



## Impact of Uses of Technology Tools Among Teachers and Students of Mathematics in Colleges of Education in Nigeria

<sup>1</sup>Momozoku, Umaru Salihu (PhD) & <sup>2</sup>Sani Saidu (PhD)

Corresponding Author: [emoku@yahoo.com](mailto:emoku@yahoo.com)

<sup>1</sup>Department of Mathematics, Faculty of science, Federal University of Education Kontagora, Niger State

<sup>2</sup>Department of Mathematics, Faculty of Science Education, Federal University of Education, Zaria Kaduna State

DOI: <https://doi.org/10.5281/zenodo.17313821>

---

### Abstract

*The study investigated the impact of the uses of technology tools among teachers and students in Mathematics classroom instruction in colleges of educations in Nigeria. A research question and one research hypothesis guided the study. Descriptive survey method was employed. The sample consisted of one hundred and sixty (160) students; and thirty-six teachers selected from four colleges of educations in North-West and North-Central Zones of Nigeria. Forty (40) students and Nine (9) teachers were selected each from the four colleges of educations using purposive sampling techniques. Two questionnaires consisting of ten (10) items for teachers and ten (10) items for students were used for data collection with reliability coefficients of 0.65 and 0.68 respectively using Cronbach alpha (20) Mean and standard deviation were used to answer the research question while t-test statistic was used to analyzed the hypothesis. The results showed that the mean responses of teachers and students differ significantly. Therefore, the null hypothesis of no statistical difference between lecturers and students responses was rejected. It was recommended that government and its agencies like NCCE should provide computers to colleges of educations to enable students and teachers have access to utilize them in acquiring computer skills.*

**Keywords:** Technology, Technology tools, Mathematics Education, Mathematics Instruction

---

## Introduction

Modern Technology has changed the way of living of people worldwide in all spheres of live. they are increasingly shaping the teaching of mathematics at every level of education as the classroom instruction is not an exception (Weinhandl, Houghton, Lindenbauer, Mayerhofer, Lavicza, & Hohenwarter, 2021). Mathematics being a universal subject in its concepts, and application can also benefits from modern technology. Momozoku, Tijjani and Audu (2022), Jeremy (2014) define technology in the classroom as any electronic tool that can be used to help promote human learning, including—but not limited to—calculators, tablets (such as an iPad), Smart Boards, video cameras, digital cameras internet, computer software, MP3 players, Portable Digital Assistants (PDAs), and of course, the computer. These are all innovations that have helped countless people during regular daily activities, but they can also have a profound impact on classroom learning.

Integration of technology in tertiary mathematics education enhances learning by visualizing abstract concepts, increasing students engagement, and developing higher-order thinking skills through tools like Digital technologies (*Microsoft Mathematics, internet connection and broadband communication, interactive whiteboard and power point, data handling software and dynamic statistical tools like SPSS, MATLAB, video projector and tablets, smart phones and social networking*), information and communication technology (ICT) tools, Computer-Algebra System (CAS), Interactive Simulating, online resources, machine learning (ML) and artificial intelligence (AI) (Olusegun & Honmane, 2024; Ogunode, Agbade & Bassey., 2023). AI offers advanced features like personalized learning and automated resources, effective integration requires accessible infrastructure and addresses challenges like teacher competence and learners attitudes towards digital tools (Osondu, Ogbonna & Umah, 2023; Delorme, 2016; National Council of Teachers of Mathematics NCTM, 2008). Further they stated that Mathematics is closely related to visualization, and better learning can be achieved by using different representations of mathematical objects and procedures, in order to foster students' understanding of the subject. It is even better when students can interact with these visualizations and can explore on their own new features of the mathematical content using relevant technology.

