics instruction, the adoption and effective use of digital technology in Nigerian schools remain challenging. One key issue is the availability of these digital tools and the various factors that influence their usage. Also, teachers' attitudes significantly affect their willingness to implement these tools in the classroom. Additionally, research by Adebayo and Olaniyi (2019) indicates that fears and misconceptions about unfamiliar technologies often prevent effective computer use in educational settings. It is therefore a necessity to investigate the influence of digital tools in learning mathematics.

Statement of the Problem

Despite the transformation digital tools could have brought to mathematics education by improving access to resources and fostering interactive learning environments, their effective implementation faces significant challenges. Issues such as limited internet access and digital device availability in rural areas create disparities in learning opportunities. Additionally, many educators lack the training necessary to integrate technology into their teaching, resulting in underutilization of resources. The distractions posed by social media and concerns over cybersecurity further complicate the learning process. These challenges underscore the urgent need for the integration of digital tools in mathematics education, particularly in secondary schools in Ovia-North East, Edo State.

Research Questions

The following question were raised to guild the study.

1. What digital tools do secondary school students use in learning mathematics?
2. what factors influence the choice of digital tools in learning mathematics?
3. What challenges do students face when using digital tools to learn mathematics in secondary schools?
4. How does the use of digital tools influence students' academic performance in mathematics?
5. To what extent do digital tools facilitate collaborative learning in mathematics?

Purpose of Study

This research study seeks to explore the factors that affect how secondary school students use digital tools for learning mathematics. The study specifically aims to achieve the following objectives:

1. Find out the digital tools that are used by students in secondary schools for learning mathematics.
2. Investigate the factors influencing the choice of digital tools in learning mathematics.

3. Examine the challenges that students face when using digital tools to learn mathematics.
4. Investigate how the use of digital tools impact students' academic performance in mathematics.
5. Examine the extent to which digital tools facilitate collaborative learning in mathematics.

Significant of The Study

The study investigates the different factors that affect the use of digital tools for learning mathematics in secondary schools. The researcher expects that the findings will highlight the many advantages of using technology and digital resources in secondary education.

Teachers will find the study particularly valuable as it will enhance their understanding of how to effectively incorporate digital tools into mathematics instruction, while also fostering a more positive attitude towards these resources.

Students stand to gain from improved learning outcomes in mathematics, as digital tools offer interactive and engaging learning experiences. Furthermore, the use of technology in the classroom could help students develop essential digital literacy skills which are required on daily basics.

Administrators will benefit from the findings as they can inform the development of policies and practices regarding technology use in mathematics education.

Researchers may gain new perspectives on the effectiveness of digital tools in teaching mathematics.

Scope of the Study

The study will focus on secondary schools in Ovia North-East Edo State, examining the influence of digital tools in the context of mathematics education. It will include an analysis of various digital tools. The research will explore how digital tools are integrated into the mathematics curriculum and their impact on students' understanding of Mathematics.

Definition of Terms

The following terms are operationally defined as used in the study.

Influence

Influence refers to the factors shaping teachers' instructional approaches, including personal beliefs, professional development, and resource availability.

Digital Tools

These are electronic resources that support mathematics education, such as software, online platforms, and interactive whiteboards that enhance student engagement.

Social media

These are online platforms for creating and sharing content, serving as a tool for professional development, collaboration among educators, and interactive student engagement in mathematics.

CHAPTER TWO

LITERATURE REVIEW

Introduction

This chapter revealed the literature review of the study under the following sub-headings:

The concept of digital tools in learning mathematics

Types of digital tools for learning mathematics

Factors affecting the selection of digital tool for learning mathematics

Challenges of using digital tools in learning mathematics

Impacts of digital tools on mathematics achievement

The role of digital tools in enhancing collaborative learning in mathematics

Summary of reviewed literature

The concepts of digital tools in learning mathematics

he use of digital tools in teaching mathematics is becoming more important in Nigeria education system, especially in Edo State, where schools are working to improve teaching and learning. Digital tools include different types of technology, such as apps, websites, and interactive devices, that help students learn math. These tools range from simple calculators to advanced software like GeoGebra. Studies show that digital tools make learning more interesting and motivate students (Adefuye et al., 2021). They also help students understand math better by turning difficult ideas into clear pictures. For example, geometry software allows students to move shapes and see changes in real-time (Ogunleye, 2020).

