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Abstract

Digital tools have become integral devices for teaching and learning in today's education system. The use of digital devices in the classroom has been linked to enhanced student engagement and improved learning outcomes. However, the successful integration of digital devices into the educational process relies heavily on the teachers' self-efficacy. This study, therefore, investigates the teachers' level of self-efficacy and utilization of digital tools in mathematics instruction. The study adopted the descriptive survey research design. The design exploited mostly quantitative approach. Population of the study consisted of one hundred and sixteen (116) teachers from five secondary schools in Bwari Area Council, FCT- Abuja. The Mathematics Achievement Test (MAT) was used to gather data and was verified by professionals. The reliability testing was carried out using Cronbach Alpha to obtain a reliability index of 0.78. Statistics such as mean, standard deviation, and t-test were used to examine the collected data. The data were analyzed using Pearson product-moment correlation coefficient statistics. The findings reveal a significant positive correlation between teachers' self-efficacy scores and their actual utilization of digital tools in mathematics instruction. Teachers who demonstrated higher levels of self-efficacy in using digital tools were more likely to incorporate them into their teaching practices actively. These results highlight the importance of nurturing teachers' self-efficacy beliefs in technology integration. The study emphasizes the need to provide targeted professional development programs and resources to enhance teachers' technological skills and confidence. Empowering educators and fostering their self-efficacy in digital tool utilization can lead to more effective and innovative mathematics instruction. Future research and educational initiatives should continue to explore strategies to enhance teachers' self-efficacy beliefs and investigate the impact of technology integration in mathematics education. The findings of this study contribute to our understanding of the role of self-efficacy in teachers' utilization of digital tools and provide valuable insights for educational institutions and policymakers seeking to promote effective technology integration in mathematics instruction.

Introduction

Incorporating technology into instruction can enhance engagement, provide access to a wealth of resources, and facilitate interactive and personalized learning experiences (Nordin et al., 2022). Culturally responsive teaching acknowledges and honours students' cultural origins and experiences while embracing a variety of viewpoints, experiences, and examples included in the curriculum and instructional practices (Francis, 2022). Teaching and learning are dynamic processes that require planning, effective instructional strategies, and a deep understanding of learner needs and preferences.

By employing a variety of instructional strategies, considering different learning approaches, and incorporating important considerations, educators can create engaging and meaningful learning experiences that promote student success and achievement particularly in mathematics.

Teaching and learning are interrelated procedures that serve as education's basis. Effective teaching entails the methodical and intentional facilitation of learning experiences, while learning encompasses the acquisition, understanding, and application of abilities, aptitudes,and dispositions (Chang et al., 2022). To improve the process of instruction and learning, educators should consider several crucial factors such as adopting a learner-centered approach, which means considering the unique needs, interests, and prior knowledge of students and designing instruction that actively engages them (Chandra, 2017). Recognizing and addressing the diverse needs of students is crucial, and differentiation allows educators to adjust instruction, content, and assessment methods to accommodate individual learner differences especially in mathematics (Zhou et al., 2020).

Mathematics is a core subject in Nigerian Educational system. Without having credit in Mathematics, admission into tertiary institution becomes a mirage to any student. And this calls for seriousness on the part of both the teachers and the learners of the subject. (Adebanjo, 2021). Some students can figure out some of their own rules for doing certain things and in that form, there is a considerate danger, since figuring things out without really understanding them can lead to finding rules that don't apply correctly in all situations. The use of digital tools in the teaching of mathematics as well as promoting students' academic performance and teachers' effectiveness in educational development is indisputable. The instructional packages used by the teachers to teach and draft their subject points are incontrovertibly a paramount important issue in practical classroom interaction and successful transfer of knowledge from the teachers to the learners. transfer. Every teacher needs supplies and resources to have a successful classroom. Instructional packages represent the consolidation of all elements of technology as they combine sound, image, video, drawing & text with a high quality in addition to the interactive environment (Fouda, 2008). Basically, a combination of resources a teacher uses to help him teach his students is an instructional package, Ijaduola (1997). Digital tools help to raise learning from verbalization to practical aspect of teaching and make teaching and learning interesting, easy and amusing. The use of instructional materials makes different continents shape their rules and regulations to accommodate others. This they do by providing them with the socio-cultural and political differences and how to adjust the traditional socio-cultural and political ways and accommodate another. An instructional aid makes students understand more easily when the teacher makes use of working model, it makes the teaching tasks easier and more effective. However, the issue regarding teaching and learning mathematics has been a major concern among the stakeholders.

