



# **The Effect of the use of Technology on Students’ Academic Achievement in Junior Secondary School Mathematics in Onitsha North Local Government Area of Anambra State**

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## **ABSTRACT**

The study examined the effect of the use of technology on students’ achievement in junior secondary schools Mathematics in Onitsha North Local Government Area of Anambra State. The population for the research includes all JS 2 students in public secondary schools within the area, which comprises a total of 2,421 students for the 2023/2024 academic session. At the time of the study, there were 16 secondary schools in Onitsha North Local Government Area. Simple random sampling process was used to select one hundred and sixty-four (164) JS 2 students from the 16 schools. Four research questions and one null hypothesis were formulated to guide the study. The data for the study was collected by means of structured questionnaire and Mathematics Achievement Test. Mean score and standard deviation were used for analysis of the result, and z-test was used to test the hypothesis. The following findings were made: Interactive tools, like whiteboards and educational games, can make lessons more engaging and can encourage students to participate actively. It also makes learning more enjoyable, which can increase students' motivation to learn and practice mathematics. Tools like graphing calculators and simulation software help students visualize complex concepts, making them easier to understand. The study recommended among others that: the curriculum should be revised to incorporate technology meaningfully into mathematics instruction. This includes developing lesson plans that utilize: educational software, online resources, and interactive platforms to enhance the learning experience. Also, schools should encourage parental involvement in technology-based learning. Workshops and information sessions can help parents understand how to support their children in using technology effectively for their mathematics studies.

**Keywords:** Achievement, Test, Questionnaire, Whiteboards, Mathematics.

## **INTRODUCTION**

Mathematics is a critical subject in the Nigerian junior secondary school curriculum. Mathematics fosters logical reasoning and critical thinking skills. It helps students develop the ability to think analytically and solve problems efficiently. These skills are essential for academic success and are applicable in everyday life situations (Ogunleye, 2019). The study of mathematics enhances cognitive skills such as memory, attention, and spatial awareness. It encourages a structured approach to tackling problems and promotes a deep understanding of abstract concepts (Adetunji, 2018). Furthermore, mathematics is fundamental for students aspiring to enter science, technology, engineering, and mathematics (STEM) fields. Proficiency

in mathematics is a prerequisite for many higher education courses and professional careers in these areas (Nwabueze, 2020).

Academic achievement in mathematics refers to the extent to which a student has attained their short or long-term educational goals in the subject of mathematics. This encompasses a range of competencies and skills, including understanding mathematical concepts, performing calculations accurately, solving problems, and applying mathematical reasoning to real-world situations. These factors can be broadly categorized into student-related factors, teacher-related factors, and school-related factors. Student-related factors include attitudes towards mathematics, motivation, and prior knowledge. Teacher-related factors encompass the quality of instruction, teaching methods, and teacher qualifications. School-related factors involve the availability of resources, classroom environment, and administrative support (Iji, 2019).

Students' achievement in mathematics has become an issue in the last two decades. Many students perceive mathematics as the most difficult subject in their course of study, despite its fundamental role in human development. In most African countries, especially Nigeria, the study of mathematics is made compulsory at the basic level of education (from primary one to junior high level) and senior high school (SHS) level. This is because mathematics is seen as a crucial tool for national development and it improves individual learning capabilities (Ampofo, 2019). However, due to the high level of poor achievement in mathematics, different researchers have researched the causes of the poor achievement of students in mathematics. Some studies are based on the students' interest in their mathematics achievement (Warren, Reilly, Herdan, & Lin2021). Others say the gender of the students has a significant effect on their mathematical achievement (Innabi & Dodeen, 2018). Additionally, the way teachers present lessons significantly impacts students' motivation to learn mathematics, which will have an impact on their academic achievement, according to Noreen et al. (2019).

Academic achievement in mathematics has been a subject of concern for educators, policymakers, and parents in Onitsha North Local Government Area. The region has witnessed a consistent pattern of poor performance in mathematics among junior secondary school students. This trend raises questions about the effectiveness of the current teaching methods and the overall learning environment. Several factors have been identified as contributing to students' academic performance, including teaching quality, learning resources, student motivation, and socio-economic conditions (Akinoso, 2018).