Digital tools also support learning at different speeds, allowing students to study at their own pace (Ogunleye, 2020). However, some problems make it hard to use these tools properly. Many students do not have access to devices or the internet (Adefuye et al., 2021). Also, some teachers do not have enough training to use technology in their lessons (Ogunleye, 2020). There is also a concern that students might rely too much on technology and struggle to solve problems on their own (Adefuye et al., 2021). To make the best use of digital tools, teachers need to adjust their teaching methods and include technology in a way that supports teamwork and project-based learning (Ogunleye, 2020). In conclusion, digital tools are very useful in teaching mathematics in Nigeria, especially in Edo State. They help students stay engaged, understand better, and learn at their own pace. However, challenges like lack of access and teacher training must be solved to fully benefit from these tools.

Types of Digital Tools for Learning Mathematics

Digital tools help students learn mathematics in different ways, making lessons more engaging and easier to understand. One type of digital tool is computer software and applications, which allow students to interact with math concepts. Examples include GeoGebra, Desmos, and MATLAB. GeoGebra helps students learn algebra, geometry, and calculus by letting them explore and build mathematical objects on the screen (Hegedus & Moreno-Armella, 2019). Desmos is an online graphing calculator that helps students draw graphs, solve equations, and understand coordinate geometry (Drijvers et al., 2020). These tools make difficult math ideas clearer and easier to visualize. MATLAB, on the other hand, is mainly used in higher education for complex calculations, simulations, and problem-solving (Higham & Higham, 2016).

Another category is online platforms and virtual learning environments, which help students learn at their own pace and improve collaboration. Websites like Khan Academy, Coursera, and Edmodo offer

structured lessons, video tutorials, and practice exercises to match students' learning speeds (Li & Ma, 2010). These platforms allow students to review lessons anytime and get instant feedback. Learning management systems (LMS) like Moodle and Google Classroom organize digital resources, tests, and discussion boards to make learning more interactive (Bonk & Graham, 2012). AI-powered tutoring programs like Carnegie Learning and DreamBox personalize lessons by adjusting to students' progress, helping them strengthen problem-solving skills (VanLehn, 2011). These tools make math education more accessible, especially for students in remote or disadvantaged areas (Magen-Nagar & Cohen, 2017).

A third type of digital tool includes physical and interactive devices like graphing calculators, smartboards, and augmented reality (AR) applications. Graphing calculators such as the TI-84 and Casio fx-series are widely used in schools and universities to help students work with functions and statistics (Ellington, 2003). Smartboards, like those from Promethean and SMART Technologies, allow teachers to visually explain math problems and create interactive lessons (Hwang et al., 2012). Augmented reality apps, like AR Math and GeoGebra AR, let students see 3D math objects and explore real-world math applications in an exciting way (Cai et al., 2021). These tools make learning more engaging, encourage teamwork, and improve understanding. In general, digital tools play a big role in making mathematics education more interactive, accessible, and personalized, but their success depends on how well they are used and how prepared teachers are to incorporate them into lessons.

Factors Affecting the Selection of Digital Tools for Learning Mathematics

The selection of digital tools for learning mathematics in Nigeria depends on many factors, including school infrastructure, teacher skills, and how well the tools fit into the school curriculum. These factors

influence how effectively students and teachers can use technology to improve mathematics education. Without the right support, digital tools may not be used properly, limiting their benefits.

School Infrastructure and Availability of Resources:

One major factor affecting the choice of digital tools is the availability of technology in schools. Many schools in Nigeria lack basic facilities such as computers, projectors, or reliable internet access, which makes it difficult to use digital tools for teaching mathematics. According to Oladimeji et al. (2019), cultural beliefs do not significantly influence the use of technology in mathematics education, but the presence of technology in schools plays a key role. Schools that have access to computers, smartboards, and educational software are more likely to integrate digital tools into their lessons. However, in rural areas where electricity and internet services are unreliable, teachers and students struggle to access these resources. To improve the selection and use of digital tools, schools need better funding and investment in technological infrastructure. Without these improvements, many students will continue to miss out on the benefits of digital learning.

Teacher Skills and Training in ICT Tools:

Another important factor is how well teachers can use digital tools. Even if schools provide computers and software, teachers may not use them effectively if they do not have proper training. A study by Ameen, Adeniji, and Abdullahi (2019) in Ilorin found that both teachers and students use ICT tools, but many of them lack the necessary skills to make the most of these tools. This problem is made worse by the fact that many teachers were not trained in digital learning during their education. If teachers do not feel confident using technology, they may avoid it altogether or use it in a way that does not fully

support student learning. Providing workshops and training programs for teachers is essential for improving their ability to use digital tools effectively in mathematics education. Schools and government agencies should invest in professional development programs to help teachers gain the necessary skills.