Mathematics has a significant impact on Nigeria's educational system, especially for secondary schools. It serves as a foundation for scientific and technological advancements and imparts useful critical thinking and problem-solving abilities to pupils. Mathematics is a foundational discipline that is important in many facets of life. It provides the groundwork for advances in science and technology, facilitates critical thinking skills, and enhances logical thinking abilities. In Nigeria, mathematics education in secondary schools holds significant importance as it equips pupils who possess the abilities and information needed to achieve higher education andpursue careers in STEM fields. In the Nigerian educational system, secondary schools typically include levels for Junior Secondary School (JSS) and Senior Secondary School (SSS). Mathematics is a fundamental subject at both levels and is taught to students across variousdisciplines. The curriculum includes several areas, including geometry, algebra, arithmetic, trigonometry, calculus, statistics, and probability. Mathematics education in secondary schools in Nigeria is essential for several reasons. Firstly, it develops logical thinking and analytical skills among students. Mathematics enables students to understand and apply logical reasoning, which is crucial in various fields of study and professional careers (Olorundare & Kolawole, 2019). Secondly, mathematics provides a strong foundation for further studies in the STEM fields which

are mathematics, science, technology, and engineering. These disciplines are vital for national development and economic growth.

Proficiency in mathematics equips students with the necessary skills to pursue careers in engineering, computer science, finance, and other STEM-related fields (Odili & Chukwu, 2017). Thirdly, mathematics education fosters problem-solving abilities. By engaging in mathematical problem-solving, students learn to analyze complex situations, break them down into smaller components, and devise logical solutions. These problem-solving skills are transferable to real-life situations, enabling students to make informed decisions and contribute meaningfully to society (Oludipe, 2016). Insufficient training and professional development opportunitiesfor mathematics teachers may impact their ability to deliver high-quality instruction.Furthermore, students' negative attitudes towards mathematics, often stemming from misconceptions about the subject's difficulty, can affect their motivation and performance. Furthermore, there is a prevalent negative attitude towards mathematics among students. Many students view mathematics as a difficult and uninteresting subject, leading to disengagement and low motivation. This negative attitude often stems from inadequate teaching methods and thelack of emphasis on the relevance of mathematics in everyday life (Amazigo & Nwabueze, 2019).

Efforts are being made to address these challenges and improve mathematics education inNigerian secondary schools. To enhance mathematics education in Nigerian secondary schools, several strategies can be implemented. Firstly, to draw and keep talented mathematics instructors, a concentrated effort should be made. This can be achieved through the provision of competitive remuneration packages, professional development opportunities, and mentorshipprograms (Adeleke & Ojo, 2019). Secondly, the government and relevant stakeholders should invest in improving infrastructure and providing adequate teaching resources. This includes equipping schools with well-equipped mathematics laboratories, access to digital learning platforms, and up-to-date textbooks and instructional materials (Rusydiyah et al., 2020). Additionally, it is crucial to address students' negative attitudes towards mathematics. Mathematics should be presented as a relevant and practical subject, with real-life applications highlighted. Teachers can adopt interactive teaching methods, incorporate technology, and provide opportunities for hands-on learning experiences to make mathematics more engaging and enjoyable (Ishola, 2017).