The educational landscape has undergone a significant transformation in recent years, driven by the rapid advancement of technology. This transformation is particularly evident in the realm of mathematics education, where technological tools and resources have the potential to revolutionize teaching and learning processes. In Nigeria, the integration of technology in education is seen as a crucial step toward improving educational outcomes and bridging the gap between traditional teaching methods and the demands of the 21st century. Technology provides interactive and multimedia-rich content, making learning more engaging and enjoyable. Tools such as educational software, videos, and simulations help visualize complex concepts, enhancing understanding and retention (Johnson, 2019). Additionally, technology enables access to educational resources for students regardless of their geographical location. Online courses, virtual classrooms, and digital libraries ensure that quality education is accessible to all, including those in remote or underserved areas (Smith, 2020).

Moreover, the effective use of technology in education is contingent upon several factors, including the availability of resources, teacher competence, and student readiness (Oluwajana & Adebayo, 2020). In view of these, the researcher was motivated to investigate the impact of technology in teaching mathematics in junior secondary schools in Onitsha North Local Government Area of Anambra State.

### **Statement of Problems**

In the field of mathematics, technology has been increasingly integrated into teaching practices, with tools such as graphing calculators, interactive whiteboards, educational software, and online learning platforms becoming commonplace. Despite the potential benefits, there remains a gap in understanding the actual impact of these technologies on students' learning outcomes in mathematics.

The problem centers on whether the use of technology in mathematics education effectively enhances students' understanding of mathematical concepts, improves their academic achievement, and fosters long-term retention of knowledge. There are concerns that while technology can make lessons more

engaging and accessible, it might also lead to over-reliance on tools, reducing students' ability to perform mathematical operations independently. Additionally, disparities in access to technology and varying levels of technological proficiency among students and teachers may create inequities in learning experiences.

One of the critical factors influencing students' academic achievement in mathematics is the quality of mathematics instruction. Effective teaching strategies that engage students and make abstract concepts more understandable are essential for improving performance in mathematics. However, many teachers in Nigeria face challenges such as inadequate professional development opportunities, limited access to teaching resources, and large class sizes, which can hinder effective teaching and learning. Therefore, the researcher deemed it fit to investigate the effect of the use of technology on students' academic achievement in junior secondary school mathematics.

### **Purpose of the Study**

The general purpose of the study is to ascertain the effect of the use of technology on students' academic achievement in junior secondary school mathematics in Onitsha North Local Government Area of Anambra State. Specifically, the study aims to:

1. Determine the types of technological tools and resources used in teaching junior mathematics in Onitsha North Local Government Area of Anambra State.
2. Assess the effects of these technological tools on students' understanding and achievement in learning mathematics in Onitsha North Local Government Area of Anambra State.
3. Determine the effect of the use of technology on the male and female students' academic achievement in Onitsha North Local Government Area of Anambra State.
4. Examine the differences in academic achievement between students taught mathematics using technology and those taught through traditional methods in secondary schools in Onitsha North Local Government Area.

### **Significance of the Study**

This study will help students understand the benefits of learning mathematics with ICT technologies. It will also teach them how to effectively use ICT gadgets at home to improve their performance in examinations and identify which technologies to use for specific tasks. Insights from the study can guide professional development programs for teachers, helping them to effectively integrate technology into their teaching methods.

The findings of the study will inform educational administrators about the necessary learning technological and workshops needed for effective mathematics teaching. The study will highlight the need for increased investment in ICT materials for schools to facilitate effective teaching and learning.

Finally, for future researchers, the study will contribute to the body of knowledge on technology in education, providing a foundation for future research in this area. Future researchers can build on these findings to explore further advancements in educational technology and their impact on student achievement.

### **Scope of the Study**

The study focuses on the examining the effect of the use of technology on students' academic achievement in junior secondary school mathematics. The geographical scope of the study is limited to selected government secondary schools in Onitsha North Local Government Area of Anambra State.

### **Research Questions**

- IV. What types of technological tools and resources are used in teaching mathematics in Onitsha North Local Government Area of Anambra State?
- V. What are the effects of these technological tools on students' understanding and achievement in learning mathematics in Onitsha North Local Government Area of Anambra State?
- VI. How does the use of technology in mathematics instruction affect the academic achievement of male and female students differently in secondary schools in Onitsha North Local Government Area?