Technology can be used in a variety of ways to improve and enhance the teaching and learning of mathematics. According to Ukasha, and Jatau (2023), technology enhance visualization, improve learning and studying abilities in the learners. Development of computer creativity ease mathematics teaching by mathematics instructors and making mathematics teaching more attractive and interesting, and developing self-confidence among the students. In addition, the computational and graphical

capabilities of current technologies enable users to efficiently generate and manipulate a variety of representations of mathematical ideas and processes. Activities that engage students in connecting multiple representations (e.g., graphical, numerical, algebraic and verbal), and those that invite students to analyze or create images, visualizations, and simulations provide wide-ranging opportunities for mathematical exploration and sense making (Delorme , 2018; Means & Haertel, 2004; NCTM, 2008). Computer-based technologies have the potential to dramatically transform Mathematics education in Nigeria. Computers can accommodate a greater variety of teaching and learning styles, make some problems and topics more accessible, and provide new ways to represent and handle mathematical information, affording choices about content and pedagogy, offering such educational settings as puzzles, micro worlds, tutoring systems, mathematical programming environments, visualizations in mathematical domains from statistics to calculus, geometric construction tools, abstract algebra and more (Sfard & Leron, 1996). Computer rich learning environment simulates and improves students understanding on mathematical concepts. It also increases interactive learning—promotes exploration, generalizations and reasoning process (diSessa, 2001).

Teaching with various technologies like several computers or calculator tools and not really mastering them may do more harm than good. Learning a few good tools well enough and use them knowledgeably, intelligently, mathematically, confidently, and appropriately in solving otherwise difficult problems makes a genuine contribution to a student’s mathematical education (Goldenberg, 2000). Instruction that takes full advantage of what technology has to offer can encourage, foster, and support students’ construction of mathematical knowledge in a variety of ways. Technology can also improve mathematical communication, facilitate more efficient use of mathematical resources, and raise the quality of mathematical products and presentations.

Technology can change the nature of school mathematics by engaging students in more active mathematical practices such as experimenting, investigating and problem solving that make learning in-depth and encourage them to ask questions rather than only looking for answers (Makar & Confrey, 2006; Das, 2019; Momozoku et al, 2022). It enables users to explore topics in more depth (e.g., interconnect mathematics topics, write programs, devise multiple proofs and solutions) and in more interactive ways (e.g., simulations, data collection with probes). Technology also makes accessible the study of mathematics topics that were previously impractical, such as real and functional analyses, by removing computational constraints (Joe, et al, 2014).

The integration of the use of a calculator, a spreadsheet, a computer algebra system, a statistical

package, or dynamic geometry software, graphic calculators and computers in mathematics classrooms is a recent change in mathematics education (Osondu et al, 2023, Momozoku et al, 2022; Das, 2019). Afolabi (2014) and Davis (1997) opined that technology will enhance learner centered classroom, collaboration, communication, cooperation and learning through enquiry. It also meets individual differences where students learn with immediate feedback on task. The boredom experienced in solving complex problems can be reduced through introduction of technology into Mathematics education Abimbade (2007) and Jeremy (2016) believed that the power of using technology in the teaching of mathematics has been emphasized by researchers in Mathematics education as a strategy for developing problem solving skills which was seen as a new development in this twenty first century. With the potentials in technology, abstraction and complexity associated with learning Mathematics will be reduced. Mathematics education that is technology driven will promote collaboration in learning, increase in interest and positive attitude. Technology is an effective aid to teaching and a tool that facilitate learning (Afolabi, 2014; Goldenberg, 2000). Students can work independently and interaction between them and the teacher becomes minimal whereas learning is increased (Mensah, 2022; Das, 2019). There is the possibility of self-tutoring when the students make use of the computer assisted instruction (Momozoku et al, 2022).

Technology tools are widely used today in the mathematics classroom and are proving to be very effective teaching aids. As a teaching tool, technology software can provide a new way to link abstract concepts with tangible visualizations. Technology software offers students the opportunity for self-learning and can also be instrumental in motivating them to learn abstract Mathematical concepts.

Motivation is an essential aspect of teaching and learning. Findings from related studies indicate that the use of technology resources plays a major part in motivating students to learn (Momozoku et al, 2022; Olusegun & Honmane, 2024). Once students are motivated they will learn from any media if it is completely used and adapted to their needs. They become stimulated when they are actively and emotionally involved in their own learning. Therefore, teachers need to provide motivational activities or strategies to hold the learners attention and sustain it throughout the lesson. Osondu et al (2023) and Momozoku et al (2022) noted specifically that integration of technology tools in teaching and learning mathematics provide motivational activities that stimulate them to learn. Therefore, the study investigated the impact of the uses of technology tools among teachers and students in Mathematics classroom instruction in colleges of educations in Nigeria.