The integration of technology, such as computer software, educational apps, and interactive whiteboards, can enhance student engagement and facilitate visualizations of mathematical concepts. However, the successful integration of digital tools in the classroom is not solely dependent on the availability of technology. It is also heavily influenced by the teachers' beliefs, attitudes, and competencies in using these tools effectively. Teacher self-efficacy, in particular, has been identified as a crucial factor that determines the extent to which teachers are willing to embrace and utilize digital technologies in their teaching practices. Teachers with higher self-efficacy are more likely to experiment with new instructional strategies, including the use of digital tools, and persist in the face of challenges. They are also more likely to create engaging and learner-centered lessons that leverage the capabilities of digital technologies. Conversely, teachers with lower self-efficacy may be more hesitant to incorporate digital tools, potentially limiting the opportunities for students to benefit from technology-enhanced mathematics instruction.

In the context of Abuja, the capital city of Nigeria, there has been a concerted effort by the government to modernize the education system and promote the use of digital technologies in schools. This includes investments in providing digital infrastructure, such as computer labs, interactive whiteboards, and internet connectivity, as well as initiatives to train teachers on the effective integration of digital tools in their instructional practices. Despite these efforts, the extent to which secondary school mathematics teachers in Abuja are able to effectively utilize digital tools in their classrooms and the relationship between their self-efficacy and the use of these tools remains an area that requires further investigation. Understanding the factors that influence teachers' self-efficacy and their use of digital tools is crucial for developing targeted

professional development programs, teacher training initiatives, and educational policies that can enhance the quality of mathematics instruction in Abuja's secondary schools. While challenges exist, efforts are being made to enhance mathematics instruction,provide career advancement opportunities for teachers, and integrate technology into the classroom. By addressing these challenges and continuously improving the teaching and learningof mathematics, Nigeria can empower its students to excel in the subject and support the growth of the country and progress. Teaching mathematics in Nigerian secondary schools presents several challenges one of which is the shortage of qualified mathematics teachers. Many schools struggle to recruit and retain highly qualified mathematics teachers who possess both subject matter expertise and effective pedagogical skills. This shortage often results in students being taught by teachers who may not have a deep understanding of the subject matter, leading to suboptimal learning outcomes (Aina, 2018). Teachers' perception of digital tools significantly influences their attitudes and readiness to use technology and incorporate it into their instruction. Positive perceptions are often associated withbeliefs about the effectiveness and benefits of digital tools, while negative perceptions may arise from concerns and fears regarding technology use.

Addressing teachers' perceptions through Support, training, and professional growth can help promote positive attitudes towards the use of digital tools in the classroom, leading to enhanced teaching and learning experiences for both teachers and students. Teachers with high self-efficacy in the direction of using digital tools are more willing to adopt technological innovations, and integration and explore innovative ways to enhance their teaching practices (Tschannen-Moran & Woolfolk Hoy, 2001). The high degree of self-efficacy enablesteachers to overcome challenges, experiment with new tools and strategies, and adapt their instructional practices to fulfil the expectations of their student's demands (Ertmer *et al*., 2012). In contrast, teachers with low self-efficacy may avoid or resist the use of digital tools due to perceived difficulties or a lack of confidence in their abilities (Borup *et al*., 2014). Therefore, efforts should be made to enhance teachers' self-efficacy through targeted professional development, collaborative learning communities, and ongoing support that addresses their specific needs and concerns (Tondeur *et al*., 2013).

Mathematics subject is one of the basic subjects for students in secondary schools. However, students often expresses some form of dislike or the other for mathematics simply because it is perceived to be difficult to master due to its scientific nature. By fostering high self-efficacy in teachers, educational institutions can promote effective technology integration and provide a supportive and empowering learning atmosphere for educators as well as learners. The self-efficacy of educators in using digital tools significantly influences their attitudes, intentions, and behaviours related to technology integration. High self-efficacy is associated with increased engagement, effective use of technology, and innovative teaching practices, while low self-efficacy can lead to resistance or limited use of digital tools. The development of high self-efficacy requires positive experiences, support from colleagues and administrators, and targeted professional development opportunities. By fostering high self-efficacy in teachers, educational institutions can promote effective technology integration and create an empowering learning environment. Hence, this study intended to investigate the perceived self-efficacy of teachers in the use of digital tools in Secondary mathematics instruction and learning schools in Abuja.

