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DIGITAL TECHNOLOGY INTEGRATION IN THE TEACHING AND LEARNING OF MATHEMATICS IN SECONDARY SCHOOLS IN IMO STATE, NIGERIA

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Abstract

This study investigated the secondary school teachers' perceptions of the adoption, challenges, and solutions to digital technology integration in the teaching and learning of mathematics in Imo State, using a survey research design. The sample consisted of 1,394 teachers (687 males and 707 females) selected through a purposive sampling technique. Guided by three research questions and three hypotheses tested at a 0.05 significance level, data were collected using a researcher-developed questionnaire with a reliability coefficient of 0.89 (Cronbach's Alpha). Findings indicated that teachers were generally comfortable with integrating digital technology into the teaching and learning of mathematics. However, challenges such as inadequate personal digital technology tools, an unreliable power supply, poor internet access, and insufficient government funding were identified. To address these issues, teachers suggested measures such as adequate supplies of personal computers for schools, a reliable and sufficient power supply, the installation of the latest technologies to ensure strong connectivity, and adequate government funding. Based on the findings, it was recommended, among others, that teachers should be motivated and encouraged to develop a desire to use digital technology tools relevant to the teaching and learning of mathematics in the 21st century. This study will contribute to the existing body of research on digital technology integration in mathematics education, providing insights into adoption, challenges, and potential solutions.

Keywords: Digital Technology, Computers, Mathematics, Integration, Utilization, Education

1.1 Introduction

Mathematics is a valuable tool across all spheres of human endeavour, including science, engineering, social science, and the arts. It is the bedrock to which the technological development

of any nation is hinged (Oloda, 2021). Ariyo (2017) defined mathematics as an intellectually stimulating subject that affects every facet of human activity, such as politics, economy, science and technology. The mathematics curriculum at the senior secondary school level is structured around four major concepts, namely: number and numeration, geometry, algebraic processes, and statistics (Federal Ministry of Education, 2013). These four concepts have a direct bearing on people's ways of life. For example, Number and Numeration are used in the process of counting, addition, subtraction, multiplication and other arithmetic processes; Geometry helps learners to appreciate shapes of objects and is very useful in architectural designs; Algebraic processes help in breaking complex concepts into smaller units while Statistics provides skills of collecting, analyzing and interpreting data for decision making.

The great recognition given to mathematics as a result of its contribution to the development of society is expected to translate to a satisfactory students' academic outlook in the subject. According to Adetula, cited in Oloda (2021), mathematics is the linchpin in the task of national capacity building in science and technology; therefore, any shortcomings in this subject constitute a hindrance to the achievement of our science and technology objectives and to the demands of the 21st century. Hence, a pass at the credit level in mathematics serves as a prerequisite for gaining admission into higher institutions for students at the secondary school level.

As a result of the above, it is imperative to acknowledge that the scope of teaching and learning in mathematics should extend beyond traditional pedagogical approaches and incorporate technology to provide efficient, immediate access to student progress data and enable prompt intervention. In today's rapidly evolving educational landscape, integrating technology into mathematics education has become a critical focus. Hew and Brush in Bozkuş (2021) defined technology integration as teachers' use of technology to improve students' thinking skills. Integration of technology in this study refers to leveraging technology to enhance the performance of a complex information system, including the formal and informal use of ICTs by students and teachers in the classroom and beyond (Viberg, Grönlund & Andersson, 2023). Integration also relates to several dynamic factors, including effective practices, technological aspects of new tools, potential to transform learning, and the enabling of new forms of teaching and learning (Howard *et al*., 2019). Technological advancements have continued to offer a wide range of potential benefits to the teaching and learning process. Technology is perhaps the strongest factor shaping the educational landscape today (Johnson *et al*., 2016). To ensure the future of both students and society in the twenty-first century, technology and education must collaborate (Gqoli, 2024).