Curriculum Alignment and Cultural Perceptions:

The way the school curriculum is designed also affects which digital tools teachers choose. If a digital tool does not fit well with the topics covered in the curriculum, teachers may not see the need to use it. According to research on Nigeria's mathematics education challenges, an outdated curriculum can make learning difficult for students, reducing their interest in mathematics. Some schools may also struggle to find digital tools that match their teaching goals. Additionally, cultural factors may play a role in the adoption of technology. In some parts of Nigeria, there is a belief that technology-related fields are more suited for men than women, which may discourage female students from engaging with digital learning tools. To make digital learning more effective, the curriculum should be updated to include modern teaching methods, and schools should encourage all students, regardless of gender, to participate in digital learning. Furthermore, the choice of digital tools for learning mathematics in is influenced by multiple factors, including school infrastructure, teacher training, and how well the tools fit into the curriculum. Without proper technology, students and teachers cannot fully benefit from digital learning. Similarly, if teachers do not receive the right training, they may not use digital tools effectively. Finally, the curriculum and cultural beliefs also play a role in determining which tools are used in schools. To improve mathematics education in Nigeria, it is essential to invest in better infrastructure, provide teacher training, and update the curriculum to support modern teaching methods.

Challenges of Using Digital Tools in Learning Mathematics

The use of digital tools in learning mathematics presents several challenges that can hinder effective teaching and learning. One significant challenge is the lack of access to technology. Many schools in Ovia-North East, Edo State, especially those in rural or underprivileged areas, struggle with limited access to computers, tablets, and a reliable internet connection. This situation creates a digital divide, where only students in well-resourced schools can fully benefit from digital learning tools. Research by Omoregie (2019) highlights that this disparity can lead to unequal learning opportunities, as students without access may fall behind their peers who have the resources to engage with digital tools. According to Adedoyin and Soykan (2020), this issue is widespread, affecting not just mathematics education but also other subjects, limiting overall student performance and engagement. Ensuring that all students have access to the necessary technology is crucial for leveling the playing field in education.

Another challenge is inadequate training for teachers. Many educators in Nigeria may not have received comprehensive training on how to effectively integrate digital tools into their teaching practices. Aigbavboa and Thwala (2021) note that without proper training, teachers may feel overwhelmed when trying to use technology in the classroom. This lack of confidence can lead to underutilization of available tools, meaning that students miss out on potential learning benefits. Additionally, teachers might struggle to adapt their traditional teaching methods to incorporate digital tools effectively. Research by Balogun (2019) found that many teachers express a desire for more training and professional development opportunities specifically focused on technology integration. When teachers are not adequately prepared, it can create a barrier to the successful implementation of digital resources in mathematics education.

Technical issues also present a significant barrier to the effective use of digital tools. Frequent problems such as software glitches, slow internet connections, and outdated hardware can disrupt lessons and frustrate both teachers and students. Osokoya (2021) highlights that these technical difficulties can waste valuable instructional time, leading to disengagement among students. For example, if a teacher plans a lesson around an interactive tool but it fails to work due to a poor internet connection, the lesson's effectiveness is compromised. This can discourage students from wanting to use digital tools in the future. In a broader context, a study by Udo and Ogbebor (2021) indicates that many schools in Nigeria face persistent technical challenges that hinder the integration of technology in education, further exacerbating the problem.

Lastly, there is the challenge of student readiness and motivation. Not all students come to the classroom with the same level of comfort or skill when it comes to using digital tools. Some may lack the necessary digital literacy skills to navigate software or online platforms effectively. Ijeoma (2020) emphasizes that students' motivation to learn can also vary widely; if they do not see how digital tools relate to their learning or if they find them too complicated, they may not engage fully. This lack of engagement can lead to superficial understanding of mathematical concepts, as students may not invest the effort needed to explore the tools deeply. According to a study by Ehiametalor (2020), fostering a positive attitude toward technology among students is essential, as it can significantly enhance their learning experiences. Schools need to provide support and encouragement to help students develop the necessary skills and motivation to use digital tools effectively.

Impact of Digital Tools on Mathematics Achievement

The use of digital tools in mathematics education has become increasingly important, especially in Nigeria, including Ovia-North East Edo. The impact of these tools on students' achievement in mathematics is significant, as they can enhance engagement, improve understanding of concepts, and boost overall performance. This literature review draws on research from various scholars in Benin particularly from Ovia-North East, highlighting the positive effects of digital tools on students' mathematics achievement.