- VII. What is the difference in academic achievement between students taught mathematics using technology and those taught using traditional methods in secondary schools in Onitsha North Local Government Area?

### **Research Hypothesis**

**Ho<sub>1</sub>:** There is no significant difference in the academic achievement of male and female students when taught mathematics using technological tools in secondary schools in Onitsha North Local Government Area.

## **METHOD**

### **Research Design**

The research design adopted for this study is a Quasi-experimental research design. Nworgu (2006) explains that quasi-experimental designs are common when researchers cannot fully control all variables but still wish to explore causal relationships. Such designs include pretest-posttest designs, non-equivalent group designs, and time-series analysis. Quasi-experimental designs identify a comparison group that is as similar as possible to the treatment group in terms of baseline (pre-intervention) characteristics.

### **Area of the Study**

The study was carried out in Onitsha North Local Government Area of Anambra State located at the South Eastern geopolitical zone of Nigeria. Onitsha North Local Government Area is bordered in the East by Idemili North and Oyi Local Government, in the north Anambra East Local Government, in the South by Onitsha South Local Government and in the West by Delta State. Onitsha North is situated in Onitsha Town. The metropolitan city Onitsha is known for its river port and an economic hub for commerce, industry and education. The headquarter of Onitsha North is located in Onitsha Town. Onitsha North is mostly populated by members of the Igbo ethnic group for which Igbo and English language are commonly spoken. Onitsha North local government accommodates people from diverse ethnic group, state, local government and communities. The primary/major occupations of the indigenes are trading, agriculture, etc, for which the local government hosts the Onitsha main market in Africa in terms of geographical size and volume of goods. Onitsha North has several public, missionary, private, nursery, primary, and secondary schools. Therefore, Onitsha North Local Government Area of Anambra State is appropriate for the study because adequate sample size is assumed based on the large population of junior secondary school students.

### **Population of the Study**

The population for the research comprises all JS 2 students in public secondary schools within the area, which comprises a total of 2,421 students for the 2023/2024 academic session. At the time of the study, there were 16 secondary schools in Onitsha North Local Government Area.

### **Sample and Sampling Technique**

Simple stratified sampling technique was used to select three (3) secondary schools in Onitsha North Local Government Area out of sixteen (16) secondary schools. A total number of one hundred and sixty-four (164) JS 2 students were selected for the study. The sample consist of one girls' school with the population of fifty-six (56) students, one boys' school with population of fifty (50) students and one mixed school with the population of fifty-eight (58) students.

### **Instrument used for Data Collection**

The instrument used for data collection was Mathematics Achievement Test (MAT) developed by the researcher. It covered the topics from sequence and modula arithmetic for JS 2 students. It comprises twenty (20) objective tests with four options.

### **Validation of Instrument**

Validity is the extent to which the instrument measures what it is supposed to measure. The instruments used in this research was validated by two experts one from the department of mathematics and the other from department of psychology all from Nwafor Orizu College of Education. They all offered useful advice to enable the researcher to elicit the required information and data for the study.

### **Reliability of the Instrument**

For reliability of the instrument, a pilot study of the validated instrument was done outside the sample school. One Government Secondary School was used for the pilot test. A test retest was used at two weeks interval. The two sets of response were correlated using Pearson product moment correlation coefficient, and the reliability coefficient of 0.75 was established, hence the study is reliable.

### **Experimental Procedures**

The first week, the researcher visits the sampled schools for introduction and the purpose of the study to take permission to use the schools, samples the classes and the students to be involved in the study. The second week, the students were divided into two groups, in each school, the experimental group and control group. Pretest was then administered to all the students involved, both the control and experimental group. Thereafter, teaching on sequence was carried out with the aid of technology for the experimental while that of control group was conventional method. The teachers in charge of mathematics in each school took over the control group for conventional teaching, and also the students with a technology gadget (Phone and Laptop). At the end of lessons, Posttest was administered on all the students involved in the study, to determine their retention of the study. The marks obtained from the tests were added together to form the data for the study, and the average determined.

### **Method of Data Collection**

The method of data collection used in this study was Mathematics Achievement Test (MAT). The researcher administered the copies of the (MAT) to JS 2 students in the selected secondary schools in Onitsha North Local Government Area of Anambra State. The (MAT) was collected after 45minutes from the students.