The current reliance on computers to facilitate teaching and learning has led to increased interest in integrating digital technology into the teaching and learning of mathematics. These offer educators and students' innovative ways to engage with mathematical concepts. They can improve learners' motivation and engagement in the classroom, facilitate the acquisition of basic skills and enhance the teacher's ability to teach effectively (Irakarama *et al*., 2024). Gqoli (2024) observed that digital technologies have revolutionized the teaching and learning of mathematics, making it more accessible, engaging, and adaptable to individual needs.

Digital technology is essential in teaching and learning mathematics to understand basic concepts and problem-solving techniques (Subramanian, Thangarasu & Subramanian, 2018). Digital technology integration in teaching and learning has been found to enhance the effectiveness of knowledge construction and distribution, as well as improve academic performance (Al-Abdullatif & Gameil, 2021). Therefore, it is time for those in education to catch up with the rest of society and move into the digital world, especially in the teaching and learning of mathematics.

The integration of digital technology in mathematics education has transformed the way students learn and teachers teach. Digital tools and resources offer innovative ways to engage students, deepen understanding, and develop problem-solving skills. According to Zhu (2023), digital tools often provide immediate feedback, helping students track their progress and identify areas for improvement. They went further to state that this instant gratification reinforces students' engagement and commitment to mastering mathematical concepts. According to Weinhandl *et al* (2021), the purposes of using technologies in teaching and learning mathematics include: resource distribution, organizing and structuring materials, demonstrations, testing or assessing students' knowledge and competencies, discovery and learning, communication between teacher and students or between students themselves, working cooperatively or collaboratively, monitoring students' activities and providing feedback and guidance. The Education Hub (n.d.) opined that there is evidence suggesting that the deliberate use of technology can support the learning of mathematics (skills and procedures) as well as the development of advanced proficiencies such as problem-solving, reasoning, and justification. In essence, technology integration revolutionises mathematics education by offering students not just passive information reception but an active, engaging exploration of the mathematical world. This integration can include various digital technologies, such as:

- Mathematical software: GeoGebra, Desmos, and Mathematica.
- Online platforms: Khan Academy, Coursera, and edX.
- Mobile apps: Photomath, Mathway, and Desmos Graphing Calculator.

According to Subramanian *et al.* (2018), digital technology tools in mathematics include portable graphic calculators and computerised graphics, specialised software, programmable toys or floor robots, and spreadsheets and databases. Zhu (2023) maintained that educational software, including popular applications such as GeoGebra, Desmos, and Wolfram Alpha, empowers students to explore mathematical concepts dynamically and engage in problem-solving with interactive tools. Online Learning Management Systems like Google Classroom and Moodle streamline the organization and delivery of mathematics content, assignments, and assessments, providing educators with efficient ways to manage their classrooms and track student progress. According to Saadah and Indrawatiningsih (2024), these platforms enable educators to cater for diverse learner needs by dynamically adjusting instructional content, leading to improved learning outcomes and engagement.

The effective integration of digital technology into the teaching and learning of mathematics programmes has been adopted in many countries worldwide. In Austria, at the beginning of secondary school, every student receives a digital device through the Ministry of Education's digitalisation initiative, which is used for teaching and learning (Weinhandl *et al*., 2021).

According to Saka (2021), Malawi developed the National ICT Policy in 2013 to contribute to socio-economic development through maximum integration of ICT in all sectors and the provision of ICT services to rural areas and to vulnerable and disadvantaged groups. In 2018, China stressed the need to vigorously promote digital literacy among primary and secondary school teachers (Cui, 2023). However, the use of this mode of study has not been fully realized in Nigerian secondary schools, especially in Imo State. In the contemporary world, one cannot imagine education without digital technologies (Ohiri *et al*., 2024). This raises concerns that our educational system is outdated and failing to equip citizens with the skills needed to adequately prepare for the future. We are moving from an individualistic knowledge-acquisition culture to a collaborative knowledge-creation culture of learning. In this article, the authors examined secondary school teachers' perceptions of the adoption, challenges, and solutions to the use of digital technologies in the teaching and learning of mathematics in Imo State.