One major benefit of digital tools is their ability to increase student engagement. Research by Ehiametalor (2020) shows that using interactive software and educational games can make learning mathematics more enjoyable for students. These tools create an exciting learning environment that encourages students to participate actively. For example, platforms like Kahoot! And Quizizz allow students to compete in fun quizzes, which can motivate them to learn. Ehiametalor found that students who used these digital tools showed higher interest in mathematics compared to those who learned through traditional methods. This increased engagement is crucial because when students are more interested in a subject, they are more likely to invest time and effort into mastering it, leading to better academic performance.

In addition to enhancing engagement, digital tools help students understand complex mathematical concepts more easily. Research by Ijeoma (2020) indicates that visual aids and simulations can clarify difficult topics. For instance, using tools like GeoGebra allows students to see how changing one part of a mathematical equation affects the whole, making abstract concepts more concrete and relatable.

Ijeoma found that students who engaged with these tools performed better in problem-solving tasks. This aligns with the findings of Osokoya (2021), who emphasized that when students can visualize and interact with math concepts, they develop stronger reasoning skills. The ability to experiment with different variables in a digital environment encourages students to think critically about mathematics and enhances their overall understanding.

Moreover, digital tools have been linked to improved academic performance in mathematics. A study by Udo and Ogbebor (2021) examined students' test scores in mathematics and found that those who used digital learning tools consistently scored higher than their peers who did not. The personalized learning experiences offered by these tools allow students to progress at their own pace, helping them master concepts before moving on to more challenging material. For example, programs like Khan Academy offer tailored practice problems, enabling students to focus on areas where they need more help. This immediate feedback helps students recognize their strengths and weaknesses, allowing them to improve their skills over time.

Despite the many advantages of digital tools, some challenges still exist. Research by Omoregie (2019) highlights that access to technology can be a barrier, especially in rural areas where schools may lack computers or reliable internet. Additionally, teacher training is crucial for ensuring that digital tools are used effectively. Ijeoma (2020) points out that many teachers may not feel confident using technology in their lessons due to a lack of training. This means that even when digital tools are available, their impact may be limited if teachers are not equipped to integrate them into their teaching. Omoregie emphasizes the need for professional development programs that focus on training teachers to use these tools effectively, which is essential for maximizing their benefits in the classroom.

Role of Digital Tools in Enhancing Collaborative Learning in Mathematics

Collaborative learning in mathematics involves students working together to solve problems, share ideas, and deepen their understanding of mathematical concepts This literature review examines studies focusing on the integration of Artificial Intelligence (AI), Information Technology (IT), digital games, online learning platforms, collaborative tools in secondary education, and mathematics competitions in fostering collaborative learning in mathematics.

Artificial Intelligence (AI) in Mathematics Learning

In 2024, Solomon Ifeanyi Oliweh and Happy Evawere Ugo from the University of Benin explored the impact of AI on digital learning and assessment in secondary school mathematics. Their study revealed that AI-powered platforms can personalize learning experiences by adapting lessons to individual student needs and automating grading processes, thereby assisting teachers in efficient assessment. This personalization fosters collaboration, as students engage together on AI-generated problems suited to their learning levels. The researchers recommend investing in high-quality AI-driven learning platforms and providing teacher training to maximize the benefits of AI in mathematics education.

Information Technology (IT) Enhancing Student Perception and Achievement

Esther N. Odafe and Annie O. Egwali, also from the University of Benin, conducted a study in 2022 examining the effect of IT on students' perceptions and achievements in mathematics. They implemented an e-learning program that included online video tutorials and interactive databases. Findings indicated that students utilizing these IT tools demonstrated improved understanding and

higher achievement in mathematics compared to those relying solely on traditional methods. The interactive nature of IT tools encouraged collaborative learning, as students worked together to discuss concepts and solve problems. The study emphasizes the need for continuous integration of IT into the mathematics curriculum to promote collaboration and enhance academic performance.

Digital Games as Collaborative Learning Tools

Digital games are effective tools for teaching mathematics. These games create an engaging and interactive learning environment, motivating students to collaboratively explore mathematical concepts. When students participate in educational games together, they discuss strategies, solve problems as a team, and learn from each other's perspectives. This collaborative gaming approach helps demystify complex mathematical ideas and reduces anxiety associated with the subject. Scholars advocate for the integration of more game-based learning tools in mathematics classrooms to foster engagement and teamwork.