### **Method of Data Analysis**

The data collected were analyzed using mean and standard deviation for research questions while z-test was used to test the hypothesis at 0.05 level of significance. The researcher compared the mean scores, that is, the mean score of the results of the students when taught with conventional teaching method and the mean score of their results when taught with the aid of technological gadget. The researcher also compared the mean scores of the result of the male students and the mean score of the female students. This is because mean is the most reliable representative measure of central tendency and standard deviation is the most reliable estimate of variability.

### **Decision Rule**

If Z-Critical is greater than the Z-Calculated we accept the null hypothesis if not we do not accept the null hypothesis.

**PRESENTATION AND ANALYSIS OF DATA**

**Research Question 1:** *What types of technological tools and resources are used in teaching mathematics in Onitsha North Local Government Area of Anambra State?*

**Table 1:** Mean Responses on types of technological tools and resources used in teaching mathematics in Onitsha North Local Government Area of Anambra State.

S/N	ITEMS	SA	A	D	SD	N	$\bar{X}$	S.D	Decision
1.	Mathematics teachers use Interactive white boards while teaching.	62	60	32	10	164	3.06	0.90	Accepted
2.	Teachers use YouTube and other video platforms to supplement lessons with visual and auditory explanations.	10	41	51	62	164	2.25	0.46	Rejected
3.	Interactive games that promote problem-solving and critical thinking skills are used by mathematics teachers in a fun, and engaging way.	15	29	21	99	164	1.65	1.00	Rejected
4.	Programs like GeoGebra, and MATLAB that provide interactive platforms for exploring mathematical concepts are used in mathematics learning.	20	21	23	100	164	1.64	1.27	Rejected
5.	Graphing Calculators that help students visualize and solve complex mathematical problems are used in mathematics class.	56	60	20	28	164	2.88	1.06	Accepted

From table 1, it was revealed that item numbers 1 and 5 were accepted with the mean scores of 3.06, and 2.88 respectively which are above the cut-off point of 2.50. While item 2, 3 and 4 were rejected with the mean scores of 2.25, 1.65 and 1.64 respectively. This shows that the types of technological tools and resources used in teaching mathematics in Onitsha North Local Government Area of Anambra State includes only Interactive white boards; where teachers can write, draw, and manipulate mathematical concepts, and Graphing Calculators that help students visualize and solve complex mathematical problems.

**Research Question 2:** *What are the effects of these technological tools on students' understanding and achievement in learning mathematics in Onitsha North Local Government Area of Anambra State?*

**Table 2:** Mean responses on the effects of these technological tools on students' understanding and achievement in learning mathematics in Onitsha North Local Government Area of Anambra State.

S/N	ITEMS	SA	A	D	SD	N	$\bar{X}$	S.D	Decision
6.	Interactive tools, like whiteboards and educational games, can make lessons more engaging and can encourage students to participate actively.	49	73	20	22	164	2.93	0.90	Accepted
7.	Technology often makes learning more enjoyable, which can increase students' motivation to learn and practice mathematics.	56	48	50	10	164	2.91	0.95	Accepted
8.	Tools like graphing calculators and simulation software help students visualize complex concepts, making them easier to understand.	76	68	15	5	164	3.31	0.76	Accepted
9.	Technology can demonstrate the practical applications of mathematical concepts, bridging the gap between theory and real-life scenarios.	65	43	47	9	164	3.05	0.77	Accepted
10.	Online platforms provide a wealth of resources that cater to different learning styles, allowing students to learn at their own pace.	70	79	10	5	164	3.36	0.46	Accepted

From table 2, it was discovered that all the item from 6 -10 were all accepted with the mean score of 2.93, 2.91, 3.31, 3.05 and 3.36 respectively. This indicates that the effects of these technological tools on students' understanding and achievement in learning mathematics in Onitsha North Local Government Area of Anambra State includes: Interactive tools, like whiteboards and educational games, can make lessons more engaging and encourages students to participate actively, it makes learning more enjoyable, which can increase students' motivation to learn and practice mathematics. Tools like graphing calculators and simulation software help students visualize complex concepts, making them easier to understand, it can demonstrate the practical applications of mathematical concepts, bridging the gap between theory and real-life scenarios. Online platforms provide a wealth of resources that cater to different learning styles, allowing students to learn at their own pace.