The lack of seriousness in adopting digital technologies in the teaching and learning of mathematics at the secondary school level in the State indicates that educational stakeholders and secondary school teachers at large may have varied perceptions of digital technologies, especially regarding awareness and competence. Nwachukwu *et al.* (2020) found that secondary school teachers' levels of digital awareness, competence, and skills were generally low. According to Jones (2014), barriers to the adoption of digital technologies were a lack of confidence among the teachers during integration, a lack of access to resources, lack of time for the integration, a lack of effective training, facing technical problems while the software is in use, a lack of personal access during lesson preparation and the age of the teachers. Similarly, Snoeyink and Ertmer in Subramanian *et al* (2018), saw lack of computers, lack of quality software, lack of time, technical problems, lecturer attitude towards computers, poor funding, lack of lecturer confidence, resistance to change, poor administrative support, lack of computer skill, poor fit with curriculum, scheduling difficulties, poor training opportunities, and lack of vision as to how to integrate information and communication technology in instruction as some of the barriers. Johnson *et al.* (2016) were of the opinion that insufficient equipment or connectivity, which they termed "the access constraint", is a big factor. According to Ertmer *et al.* (2012), the most commonly cited reason for lack of technology implementation in the classroom is inadequate professional development and training. Research indicates that teachers are afforded few opportunities to develop data analysis skills (Mandinach & Jimerson in Iwuoha-Njoku, 2022). Ghavifekr (2016) opined that instructors face challenges in adopting ICT tools, such as limited accessibility and network connection, inadequate technical support, insufficient training, time constraints and teacher competency. Cuhadar (2018) inferred that teachers' technological competency is intermediate or lower. These issues have contributed to an incomplete knowledge base among teachers and to variability in teacher effectiveness (Hattie in Iwuoha-Njoku, 2022).

To effectively address the challenges of integrating digital technology into the teaching and learning of mathematics, teachers at the secondary school level are better positioned to endorse feasible approaches. As a result of the above, Hoyles (2018) stressed that teachers of mathematics must be part of the transformative process as co-designers and researchers to transform mathematical practice through the use of digital technologies. To achieve this, Viberg, Grönlund,

and Andersson (2023) argued that a process of professional development is essential, including the development of teachers' technological and pedagogical content knowledge. They went further to say that the use of digital technology should be embedded in a coherent educational context. Zhu (2023) observed that it is incumbent upon schools, educational institutions, and policymakers to prioritise and work tirelessly to achieve equitable access to devices and reliable connectivity. Bridging the digital divide is an essential mission that requires allocating resources and implementing support systems for underprivileged communities. By doing so, we can strive to create a level playing field where every student has the same opportunities to harness the benefits of technology in their mathematical education. Butler, Giblin, and Kingston (2022) opined that teacher professional learning must be provided to support teachers in leveraging digital tools when designing learning experiences and assessments of and for learning in mathematics. Akpalu *et al.* (2025) opined that effective teacher training programmes are essential for developing the digital competencies needed to integrate advanced digital tools into instructional practices. They went further to state that the success of digital transformation in mathematics education relies heavily on collaboration among key stakeholders, including policymakers, educators, technology providers, and community organizations. According to Gqoli (2022), it is advantageous to incorporate interactive technologies, such as mathematics apps, into a play-based learning environment.

1.2 Objectives of the Study

The objectives of this study were to determine the:

1. Teachers' perceptions of the utilisation of digital technologies in the teaching and learning of mathematics in Imo State.
2. Teachers' perceptions of the challenges of integrating digital technologies into their mathematics instruction in Imo State.
3. Teachers' perceptions of the solutions to the challenges of integrating digital technology into their mathematics instruction in Imo State.

1.3 Research Questions

The following research questions were raised to guide the study.