Online Learning Challenges and Collaborative Solutions

The COVID-19 pandemic necessitated a shift to online learning, presenting challenges, particularly in mathematics education. A study highlighted that student faced difficulties due to limited access to digital resources and reduced interaction with peers and instructors. To address these issues, the study suggests enhancing collaborative online tools and ensuring that both students and teachers are adequately trained to use these platforms effectively. By doing so, students can engage in virtual collaboration, share ideas, and support each other's learning, even in remote settings.

Digital Collaborative Tools in Higher Education

Research on tertiary students examined the use of online collaborative tools such as forums, chat rooms, and shared digital workspaces. The findings indicate that these tools positively influence students' academic performance in mathematics. Collaborative online platforms enable students to tackle complex problems collectively, share diverse perspectives, and develop a deeper understanding of mathematical concepts. The study recommends that higher education institutions incorporate these collaborative tools into their teaching methodologies to promote teamwork and enhance learning outcomes.

The integration of digital tools in mathematics education in Ovia-North East Benin, has enhanced collaborative learning. Technologies such as AI, IT applications, digital games, and online collaborative platforms have transformed traditional learning environments into interactive spaces that promote active student engagement and peer collaboration. To maximize the effectiveness of these tools, it is essential to provide adequate training for educators and students, ensure access to necessary digital resources, and develop supportive policies that encourage the adoption of digital tools in educational settings. Embracing digital transformation in education can make mathematics learning more engaging, inclusive, and effective for students in Ovia-North East, Edo.

Summary of Literature Reviewed

The reviewed studies explain that digital tools are technology-based resources that help in learning mathematics. These tools include basic ones like calculators and educational apps, as well as more advanced tools like AI-powered platforms. They can be grouped into categories such as visualization tools (e.g., GeoGebra, Desmos), calculation tools (e.g., Wolfram Alpha, MATLAB), and assessment tools (e.g., Kahoot, Google Forms). Choosing the right tool depends on factors like how well it fits the

curriculum, ease of use, student interest, and teacher skill level. However, some studies do not clearly organize or classify these tools, making it hard to compare their effectiveness.

Research also discusses the challenges of using digital tools in learning mathematics. Some problems include lack of access to technology, teachers not being trained to use the tools properly, and students struggling with new platforms. Poor internet and technical issues can also interrupt learning. Even though digital tools generally help students understand mathematics better and improve their problem-solving skills, some studies do not consider the downside, like students becoming too dependent on technology and not thinking critically when tools provide direct answers.

Another important topic is how digital tools support teamwork in learning math. Online platforms, interactive whiteboards, and group problem-solving apps help students share ideas and work together. These tools make learning more interactive and encourage discussions outside the classroom. However, some studies do not focus on the fact that not all students have equal access to technology, which can create learning gaps. Overall, digital tools make learning math easier and more engaging, but more research is needed to make sure all students can benefit equally. It is in view of these short comings and oversight that this research study holds.

CHAPTER THREE

METHODOLOGY

Introduction

This chapter shows the research method and procedures used in carrying out the research study. The description of the procedures falls under the following subheadings:

Design of the Study

Population of the Study

Sample and Sampling Technique

Research Instrument

Validity of the Instrument

Reliability of the Instrument

Method of Data Collection

Method of Data Analysis

Design of the Study

Research design refers to the structured plan or framework that guides a study, ensuring that all components work together systematically to address the research problem. It specifies the approach for gathering, analyzing, and interpreting data to produce reliable and valid results. For the purpose of this research, we will use a survey design. It is chosen because the study is descriptive in nature and the purpose is to ascertain answer to the research questions generated in the study.

Population of the Study

The study's population will include all 174 secondary schools in the Ovia-North East Local Government Area of Edo State, Benin.

Sample and Sampling Technique

A simple random sampling method was employed to select participants from the population. This approach ensures that every individual has an equal probability of being chosen, aligning with the core principle of probability sampling. The selection process involved assigning a number to each member on the population list and using a random number to determine the sample. In total, 100 secondary school students from ten different schools were randomly chosen. The sample included 15 students from School A, 15 students from School B, 10 students from School C, 5 students from School D, 10 students from School E, 5 students from school F, 10 students from school G, 15 students from school H, 5 students from school I and 10 students from school J.