**Research Question:** What impact does the use of Technology tools have on the teacher and students' in the classroom instruction?

**Research Hypothesis (Ho):** There is no significant difference among the mean responses of teacher and students on the uses of Technology tools in the classroom instruction.

### **Research Methodology**

The study employed the survey method. The researchers simply surveyed the opinion of the teachers and students in the sampled colleges of education; and generalize the findings obtained to the entire population. The study was carried out among Government Colleges of Education in North-West Zone of Nigeria.

The populations of the study comprised of eight three (83) Mathematics teachers and two thousand, one hundred and forty-five (2145) students offering Mathematics in the selected colleges of educations in Nigeria. The sample of the study consisted of one hundred and sixty (160) students; and thirty-six Lecturers selected from four colleges of educations in the zone. Forty (40) students and Nine (9) Lecturers were selected each from the four colleges of educations using purposive sampling techniques. The instruments for data collection for the study were a ten (10) item questionnaire and a ten (10) item questionnaire for Lecturers and students respectively. The questionnaires were four item Likert's scale having four responses of Strongly Agree (SA=4); Agree (A=3); Disagree (D=2) and Strongly Disagree (SD=1). The reliability of the questionnaires was determined using Cronbach alpha ( $\alpha_{20}$ ) and found to be 0.65 and 0.68 respectively. This indicates that the questionnaires items were reliable and can be used for the study.

Two questionnaires consisting of ten items for Lecturers and ten (10) items for students were used for data collection. The questionnaires were administered to the students and teachers in their respective schools through their head of departments. After their responses to the items in the questionnaire which lasted for one hour, the questionnaire was immediately retrieved from the respondents by the head of departments and forwarded to the researchers.

The Statistical tools of mean ranks; mean ranks difference and standard rank deviation were used to answer the research questions while t-test statistic was used to analyze the hypothesis of the data collected from the study.

### **Results**

The data collected from this study were analysed using descriptive statistics of mean, standard deviation

and mean difference to answer the research question while inferential statistics of t-test was used for the hypotheses testing at  $\alpha = 0.05$  level of significance. The details of the analyses were as follow:

**Research Question:** What impact does the use of technology have on the lecturers and students' in the classroom instruction? To answer this research question, the result is presented in table 1:

*Table 1: Mean, Standard Deviation and Mean Difference of Lecturers and Students responses to the questionnaires*

Group	N	Mean	Std Dev	Mean Diff
Lecturers	36	32.14	2.10	7.58
Students	160	24.56	1.94	

The results in table 1 show the mean response of teachers to be 32.14 with standard deviation of 2.10 while the mean response of students was 24.56 with standard deviation of 1.94. The mean difference between Lecturers response and students' response to the uses of technology tools for classroom instruction was 7.58.

**Research Hypothesis (H<sub>0</sub>):** There is no significant difference between the mean responses of Lecturers and students on the uses of Technology tools in the classroom instruction. To answer this hypothesis, inferential statistics of t-test was used as presented in table 2:

*Table 2: t-test statistic of Mean Responses between Lecturers and Students*

Group	N	Mean	Std. dev	Mean diff	P	Df	t <sub>cal</sub>	Remark
Lecturers	36	32.14	2.100	7.58	0.000	194	20.84	*
Students	160	24.58	1.942					

\*Significant at  $P < 0.05$

The result in table 2 showed that the calculated (t) t<sub>cal</sub> is 20.84 with degree of freedom of 194 having p-value of 0.000. The p-value of 0.000 is less than alpha value of 0.05. Based on this result, the null hypothesis was rejected. It implies that there was significant statistical difference between the mean responses of Lecturers and students on the uses of technology tools for classroom instruction. It creates room for more students-centred approach than Lecturer-centred approach.

## Discussions of Findings

The study was set to investigate the impact of technology in Mathematics classroom instruction in

Colleges of Education in Nigeria. The finding obtained from the hypothesis tested was discussed as follow:

The results of hypothesis in table 2 showed that the mean responses of teachers and students differ significantly. It means that they have various accesses to the use of the technology tools. The two groups' were influenced by the use of technology tools as such the null hypothesis was rejected.