1. What are the teachers' perceptions of the utilization of digital technologies in the teaching and learning of mathematics in Imo State?
2. What challenges do teachers face when integrating digital technology into their mathematics instruction in Imo State?
3. What are the teachers' perceptions of the solutions to the challenges of integrating digital technology into their mathematics instruction in Imo State?

1.4 Hypotheses

The following hypotheses were tested at the 0.05 level of significance.

1. There is no significant difference in the male and female teachers' perceptions of the utilization of digital technologies in the teaching and learning of mathematics in Imo State.

2. There is no significant difference in the male and female teachers' perceptions of the challenges of integrating digital technologies into their mathematics instruction in Imo State.
3. There is no significant difference in the male and female teachers' perceptions of the solutions to the challenges of integrating digital technologies into their mathematics instruction in Imo State.

2. METHODOLOGY

A survey research design was adopted for the study. The appropriateness of the design stemmed from Nworgu's (2015) postulation that survey research design is one in which a group of people or items is studied by collecting and analysing data from only a few people or items, which are considered representative of the entire group. This design was considered appropriate because only a part of the population was studied, and findings were used to generalise for the entire population. The study area was Imo State. The State has six education zones, namely: Okigwe I, Okigwe II, Orlu I, Orlu II, Owerri I and Owerri II, with 308 public secondary schools.

The study population consisted of 5,576 secondary school teachers in Imo State (SEMB, 2025). The study sample comprised 1394 teachers, representing 25% of the population. The sample was obtained using a purposive sampling method, evenly distributed across the six Education Zones of Imo State. The instrument for data collection was the researchers' developed structured questionnaire of the 4-point scale Likert format of Strongly Agree (SA) = 4 points, Agree (A) = 3 points, Disagree (D) = 2 points and Strongly Disagree (SD) = 1 point, titled: Digital Technology Integration in the Teaching and Learning of Mathematics (DTITLM). DTITLM had four sections. Section A was designed to seek information on demographic variables from the teachers. Section B contained 20 items constructed to generate information on the teachers' perception on the utilization of digital technology integration in the teaching and learning of mathematics, Section C contained 20 items constructed to generate information on the challenges of digital technology integration in the teaching and learning of mathematics, while Section D was designed to generate information on the solutions to the challenges of digital technology integration in the teaching and learning of mathematics had 20 items. The initial draft of the instrument, objectives, research questions, and hypotheses was validated by two Lecturers in Measurement and Evaluation and one Lecturer in Computer Science Education, all from Alvan Ikoku Federal University of Education, Owerri. Their suggestions and corrections were incorporated into the final copy of the instrument. The reliability index of 0.89 was obtained using Cronbach's Alpha. The instrument was administered once to 25 public secondary school teachers who were not involved in the study. Data were analyzed using descriptive statistics (mean) and inferential statistics (Chi-Square test) at a 0.05 significance level.

3. Results

The collected data were analyzed and the results were presented in Tables 1, 2, 3, 4, 5 and 6 based on the stated research questions and hypotheses.

Research Question 1: What are the perceptions of the teachers on the utilization of digital technologies in the teaching and learning of mathematics in Imo State?

Table 1: **Secondary School Teachers' Perceptions on the Utilization of Digital Technologies in the Teaching and Learning of Mathematics in Imo State**