Research instrument

The research instrument is a structured questionnaire designed by the researcher. The instruments are divided into two sections: Section A and B. section A contains particulars of the respondents (demographic data) such as Class, age and gender. While Section B contains several items. The twenty (20) items contained in the questionnaire revolves round the research questions raised in chapter one of

this study. The response is categorized into the following: Strongly Agree (SA), Agree (A), Strongly Disagree (SD), Disagree (D).

Validity of the Instrument

To ensure the content validity of the instrument, the draft result sheet was presented to the project supervisor for evaluation and validation. Upon receiving the supervisor's approval, the final result sheets were collected and used for data analysis.

Method of Data Collection

With the principals' permission, the researcher visited the schools to distribute the questionnaire to secondary school students. The respondents were assured of confidentiality and encouraged to answer the questions honestly and to the best of their knowledge. Clear instructions were provided on how to complete the questionnaire, which was collected on the same day to prevent any risk of loss.

Method of Data Analysis

The data collected from the questionnaire were properly organized and tabulated. The responses were analyzed using the frequency tables and mean scores, which provided answers to the research questions. In analyzing the data collected, a mean score was used to achieve this. The four-point rating scale will be given values as follows:

SA = Strongly Agree 4

A = Agree 3

D= Disagree 2

SD = Strongly Disagree 1

Decision Rule:

To ascertain the decision rule; this formula was used

Total score 4+3+2+1 =10

Mean score 10/4= 2.5

Any score that was 2.5 and above was accepted, while any score that was below 2.5 was rejected.

Therefore, 2.5 was the cut-off mean score for decision taken.

CHAPTER FOUR

PRESENTATION OF RESULTS AND DISCUSSION OF FINDINGS

This chapter focuses on presentation and discussion of results obtained from the research carried out by the researcher.

PRESENTATION OF RESULTS

Research Question One:

What digital tools do secondary school students use in learning mathematics?

Table 1: Mean and standard deviation on the types of digital tools secondary school students use in learning mathematics.

S/N	Items	N	Mean	S. D	Decision
1.	**I use math apps like photomath and GeoGebra to study**	100	2.36	.21	Disagree
2.	**Watching online videos helps me understand math better**	100	3.22	2.71	Agree
3	**I use digital calculators to solve math problems.**	100	3.18	2.66	Agree
4	**Websites like Khan Academy help me improve in math**	100	2.23	.19	Disagree
	Ground Total	100	3.20	0.49	Agree

Benchmark: 2.50

Table 1 summarizes the responses of the respondents to research question one. The respondents generally agreed that students use **mathematics applications like photomath and GeoGebra, watching online videos, use digital calculators and visit websites like Khan Academy when learning mathematics (Mean = 3.20; S.D = 0.49).**

Research Question Two:

What factors influence the choice of digital tools in learning mathematics?

Table 2: Mean and standard deviation on factors that influence the choice of digital tools in learning mathematics.

S/N	Items	N	Mean	S. D	Decision
1.	I choose digital tools based on how easy they are to use.	100	3.32	2.27	Agree
2.	I use digital tools that my teachers recommend.	100	2.33	1.04	Disagree
3	The availability of free digital tools influences my choice.	100	2.87	.39	Agree
4	I prefer digital tools that make math more fun and interactive.	100	3.20	2.68	Agree
	Ground Total	100	3.06	1.25	Agree

Benchmark: 2.50

Table 2 shows the summary of factors that influence student's choice of digital tools in learning mathematics. The respondents generally agreed that the following factors affects student's choice of digital tools in learning mathematics. The ease of digital tools, teacher's recommendations, availability of free digital tools, more fun and interactive tools (Mean = 3.06; S. D=1.25).

Research Question Three:

What challenges do students face when using digital tools to mathematics in secondary schools?

Table 3: Mean and standard deviation on the challenges students face when using digital tools to learn mathematics in secondary schools.

S/N	Items	N	Mean	S. D	Decision
1.	I struggle to find the right digital tools for learning math	100	3.10	2.57	Agree
2.	Some digital tools are too difficult to use	100	3.11	2.58	Agree
3	Unstable internet connectivity hinders the use of digital tools	100	3.28	2.77	Agree
4	I struggle with math concepts without teacher guidance	100	3.11	2.58	Agree
	Ground Total	100	3.15	0.17	Agree

Benchmark: 2.50

From the results of the research in table 3, the respondents agreed that students face challenges such as finding the right digital tools, some digital tools are too difficult to use, unstable internet connectivity and struggle with mathematics concepts without teacher guidance (Mean = 3.15; S. D = 0.17)

Research Question Four:

How does the use of digital tools influence students' academic performance in mathematics?