The findings of the study were in line with Momozoku et al (2022) and Odera (2011) who stated that use of computer technology in teaching and learning increase students interest and make them want to learn on their own. They maintained that technologies were good motivators that heighten students' interest and enjoyment that had positive effect on the subject they learn. It also motivates students and increases their attention to learn new things. Heinich, Molenda, Russell and Smaldino (2002) opined that both teachers and students were fully engaged to the extent that no one sleep during the use of technology tools in the class, a sign that they appreciate the use of technology, what they learn from them and they are source of motivation to them. It sustains their interest and not bored by it as compared to the teachers' chalk and talk.

## **Conclusion**

Effective learning in class depends on the teachers' ability to motivate and encourage students to learn the subject matter. However, not all students are motivated by the use of computer technology. No matter how much technology is available, no matter how well it is integrated into instructional content, it is the learners' willingness or ability to learn that is paramount. The Lecturer needs to identify and adopts those aspects of teaching situation that enhance students' self-motivation by using technologies in teaching and learning which will help students to learn effectively.

## **Recommendations**

It is recommended that:

- ✓ Federal and State Governments; and their agencies like NCCE and Ministries of Educations should provide computers to colleges of educations to enable students and Lecturers acquire computer skills so as to teach and learn meaningfully.
- ✓ Mathematics educators should be fully trained by both Federal and State Ministries of Education on the use of various technologies to provide the required knowledge and skills to the students.
- ✓ Electricity supply should be improved nationwide to enable Mathematics educators (Lecturers) apply technologies while teaching.

- ✓ Federal and State Governments should provide adequate technology facilities and tools in good quantity and quality in all the schools not minding their location for effective teaching and learning.

## References

- Abimbade, A. (2007). Theoretical Framework of E-Learning: Implications for Instructional Designs and Practices. *Journal of E-Learning*, 6(2), 49-82.
- Afolabi, S. S. (2014). Globalisation, Information Communication Technology and Mathematics Education: Implications for Pedagogy in Tertiary Institutions. *ABACUS: Journal of Mathematical Association of Nigeria*, 39(1), 355-362.
- Bariu, T., Chun, X., & Azzeddine B. (2022). Influence of Teachers' Competencies on ICT Implementation in Kenyan Universities, 1-11 <https://doi.org/10.1155/2022/1370052>
- Das, K. (2019). Role of ICT for better Mathematics Teaching. *Shanlax International Journal of Education*, 7(4), <https://doi.org/10.34293/education.v7i4.641>.
- Davis, S. J. H. (1997). How Mastering Technology can Transform Mathematics Class. *Education Leadership*, 55(1), 49-51.
- Delorme, S. (2016). Technology and mathematics: Supporting students learning and engagement in mathematics in today's elementary classrooms through the use of iPads. Retrieved from [https://tspace.library.utoronto.ca/bitstream/1807/72181/1/Delorme\\_Stephanie\\_L\\_20160](https://tspace.library.utoronto.ca/bitstream/1807/72181/1/Delorme_Stephanie_L_20160)
- diSessa, A. A. (2001). *Changing Minds: Computer, Learning, and Literacy*. Cambridge (Mass.): The MIT Press.
- Goldenberg, P. E. (2000). Thinking (And Talking) About Technology in Mathematics Classrooms: *Issues in Mathematics Education*. American Association for the Advancement of Science; Education Development Center, Inc. 1.
- Jeremy, P. (2014). How Technology can Benefit your Students. *National Math + Science Initiative Blog*. Retrieved on Monday 29<sup>th</sup> May, 2025
- Joe, G; Hollylynne, S. D; Harper, S. & Timmerman, M. A. (2014). Promoting Appropriate Use of Technology in Mathematics Teachers Preparation. University of Virginia. Retrieved on Thursday 1<sup>st</sup> June, 2017.
- Makar, K., & Confrey, J. (2006). Dynamic Statistical Software: How are Learners using it to conduct Data-based Investigations? In C. Hoyles, J. Lagrange, L. H. Son, & N. Sinclair (Eds.), *Proceedings of the 17th Study Conference of the International Commission on Mathematical Instruction*. Hanoi Institute of Technology and Didirem Université Paris 7.
- Means, B., & Haertel, G. (2004). *Using Technology Evaluation to Enhance Students Learning*. New York: Teachers College Press, 1-12