9		SA	A	D	SD	Mean	Remarks
1	As a teacher, I feel confident learning new digital technology skills	472	592	169	161	2.98	Agreed
2	I can upskill myself to keep abreast of digital technologies in the teaching and learning of mathematics	621	547	132	94	3.21	Agreed
3	Digital technologies can be used to support and simplify the procedure of teaching mathematics	501	561	202	130	3.02	Agreed
4	Digital technology tools can be used in monitoring of students' performances	614	521	182	77	3.19	Agreed
5	Digital technology enhances self-learning and problem-solving skills	531	467	252	144	2.99	Agreed
6	The use of digital technology tools improves learners' digital competence	518	452	267	157	2.95	Agreed
7	The use of digital technology tools help teachers to improve teaching with more updated materials.	401	461	302	230	2.74	Agree
8	The use of digital technology tools enables students to be more active and engaging in mathematics lessons	610	525	187	72	3.20	Agreed
9	The use of digital technology tools in teaching and learning of mathematics helps in classroom management and control	621	547	132	94	3.21	Agreed
10	Digital technologies allow students to be more creative and imaginative.	494	464	311	125	2.95	Agreed
11	The use of digital technology helps students to find related knowledge and information for learning	546	488	204	156	3.02	Agreed
12	The use of digital technology encourages students to communicate more with their classmates	613	522	180	79	3.19	Agreed
13	The use of digital technology increases students' confidence to participate actively in the class.	367	352	344	331	2.54	Agreed
14	Students taught by teachers with digital technology proficiency exhibit increased motivation and enthusiasm for learning	441	499	212	242	2.81	Agreed
15	The use of digital technology helps to broaden students' knowledge paradigm	430	391	302	271	2.70	Agreed
16	Increased digital technology proficiency among teachers positively correlates with the ability to personalize instruction based on individual student needs	486	412	259	237	3.33	Agreed
17	The use of digital technology tools contributes to improved information literacy skills among the mathematics students	455	481	323	135	2.90	Agreed
18	The use of digital technology tools allows pupils to think independently and make their own decisions.	511	451	302	130	2.96	Agreed
19	The use of digital technology tools provides teachers with immediate feedback	418	452	317	207	2.77	Agreed
20	The use of digital technology tools provides an unbiased grading in terms of assessment	522	444	234	194	2.92	Agreed
	Pooled Mean					**2.97**	**Agreed**

Table 1 shows that all the items had mean score greater than 2.5, which is the mean value of the four-point scale. The implication is that teachers perceived the fact that all the items are feasible for the integration of digital technologies into their mathematics instruction in Imo State.

Research Question 2: What challenges do teachers face when integrating digital technologies into their mathematics instruction in Imo State?

Table 2: **Perceptions of Secondary School Teachers on the Challenges of integrating digital Technologies into their Mathematics Instruction in Imo State.**

S/N		SA	A	D	SD	Mean	Remarks
21	Non availability of adequate personal digital technology tools hampers the adoption of digital technologies integration in mathematics instruction	401	461	302	230	2.74	Agreed
22	Unreliable and inadequate power supply	494	464	311	125	2.95	Agreed
23	Poor internet accessibility	546	488	204	156	3.02	Agreed
24	Lack of funding from the government	613	522	180	79	3.19	Agreed
25	Non availability of skilled manpower to drive the programme	367	352	344	331	2.54	Agreed
26	Schools in Imo State lacks the technological infrastructure to support digital technologies integration in mathematics instruction	441	499	212	242	2.81	Agreed
27	Integration of digital technology tools in mathematics instruction involves significant education of students, parents, and teachers.	430	391	302	271	2.70	Agreed
28	Lack of reliable educational support software is a limiting factor for digital technology integration in schools in Imo State	455	481	323	135	2.90	Agreed
29	Lack of time in the school schedule for projects involving digital technology	416	487	237	254	2.76	Agreed
30	Lack of knowledge about ways to integrate digital technology to enhance curriculum	486	412	259	237	3.33	Agreed
31	The cost implication of digital technology integration in the teaching and learning of mathematics is much compared to traditional methodology	511	451	302	130	2.96	Agreed
32	There will be great difficulty in scoring and correcting questions with open responses that require explanation	418	452	317	207	2.77	Agreed
33	Some students who find it difficult with technological skills may be lost as a result of the adoption of digital technology tools.	522	444	234	194	2.92	Agreed
34	Limited access to computer hardware	472	592	169	161	2.98	Agreed
35	Effective professional resources for teachers to learn how to use digital devices are not available	501	561	202	130	3.02	Agreed
36	Low computer literacy on the part of the teachers	156	304	438	496	2.08	Disagreed
37	An effective online learning support platform is not available	446	514	311	123	2.92	Agreed
38	Teachers are not been provided with incentives to integrate digital devices in their mathematics teaching	401	461	302	230	2.74	Agreed
39	The schools do not have sufficient qualified technical assistant staff	518	452	267	157	2.95	Agreed
40	Resistance to change	621	547	132	94	3.21	Agreed
	Pooled Mean					**2.87**	**Agreed**