Table 4: Mean and standard deviation on the influence of digital tools on academic performance in mathematics.

S/N	Items	N	Mean	S. D	Decision
1.	Using digital tools helps me solve math problems more easily	100	3.26	2.75	Agree
2.	Digital tools improve my understanding of math concepts	100	2.74	.41	Agree
3	I perform better in math when I use digital learning tools	100	3.15	2.60	Agree
4	Digital tools make math practice more effective for me	100	3.05	2.51	Agree
	Ground Total	100	3.17	0.25	Agree

Benchmark: 2.50

From the table 4 above, the respondents agreed that using digital tools helps students solve mathematics problems more easily, improve understanding of mathematics concepts, perform better in mathematics, and digital tools make mathematics practice more effective for students (Mean = 3.17; S. D = 0.25)

Research Question Five:

To what extent do digital tools facilitate collaborative learning in mathematics?

Table 5: Mean and standard deviation on the extent digital tools facilitate collaborative learning in mathematics.

S/N	Items	N	Mean	S. D	Decision
1.	Digital tools make it easier for me to work with classmates on math	100	3.33	2.82	Agree
2.	Using digital tools makes group work in math more interesting to me	100	3.05	2.43	Agree
3	Digital tools help me share math solutions with others more easily	100	3.24	2.73	Agree
4	I feel more motivated to work with others in math when using digital tools	100	3.13	2.60	Agree
	Ground Total	100	3.24	0.29	Agree

Benchmark: 2.50

Table 5 shows the summary of responses to research question five. The respondents generally agree with item one to item four, that digital tools make it easier for students to work with classmates, makes group work in mathematics more interesting, help students share math solutions with others more easily and students are motivated to work with others in mathematics when using digital tools (Mean = 3.24; S. D = 0.29).

DISCUSSION OF FINDINGS

The results across the five research questions raised, examined the influence of digital tools in learning mathematics in secondary school in Ovia-North East, Edo State.

Research question one aimed at examining the digital tools students use in learning mathematics. From the result of the research, the participants generally agreed that, **watching online videos help students understand mathematics better and that** they use digital tools like calculators to solve mathematics problems (Mean = 4.20; S.D = 0.49). However, few respondents disagree with the use of mathematics applications such as photomaths and GeoGebra (Mean = 2.36; S.D = .21), and **websites like Khan Academy do not help in mathematics (Mean = 2.23; S.D = .19).** A study by Martínez (2016) and Ferman, B., Finamor, L., & Lima, L. (2019) found out that, GeoGebra and Khan Academy positively impacted student's achievement in mathematics however, these tools are not common among secondary school students.

Research question two reveals the factors that influence the choice of digital tools among mathematics students. From the research discovery, the respondents generally agreed that factors such as, easy of digital tools, teacher's recommendations, availability of free digital tools, fun and interactive tools influence student's choice of digital tools (Mean = 3.06; S. D=1.25). However, few respondents disagree

that students use digital tools that teachers recommend (Mean = 2.33; S.D = 1.04). this is supported by the research work of Cochrane (2010), Yao and Zhao (2022) and Drijvers et al. (2018), these studies revealed that while students generally prefer user-friendly and engaging tools, the influence of teacher recommendations varies, with some students prioritizing personal preferences. Access to free tools is crucial, as financial constraints can limit choices.

Research question three focuses on the challenges students face when using digital tools in learning mathematics in secondary schools. Respondents generally agreed that students face challenges such as finding the right digital tools to use, unstable internet connectivity, struggle with mathematics concepts without teacher guidance and some digital tools are too difficult to use (Mean = 3.15; S.D = 0.17).

Research question four examines the influence of digital tools on students' academic performance in mathematics. From the findings, respondents generally agreed that using digital tools helps students to solve mathematics problems more easily, improve students understanding of mathematics concepts and make mathematics practice more effective to secondary school students. The results also show that, students perform better in mathematics when learning with digital tools (Mean = 3.17; S.D = 0.25). These findings are in line with Mbah et al. (2023) research discovery. The study reveals that the interactive nature of digital tools makes learning more engaging and effective, providing immediate feedback and diverse strategies for practice.

Research question five sought to examine the extent to which digital tools facilitate collaborative learning in mathematics. The respondents generally agreed that digital tools make it easier for students to work collectively with classmates, makes group work in mathematics more interesting to students, facilitate sharing of mathematics solutions among students more easily and collaborative learning among students (Mean = 3.24; S.D = 0.29).