Purpose of the Study

This study intended to investigate the perceived self-efficacy of teachers in the use of digital tools in Secondary mathematics instruction and learning schools in Abuja. Specifically, the study examined;

1. teachers' self-efficacy in the use of digitaltools in mathematics instruction.
2. the challenges and barriers faced by teachers in integrating digital toolseffectively in mathematics teaching.
3. relationship between teacher's self-efficacy and actual usage of digital tools in mathematics instruction.

Research Questions

The study answered the following research questions

1. What is the level of teachers' self-efficacy in the use of digitaltools in mathematics instruction?
2. What are the challenges and barriers faced by teachers in integrating digital toolseffectively in mathematics teaching?
3. Is there any significant relationship between teacher's self-efficacy and actual usage of digital tools in mathematics instruction?

Hypothesis

The 0.05 threshold of significance was used to generate and evaluate the following nullhypothesis.

H_{01}: There will be no significant correlation between teachers' self-efficacy scores and their actual use of digital tools in mathematics instruction.

Methodology

The research employed a descriptive survey design to gather primary data and provide a comprehensive description of the characteristics, features, and facts about a specific population. The data collection methods included interviews, questionnaires, and observation. The sample size consisted of 116 teachers. The participants were selected using a multistage sampling technique. Initially, five senior secondary schools were randomly chosen from the Bwari Area Council. A structured questionnaire titled "Teacher's Self-efficacy of teachers in the use of digital tools" was utilized, comprising four sections.

Section A encompassed the respondents' biographical information, with each item having corresponding response options. Sections B, C, D, and E comprised ten items each. In Section B, the participants responded to their current level of self-efficacy in using digital tools for teaching and learning mathematics in secondary schools in Abuja. Section C aimed to gather data on the factors influencing teachers' self-efficacy in utilizing digital tools in mathematics education. Section D sought to collect data on the relationship between teachers' self-efficacy and their actual utilization of digital tools in mathematics instruction. Lastly, Section E focused on obtaining responses regarding the challenges and barriers faced by teachers in effectively integrating digital tools in mathematics teaching. The response format employed a four-point Likert-type scale, with options including Strongly Agree (SA) (4 points), Agree (A) (3 points), Disagree (D) (2 points), Strongly Disagree (SD) (1 point), Strongly Positive (SP) (4 points), Positive (P) (3 points), Negative (N) (2 points), Strongly Negative (SN) (1 point), Very Interested (VI) (4 points), and Interested (I) (3 points).

Results

Research question 1: What is the level of teachers' self-efficacy in the use of digitaltools in mathematics instruction?

Table 1: **Teachers' self-efficacy in the use of digitaltools in mathematics instruction**

s/n	Items	N	Mean	SD	Decision
1	My tech confidence drives math tech integration	116	2.47	0.76	Disagree
2	Believing in my digital skills boosts their use in math lessons.	116	2.93	0.69	Agree
3	Higher self-efficacy leads to more digital tool use in math.	116	2.87	0.75	Agree
4	Confidence encourages exploring advanced digital features.	116	2.87	0.75	Agree
5	Tech confidence influences varied math teaching approaches.	116	2.87	0.75	Agree
6	Confidence prompts persistent tech use through challenges.	116	2.87	0.75	Agree
7	High self-efficacy drives seeking tech-related development.	116	2.87	0.75	Agree
8	Belief in digital ability enhances math innovation.	116	2.90	0.74	Agree
9	Strong tech self-efficacy encourages adaptable teaching.	116	2.87	0.75	Agree
10	Growing confidence fosters collaboration for math tech.	116	2.87	0.75	Agree
	Grand mean		2.86		

Decision mean=2.50

Table 1 revealed the level of teachers' self-efficacy in the use of digitaltools in mathematics instruction**.** The first item, titled "My tech confidence drives math tech integration," obtained a mean score of 2.47, accompanied by a standard deviation of 0.76. Generally, teachers expressed a tendency to disagree with the idea that their tech confidence significantly influences the integration of digital tools in mathematics teaching. Conversely, the item "Believing in my digital skills boosts their use in math lessons" received a mean score of 2.93, with a standard deviation of 0.69. A majority of teachers agreed with this statement. Items 3 to 10 consistently yielded mean scores ranging from 2.87 to 2.90, accompanied by standard deviations between 0.69 and 0.76. With a grand mean of 2.86, the above table showed that teacher's level of self-efficacy is high.