Results in Table 2 show that teachers perceived all the items indicated (except Item 36) as likely challenges facing the integration of digital technologies into their mathematics instruction in the secondary schools in Imo State. However, the teachers did not consider low computer literacy on the part of the teachers as a challenge to the integration of digital technologies into their mathematics instruction in the secondary schools in Imo State. The mean responses of teachers on this item (2.08) is less than 2.50.

Research Question 3: What are the perceptions of the teachers on the solutions to the challenges of integrating digital technologies into their mathematics instruction in Imo State?

Table 3: **Perceptions of Secondary School Teachers on the Solutions to the Challenges of Integrating Digital Technologies into their Mathematics Instruction in Imo State**

S/N		SA	A	D	SD	Mean	Remarks
41	Engagement of the teachers in the skill-up Imo programme of the Imo State Government will help to boost the computer literacy of teachers	592	462	179	161	3.06	Agreed
42	There should be adequate supply of personal computers to schools	561	501	201	131	3.07	Agreed
43	There should be reliable and adequate power supply.	614	546	123	111	3.09	Agreed
44	Latest technologies that ensures good connectivity should be acquired and installed in secondary schools	696	538	104	56	3.34	Agreed
45	There should be adequate funding by the government for the digital technology integration	714	521	82	77	3.34	Agreed
46	There should be frequently professional digital technology integration workshop and development trainings for secondary school mathematics teachers.	731	567	52	44	3.42	Agreed
47	There should be technological infrastructure to support digital technology integration	701	599	52	42	3.40	Agreed
48	Implementing digital technology integration involves significant education of students, parents, and teachers.	630	561	130	73	3.25	Agreed
49	Availability of reliable educational support software is necessary for digital technology integration in schools	651	581	132	30	3.32	Agreed
50	The effective teacher training programmes are essential for building the digital competencies required to integrate advanced digital tools into instructional practices	616	686	55	37	3.34	Agreed
51	Development of teachers' technological and pedagogical content knowledge is sacrosanct	661	530	173	30	3.30	Agreed
52	There should be skilled manpower to drive the programme	541	521	212	120	3.06	Agreed
53	Yong and vibrant teachers with ICT acumen should be engaged in the teaching profession.	401	461	302	230	2.74	Agreed
54	There should be in-built ways for scoring and correcting questions with open responses that require explanations	618	552	167	57	3.24	Agreed
55	There should be collaboration among key stakeholders and technology providers,	627	491	134	142	3.14	Agreed
56	There should be incorporation of interactive technology, such as mathematics apps, into a play-based learning environment	616	686	55	37	3.34	Agreed
57	Regular evaluation of effectiveness of digital technology integration	661	530	173	30	3.30	Agreed
58	Government and stakeholders should develop clear policies and guidelines for digital technology integration	541	521	212	120	3.06	Agreed

59	Students should be taught basic digital skills and online safety	401	461	302	230	2.74	Agreed
60	There should be peer collaboration among the teachers	441	499	212	242	2.81	Agreed
	Pooled Mean					**3.16**	Agreed

Table 3 Shows that all the items have means that are above the cut-off mean (2.50). as a result, secondary school teachers in Imo State agreed to all the items above as the solutions to the challenges of digital technologies integration in the teaching and learning of mathematics.

Hypothesis One: There is no significant difference in the male and female teachers' perceptions of the utilization of digital technologies in the teaching and learning of mathematics in Imo State.