**Research Question 3:** *How does the use of technology in mathematics instruction affect the academic achievement of male and female students differently in secondary schools in Onitsha North Local Government Area?*

**Table 3:** Mean Achievement Scores and Standard Deviation of how the use of technology in mathematics instruction affect the academic achievement of male and female students differently in secondary schools in Onitsha North Local Government Area.

Groups	Gender	No	Pre-test Mean	Pre-test Standard Deviation	Post-test Mean	Post-Test Standard Deviation	Mean Gain
Experimental	Male	50	48	40.16	49.21	42.06	1.21
	Female	56	46.93	39.41	48.56	40.30	1.63

Table 3 shows the pre-test and post-test mean scores with standard deviations of the male and female students taught mathematics with the aid of technology. The table shows that, the male students had post-test mean score of 49.21 with standard deviation of 42.06. And a pre-test mean score of 48 with standard deviation of 40.16. The results show a mean gain score of 1.21. Similarly, the table shows that the female students had post-test mean score of 48.56 with standard deviation of 40.30. And pre-test mean score of 46.93 with standard deviation of 39.41. This shows a mean gain score of 1.63.

This implies that there is just a slight difference on male and female students' performance when taught mathematics with the aid of technology, with the female students more preferable in their performance though not much difference due to differences in number of male and female students used for the study.

**Research Question 4:** *What is the difference in academic achievement between students taught mathematics using technology and those taught using traditional methods in secondary schools in Onitsha North Local Government Area?*

**Table 4:** Mean Achievement Scores and Standard Deviation on the difference in academic achievement between students taught mathematics using technology and those taught using traditional methods in secondary schools in Onitsha North Local Government Area.

Groups	No	Pre-test Mean	Pre-test Standard Deviation	Post-test Mean	Post-test Standard Deviation	Mean Gain Score
Experimental (TM)	106	47.46	39.78	48.9	41.18	1.44
Control (CLM)	58	52.09	45.18	46.88	39.34	-5.21

**Table 4** shows the pre-test and posttest mean scores with standard deviation of the experimental and control groups. The table shows that in the experimental group, the student taught with the aid of technology has the pre-test mean score of 47.46 with standard deviation of 39.78 and a posttest mean score of 48.9 and with standard deviation of 41.18. The result shows a mean gain score of 1.44. Furthermore, the students in the control group which were taught with conventional method has the pre-test mean score of 52.09 with standard deviation of 45.18 and post-test mean score of 46.88 and standard deviation of 39.34. This shows a mean gain score of -5.21. This result shows the differences in the mean

scores of the two groups of students. The table shows further that there are increases in the students' mean scores in the experimental group while that of control group was decreased, this implies that students taught with the aid of technology performed better in their retention test while those with normal lecture method decreased in their performance.

**Testing of the Corresponding Null Hypothesis**

**Ho<sub>1</sub>:** There is no significant difference in the academic achievement of male and female students when taught mathematics using technological tools in secondary schools in Onitsha North Local Government Area.

**Table 5:** Summary of Analysis of Z-test Results of Mean Achievement Scores of male and female students taught mathematics using technological tools in secondary schools in Onitsha North L.G.A.

Groups	Gender	NO	Mean	SD	Z-Cal	Z-Crit	Sig.level	Derivation
Experimental (PTM)	Male	50	48	40.16				
Control (CLM)	Male	50	49.21	42.06	7.11	1.96	0.05	Rejected
Experimental (PTM)	Female	56	46.93	39.41				
Control (CLM)	Female	56	48.56	40.30				

Table 5 shows the analysis of z-test, conducted to determine the difference in the male and female students' academic achievement scores when taught with the aid of technology. With Z-cal = 7.11, which is greater than Z-crit which is 1.96. The null hypothesis 1 was therefore, Rejected. This implies that there was a statistically significant difference in the mean academic scores of the male and female students taught mathematics with the aid of technological teaching methods. And it was more in favor of the females.

**DISCUSSION OF FINDINGS**

***What types of technological tools and resources are used in teaching mathematics in Onitsha North Local Government Area of Anambra State?***

The findings indicated that the types of technological tools and resources used in teaching mathematics in Onitsha North Local Government Area of Anambra State are only Interactive white boards and Graphing Calculators. This finding is in line with the study of Hennessy, & London, (2013) who stated that these tools allow for dynamic presentations and real-time student interaction, which can enhance engagement and understanding of mathematical concepts.