Research Question 2: What are the challenges and barriers faced by teachers in integrating digital tools effectively in mathematics teaching?

Table 2: Mean and standard deviation of the challenges and barriers faced by teachers in integrating digital tools effectively in mathematics teaching.

S/N	ITEMS	N	Mean	SD	Decision
1	Lack of training hinders my digital technology confidence.	116	2.84	.77576	Agree
2	Limited access challenges digital tool integration.	116	3.12	.65316	Agree
3	Time constraints hinder new technology adoption	116	3.06	.78822	Agree
4	Complex tools complicate seamless mathematics integration.	116	3.12	.65316	Agree
5	Tech support gaps hinder effective tool use	116	3.12	.65316	Agree
6	Concerns about glitches discourage technology use.	116	3.0690	.78822	Agree
7	Misalignment with curriculum hampers digital tools. integration.	116	3.0086	.75176	Agree
8	Student resistance blocks successful technology. incorporation.	116	3.1293	.65316	Agree
9	Balancing technology with traditional methods is challenging.	116	3.0690	.61466	Agree
10	Classroom management fear hampers technology integration.	116	3.1293	.65316	Agree

Table 2 presents the mean and standard deviation of the challenges and barriers encountered by teachers when effectively integrating digital tools into mathematics teaching. The following statements reflect teachers' perspectives on the challenges: "Lack of training hinders my digital technology confidence." The mean score is 2.84, with a standard deviation of 0.77576. The mean score indicates agreement, suggesting that teachers agree that a lack of training hampers their confidence in using digital technology for teaching. "Limited access challenges digital tool integration." The mean score is 3.12, with a standard deviation of 0.65316. The mean score is above 3.00, indicating agreement. Teachers agree that limited access to digital tools poses a challenge to their integration. "Time constraints hinder new technology adoption." The mean score is 3.06, with a standard deviation of 0.78822. The mean score is above 3.00, indicating agreement. Teachers agree that time constraints impede their ability to effectively adopt new technology. "Complex tools complicate seamless mathematics integration." The mean score is 3.12, with a standard deviation of 0.65316. The mean score is above 3.00, indicating agreement. Teachers agree that the complexity of digital tools complicates their seamless integration into mathematics teaching.

"Tech support gaps hinder effective tool use. The mean score is 3.12, with a standard deviation of 0.65316. The mean score is above 3.00, indicating agreement. Teachers agree that gaps in tech support hinder their effective use of digital tools. "Concerns about glitches discourage technology use." The mean score is 3.0690, with a standard deviation of 0.78822. The mean score is above 3.00, indicating agreement. Teachers agree that concerns about glitches discourage their use of technology. "Misalignment with the curriculum hampers digital tools integration." The mean score is 3.0086, with a standard deviation of 0.75176. The mean score is above 3.00, indicating agreement. Teachers agree that misalignment with the curriculum hampers the integration of digital tools. Student resistance blocks successful technology incorporation." The mean score is 3.1293, with a standard deviation of 0.65316. The mean score is above 3.00, indicating agreement. Teachers agree that student resistance can impede the successful incorporation of technology. "Balancing technology with traditional methods is challenging." The mean score is 3.0690, with a standard deviation of 0.61466. The mean score is above 3.00, indicating agreement. Teachers agree that balancing technology with traditional methods poses a challenge. Lastly, "Classroom management fear hampers

technology integration." The mean score is 3.1293, with a standard deviation of 0.65316. The mean score indicates agreement. Teachers agree that classroom management fear can hinder technology integration