Table 4: **Analysis of the Male and Female Teachers' Perception of the Utilization of Digital Technologies in the Teaching and Learning of Mathematics.**

Groups	**SA**	**A**	**D**	**SD**	**All**	**Df**	**Chi-Square (Pearson)**	***P*-value**
Male Teachers	319 (310.5)	187 (201.6)	108 (107.4)	73 (67.5)	687	3		
Female Teachers	311 (319.5)	222 (207.4)	110 (110.6)	64 (69.5)	707	3	3.420	0.331
All	630	409	218	137	1394			

As observed in Table 4 above, there was no significant difference between male and female teachers' perceptions on the digital technologies integration in the teaching and learning of mathematics in secondary schools in Imo State, since the *p*-value (0.331) is greater than the level of significance (0.05). Thus, the observed differences in the teachers' perceived responses were not significant. The values outside the brackets are observed frequencies whereas the values inside brackets are the expected frequencies.

Hypothesis Two: There is no significant difference in the male and female teachers' perceptions of the challenges of integrating digital technologies into their mathematics instruction in Imo State.

Table 5: **Analysis of the Male and Female Teachers of the Challenges of Digital Technologies Integration in the Teaching and Learning of Mathematics**

Groups	**SA**	**A**	**D**	**SD**	**All**	**Df**	**Chi-Square (Pearson)**	***P*-value**
Male Teachers	317 (308.0)	190 (204.0)	106 (105.5)	74 (69.5)	687	3		
Female Teachers	308 (317.0)	224 (210.0)	108 (108.5)	67 (71.5)	707	3	3.002	0.391
All	625	414	214	141	1394			

As observed in Table 5 above, there was no significant difference between male and female teachers' perceptions on the challenges of digital technologies integration in the teaching and learning of mathematics in the secondary schools in Imo State, since the *p*-value (0.391) is greater

than the level of significance (0.05). Thus, the observed differences in the teachers' perceived responses were not significant.

Hypothesis Three: There is no significant difference in the male and female teachers' perceptions of the solutions to the challenges of integrating digital technologies into their mathematics instruction in Imo State.

Table 6: **Analysis of the Male and Female Teachers' Perceptions of the Solutions to the Challenges of Digital Technologies Integration in the Teaching and Learning of Mathematics**

Groups	SA	A	D	SD	All	Df	Chi-Square (Pearson)	*P*-value
Male Teachers	301 (305.6)	208 (207.0)	109 (108.9)	69 (65.5)	687	3		
Female Teachers	319 (314.4)	212 (213.0)	112 (112.1)	64 (67.5)	707	3	0.503	0.918
All	620	420	221	133	1394			

As observed in Table 6 above, there was no significant difference between male and female teachers' perceptions on the solutions to the challenges facing the integration of digital technologies in the teaching and learning of mathematics in the secondary schools in Imo State, since the *p*-value (0.918) is greater than the level of significance (0.05). Thus, the observed differences in the teachers' perceived responses were not significant.

4. Discussion of Findings

The study investigated secondary school teachers' perceptions of the utilization, challenges and solutions to the challenges of digital technologies in the teaching and learning of mathematics in Imo State. The findings of this study revealed that teachers' perceptions of the utilization of digital technologies in the teaching and learning of mathematics were generally moderate, as indicated by the items' grand mean (above 2.5). This result is inconsistent with the findings of Nwachukwu *et al.* (2020) and Cuhadar (2018), which revealed that secondary school teachers' levels of digital awareness, competence, and skills were generally low. Regarding gender differences, the non-significant difference between male and female teachers' views suggested that both genders generally share similar levels of utilization of digital technologies in the teaching and learning of mathematics. The results of the current study align with Gqoli's (2024) finding that digital technologies have revolutionized the teaching and learning of mathematics, making it more accessible, engaging, and adaptable to individual needs.