- Mensah, J. (2022). Assessment of Mathematics Tutors' ICT Integration into Teaching and Learning of Mathematics in Colleges of Education of Ghana. Academia.edu. [https://www.academia.edu/37359656/Assessment\\_of\\_Mathematics\\_Tutors\\_IC](https://www.academia.edu/37359656/Assessment_of_Mathematics_Tutors_IC)
- Mintz, J. & Abramovich, S. (2025). Digital Technology in Secondary and Tertiary Mathematics Education <https://doi.org/10.1080/07380569.2025.2466361>
- Momozoku, S.U, Tijjani. A. A. & Audu, A. O. (2022). Application of Technologies in Mathematics Education in the 21<sup>st</sup> Century. *African Journal of Science, Technology and Mathematics Education (AJSTME)*. 8 special Issue (1), 418-423.
- National Council of Teachers of Mathematics. (2008). *The role of technology in the teaching and learning of mathematics*. Retrieved from [http://www.nctm.org/uploadedFiles/About\\_NCTM/Position Statements/Technology%20-final.pdf](http://www.nctm.org/uploadedFiles/About_NCTM/Position Statements/Technology%20-final.pdf)
- Odera, F. Y. (2011). Motivation: the most Ignored Factor in Classroom Instruction in Kenyan Secondary Schools. *International Journal of Science and Technology*, 1(6),283-288. <http://www.ejournalofsciences.org>
- Ogunode, N. J., Agbade, O. P., & Bassey, U. O. (2023). Barriers to Effective Usage of Artificial Intelligence in Tertiary Institution in North-Central, Nigeria . *Web of Semantics. Journal of Interdisciplinary Science*, 1(1), 38–43. Retrieved from <http://web.semanticjournals.org/index.php/wos/article/view/13>
- Olusegun, A. J. & Honmane, O. (2024). Deployment of Artificial Intelligence for Teaching and Learning of Mathematics Programme in Tertiary Institutions in Nigeria. *Best Journal of Innovation in Science, Research and Development*, 3(1), 125-137. ISSN: 2835-3579 [www.bjisrd.com](http://www.bjisrd.com)
- Osondu<sup>1</sup>, S. I, Ogbonna, C. C. & Umeh, C. E. (2022). Evaluating the use of digital technology in teaching and learning of mathematics in Federal universities in Nigeria. *Annals of Technology Education Practitioners Association of Nigeria ATEPAN* 5 (1), 87-94 ISSN: 2645-2839 (Print) eI SSN: 2645-2847 (Online)
- Sfard, A. & Leron, U. (1996). Just give me a Computer and I will move the Earth: Programming as a Catalyst of Cultural Revolution in the Mathematics Classroom. *International Journal of Computers for Mathematical Learning*, 1(1), 189-195.
- Ukasha, U., & Jatau, V.D. (2023). Technology in Mathematics education. *FNAS Journal of Mathematics and Science Education*, 4(2), 1-9. [www.fnasjournals.com](http://www.fnasjournals.com)
- Wakil, A., Bornaa, C., & Boare, I. (2023). Integration of Information and Communication Technology in the Teaching and Learning of Mathematics in Junior High Schools in Tamale, Ghana. *East African Journal of Education Studies*, 6(3), 414-429. <https://doi.org/10.37284/eajes.6.3.1602>
- Weinhandl, Houghton, Lindenbauer, Mayerhofer, Lavicza & Hohenwarter <sup>1</sup> (2021).Integrating

Technologies Into Teaching and Learning Mathematics at the Beginning of Secondary Education in Austria. Eurasia Journal Mathematics, Science and Technology Education EURASIA J Math Sci Tech Ed, Volume 17, Issue 12, Modestum, Article No: em2057  
<https://doi.org/10.29333/ejmste/11428>