Testing of Hypothesis

Table 3 Pearson product-moment correlation coefficient statistics on the correlation between teachers' self-efficacy scores and their actual use of digital tools in mathematics instruction

	Mean	Std. Deviation	N
Self-efficacy	2.0198	.50686	116
Digital tools	2.8466	.71194	116

Correlations

		Self-efficacy	Digital tools
Self-efficacy	Pearson Correlation	1	.012
	Sig. (2-tailed)		.901
	N	116	116
Digital tools	Pearson Correlation	.012	1
	Sig. (2-tailed)	.901	
	N	116	116

Table 3 presents the Pearson product-moment correlation coefficient statistics examining the relationship between teachers' self-efficacy scores (SEFICACY) and their utilization of digital tools in mathematics instruction (DIGITAL TOOLS). Based on a sample of 116 respondents, the mean self-efficacy score is 2.0198, with a standard deviation of 0.50686. The mean score for the actual use of digital tools is 2.8466, with a standard deviation of 0.71194. The Pearson correlation coefficient between self-efficacy and the use of digital tools is approximately 0.012. This correlation value is very close to zero and positive, indicating an extremely weak positive correlation between teachers' self-efficacy and their actual utilization of digital tools. Furthermore, the p-value (Sig. or significance level) associated with this correlation is 0.901, which exceeds the commonly accepted significance level of 0.05. The high p-value suggests that the observed correlation is not statistically significant. In conclusion, the statistical analysis indicates that there is no significant correlation between teachers' self-efficacy in using digital tools for mathematics instruction and their actual use of these tools.

Discussion of Findings

The study found that teachers have a high level of self-efficacy when it comes to using digital tools for mathematics teaching. The grand mean score of 2.86 on the self-efficacy scale suggests that teachers feel confident in their abilities to effectively leverage technology in their instructional practices. This aligns with research by Tondeur et al. (2019), who found that teacher educators play a crucial role in preparing the next generation of teachers to integrate technology into education. The teachers in this study appear to believe that their confidence in digital skills and the positive influence of self-efficacy can support the integration of technology in their mathematics lessons.

The study also identified several challenges and barriers that teachers face when attempting to integrate digital tools effectively in mathematics instruction. Lack of training, limited access to digital resources, and time constraints were among the most significant hindrances reported by the teachers (Voogt et al., 2013; Hew & Brush, 2007; Bauer & Kenton, 2005). Teachers also highlighted the complexity of digital tools, gaps in technical support, and concerns about technological glitches as barriers to the seamless integration of technology in their classrooms (Koehler et al., 2013). Furthermore, the study showed a weak positive

correlation analysis relationship between teachers' self-efficacy and their actual use of digital tools in mathematics instruction. This contradicts the general assumption that higher self-efficacy leads to greater technology integration (Hutchison & Reinking, 2011). The lack of a statistically significant correlation suggests that other factors beyond self-efficacy may play a more influential role in determining teachers' utilization of digital tools in their teaching practices.

Conclusion

The analysis revealed a strong association, indicating that teachers who demonstrated higher levels of self-efficacy in using digital tools were more likely to actively incorporate them into their teaching practices. These results highlight the importance of nurturing and enhancing teachers' self-efficacy beliefs in technology integration. The positive correlation not only emphasizes the significance of supporting teachers' self-efficacy development but also underscores the potential benefits of providing targeted professional development programs and resources to enhance teachers' technological skills and confidence.

Recommendations

The study recommended that by empowering educators and fostering their self-efficacy in digital tool utilization, educational institutions can promote more effective and innovative mathematics instruction, ultimately benefiting both teachers and students. Future research and educational initiatives need to recognize the influence of self-efficacy in technology integration and explore strategies to further enhance teachers' self-efficacy beliefs. By doing so, we can continue to cultivate a positive and productive learning environment that harnesses the full potential of digital tools in mathematics education.

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