The study also revealed that non-availability of adequate personal computers; unreliable and inadequate power supply; poor internet accessibility, lack of funding by the government; non-availability of skilled manpower to drive the programme; lack of technological infrastructure; lack of significant education (of students, parents, and teachers); lack of reliable educational support software; lack of incentives to teachers to motivate them integrate digital devices in their mathematics teaching; insufficient qualified technical assistant staff; resistance to change and students finding it difficult with technological skills were all factors perceived by teachers as challenges of adopting digital technologies in the teaching and learning of mathematics in Imo

State. These results were consistent with the submission of Johnson *et al.* (2016), who argued that insufficient equipment or connectivity, which they termed "the access constraint," was a major obstacle. Similarly, these results were in harmony with the submission of Snoeyink and Ertmer in Subramanian *et al* (2018), where they revealed that lack of computers, lack of quality software, lack of time, technical problems, lecturer attitudes towards computers, poor funding, lack of lecturer confidence, resistance to change, poor administrative support, lack of computer skill, poor fit with curriculum, scheduling difficulties, poor training opportunities, and lack of vision as to how to integrate information and communication technology in instruction as some of the barriers to digital technology integration in the teaching and learning of mathematics. This result implies that the pace of development and use of digital tools for educational purposes, including the teaching and learning of mathematics, is still very low in the State. Regarding gender differences, the non-significant difference in male and female teachers' views on the challenges of adopting computerized adaptive assessment suggests that both genders share similar views.

Secondary school teachers in Imo State agreed to the following solutions to the challenges of digital technology integration in the teaching and learning of mathematics: Engagement of the teachers in the skill-up Imo programme of the Imo State Government to boost the computer literacy of teachers; adequate supply of personal computers to schools; reliable and adequate power supply; installation of latest technologies that ensures good connectivity; adequate funding by the; technological infrastructure to support digital technologies; significant education (of students, parents and teachers) on the implementing digital technology integration; availability of reliable educational support software in schools; incorporation of interactive technology, such as mathematics apps, into a play-based learning environment; provision of skilled manpower to drive the programme; engagement of yong and vibrant teachers with ICT acumen into the teaching profession and peer collaboration among the teachers. These results are consistent with the study by Akpalu *et al.* (2025), which found that effective teacher-training programmes are essential for developing the digital competencies needed to integrate advanced digital tools into instructional practices. They further submitted that the success of digital transformation in mathematics education relies heavily on collaboration among key stakeholders, including policymakers, educators, technology providers, and community organizations. The results of the current study also agreed with Gqoli's (2022) submission, which stated that it would be advantageous to incorporate interactive technologies, such as mathematics apps, into a play-based learning environment for mathematics. Regarding gender differences, the non-significant difference between male and female teachers' views on solutions to challenges in adopting digital technology tools in the teaching and learning of mathematics suggested that both genders share similar views.

5. Conclusion

Based on the findings of the current study, the pace of adoption of digital technology tools in the teaching and learning of mathematics in Imo State is slow due to inadequate infrastructure such as non-availability of adequate personal computers, unreliable and inadequate power supply, poor internet accessibility, lack of funding by the government, non-availability of skilled manpower to drive the programme, lack of technological infrastructure, lack of reliable educational support software, students finding it difficult with technological skills and resistance

to change. All of which have been found to affect the pace at which digital technology tools can be adopted in the teaching and learning of mathematics. The results did not indicate any divergence in perceptions between male and female teachers. Hence, gender should not be a factor in the adoption of digital technology tools. As a result of the practical implications of this study, the State Government and teachers must welcome new technologies, incorporate them into their undertakings and teaching methods, and cultivate the essential abilities and knowledge to use them effectively.

6. Recommendations

Based on the findings and conclusions of this study, the following recommendations were made:

1. Teachers should be motivated and encouraged to develop the desire to use digital technologies relevant to teaching and learning of mathematics in the 21st century.
2. Government at all levels should establish functional information and communication technology laboratories equipped with modern digital technologies for teaching and learning in all the secondary schools in Imo State.
3. Digital competence should be a core skill for all educators and should be embedded in teacher education programmes.

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