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

This study investigated the influence of Digital Tools in learning mathematics. Five research questions were raised to guild the study. These questions provided insights to type, factors, challenges, influence and the extent to which digital tools facilitate collaborative learning of mathematics among students. The design of the study comprises of all students across different schools in Ovia-North East Local Government Area, Edo State. Simple random sampling technique was used to select all 100 respondents and structured questionnaire was used to retrieve the data. The benched score is 2.50, any mean score below it was rejected (disagreed) and any mean above 2.50 was accepted (agreed).

The findings of the study were as follows;

1. Students use digital tools like Photomath, GeoGebra, calculators and videos for solving mathematics problems.
2. Students' choice of digital tools for learning mathematics is influenced by the ease of use of the tools, teacher recommendations, the availability of free digital resources, and the presence of fun and interactive features
3. Students struggle to find the right digital tools, some tools are too difficult to use, unstable internet connectivity hinders the use of digital tools and students struggle with mathematics concepts without teacher guidance
4. Digital tools help students to solve mathematics problems more easily, improve understanding, help students perform better and makes mathematics practices more effective.

5. Digital tools encourage collaborative learning, ease sharing of mathematics solutions, makes group work more interesting and increases motivation among students.

Conclusion

This study has provided valuable insight into the influence of Digital Tools in Learning Mathematics. The findings proved that students use digital tools like photomath, GeoGebra, calculators and videos to learn mathematics. This choice is influenced by factors such as the availability of free tools, ease and fun features these tools provide. The study also proved that digital tool encourages group learning, facilitate students' engagement in mathematics and sharing of solutions among students. However, challenges persist such as struggle to find the right digital tools, difficulty in using these tools, unstable internet connection, and lack of teacher's support.

Recommendations

1. Mathematics teachers should be trained on how to use relevant digital tools to assist students in learning mathematics.
2. Government, schools and stakeholders should invest in providing relevant digital tools for learning mathematics.
3. Government, schools and stakeholders should provide free internet for students, to help them access digital tools for learning mathematics.
4. Schools should encourage students to use digital tools in learning mathematics by integrating these tools into the classroom.

5. Mathematics curriculum should be updated to include recent and relevant digital tools for teaching and learning mathematics.

Suggestions for further studies

1. Investigate the level of digital literacy among mathematics students.
2. Examine students' attitude towards distance learning using digital tools.
3. Investigate the complexity of digital tools used in learning mathematics.
4. Investigate the academic performance of students who use digital tools to learn mathematic.
5. Investigate the issue of digital equality among students.

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FACULTY OF EDUCATION

DEPARTMENT OF CURRICULUM AND INSTRUCTIONAL TECHNOLOGY

QUESTIONNIER

Instructions for Completing the Questionnaire

Dear Respondent,

Thank you for taking part in this research on **The Influence of Digital Tools in Teaching and Learning Mathematics**. Your responses are valuable in understanding their impact on mathematics education.

Please read each statement carefully and select (tick) the response that best reflects your experience:

- **Strongly Agree (4)**
- **Agree (3)**
- **Disagree (2)**
- **Strongly Disagree (1)**

Your honest feedback is important — there are no right or wrong answers. All responses will remain confidential and used solely for research purposes.

Statements and Responses:

Statement	Strongly agree	Agree	Strongly disagree	Disagree
(a) Digital tools used in learning mathematics				
I use math apps like photomath and GeoGebra to study				
Watching online videos helps me understand math better				
I use digital calculators or tools to solve math problems.				
Websites like Khan Academy help me improve in math				
(b) factors influence the choice of digital tools in learning mathematics				
I choose digital tools based on how easy they are to use				
I use digital tools that my teachers recommend				
The availability of free digital tools influences my choice				
I prefer digital tools that make math more fun and interactive				
(c) challenges students face when using digital tools to learn mathematics				
I struggle to find the right digital tools for learning math				
Some digital tools are too difficult to use				
Unstable internet connectivity hinders the use of digital tools				
I struggle with math concepts without teacher guidance				
(d) Digital tools influence on students' academic performance in mathematics				
Using digital tools helps me solve math problems more easily				

Digital tools improve my understanding of math concepts				
I perform better in math when I use digital learning tools				
Digital tools make math practice more effective for me				
(e) Extent to which digital tools facilitate collaborative learning in mathematics				
Digital tools make it easier for me to work with classmates on math				
Using digital tools makes group work in math more interesting to me				
Digital tools help me share math solutions with others more easily				
I feel more motivated to work with others in math when using digital tools				