***What are the effects of these technological tools on students' understanding and achievement in learning mathematics in Onitsha North Local Government Area of Anambra State?***

The findings revealed that the effects of these technological tools on students' understanding and achievement in learning mathematics includes: Interactive tool (like whiteboards and educational games) can make lessons more engaging and can encourage students to participate actively. It also makes learning more enjoyable, which can increase students' motivation to learn and practice mathematics. Tools like graphing calculators and simulation software help students visualize complex concepts, making them easier to understand, it can demonstrate the practical applications of mathematical concepts,



bridging the gap between theory and real-life scenarios. And online platforms provide a wealth of resources that cater for students' different learning styles, allowing students to learn at their own pace. These findings are in line with Koren, & Dori, (2016) who stated that Technological tools like interactive whiteboards and educational software help students visualize abstract mathematical concepts, improving their comprehension. Tools like GeoGebra allow students to manipulate geometric shapes and functions, facilitating deeper understanding. The use of technology helps cater to diverse learning styles, allowing students to learn at their own pace, which can lead to improved performance.

***How does the use of technology in mathematics instruction affect the academic achievement of male and female students differently in secondary schools in Onitsha North Local Government Area?*** from the findings, it was discovered that there is just a slight difference in male and female students performance when taught mathematics with the aid of technology, with the female students more preferable in their performance, though not much different due to differences in number of male and female students used for the study. These findings are in line with the discovery of Okoye, (2023) who opined that Studies have often found that female students tend to display more confidence when interacting with technology in mathematics. This confidence can lead to greater engagement and willingness to explore complex mathematical concepts using technological tools such as graphing calculators, software applications, and interactive learning platforms.

***What is the difference in academic achievement between students taught mathematics using technology and those taught using traditional methods in secondary schools in Onitsha North Local Government Area?***

From the findings, it was discovered that students taught with the aid of technology performed better in their retention test, while those with normal traditional method decreased in their performance. This finding was in line with the findings of Cheung & Slavin (2018) who stated that Research comparing the two teaching methods have shown that students exposed to technology tend to retain information better and achieve higher test scores in mathematics. A meta-analysis revealed that technology integration in teaching significantly improves academic performance compared to traditional instruction methods. Studies have also indicated that students taught with technology outperform their peers in traditional settings, particularly in areas like problem-solving and critical thinking skills.

## **CONCLUSION**

The integration of technology in teaching and learning of secondary mathematics has a profound impact on students' academic performance. Evidence from various studies indicates that technology enhances student engagement, motivation, and conceptual understanding, which are critical factors in achieving academic success in mathematics. By providing interactive tools and resources, technology enables personalized learning experiences that cater to individual student needs, fostering a deeper understanding of mathematical concepts. Furthermore, students exposed to technology demonstrate improved retention of knowledge and higher achievement levels compared to those taught through traditional methods. Therefore, it is evident that the effective use of technology in mathematics instruction can lead to significant improvements in students' academic performance.

## **RECOMMENDATIONS**

1. Educational institutions should invest in professional development programs that equip mathematics teachers with the skills to effectively integrate technology into their teaching practices. Training on various technological tools and resources can empower educators to create engaging and interactive learning environments.
2. Schools should ensure that all students have access to the necessary technological tools, such as computers, tablets, and internet connectivity. This can help bridge the digital divide and provide equal opportunities for all students to benefit from technology-enhanced learning.
3. The curriculum should be revised to incorporate technology meaningfully into mathematics instruction. This includes developing lesson plans that utilize educational software, online resources, and interactive platforms to enhance the learning experience.

4. Schools should encourage parental involvement in technology-based learning. Workshops and information sessions can help parents understand how to support their children in using technology effectively for their mathematics studies.

#### **Limitation of the Study**

The most limiting factors in this study were time and distance influence in administering and collecting the questionnaire.

#### **Suggestions for Further Studies**

1. The academic benefit of effective use of technology by schools in teaching and learning of mathematics
2. Solutions for effective utilization of use of technology in teaching and learning of Mathematics in secondary schools.

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