

Relative Effectiveness of ICT tools and facilities on The Teaching and Learning of Mathematics on Senior Secondary School Students in Ekiti State

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ABSTRACT

This study investigated the relative effectiveness of ICT tools and facilities on the teaching and learning of Mathematics on SSS1 students, so that by year 2030, teachers and students, would have exploited the available technologies, to improve both students and teachers' teaching and learning outcomes. A pre-test post-test experimental design was adopted for the research; the pre-test was used to test for the homogeneity of the sample used for the study. The targeted population is 177 public senior secondary school 1. A simple random and purposive sampling technique was used to select the schools and the students respectively. 150 students from three intact classes were selected for the study which were later divided into two groups of 75 students in experimental group and 75 students in control group. This arrangement was supported by central limit theorem that regarded a minimum of 30 sample size appropriate for experimental group. Two null hypotheses were formulated and tested at 0.05 level of significance, Information and Communication Technology Mathematics Achievement Test (ICTMAT) was the instrument used in collecting data for the study. The reliability coefficient of the instrument was realized as $r=0.76$ and the instrument was also given content, facial and criterion validation. The data collected was analyzed using mean, standard deviation and t-test statistics at 0.05 level of significance. Outcome results indicated that students taught Mathematics with ICT tools and facilities (Experimental group) performed better than those students taught with traditional method (Conventional strategy). The result of gender differential on students taught Mathematics with ICT tools and facilities also revealed that male students performed better than female students. The outbreak of handset was an advantage to students to learn fast which assisted them in the usage of ICT tools and facilities. The study recommended among others that Mathematics teachers should endeavor to integrate the uses of ICT tools and facilities to their teaching and learning of Mathematical concepts and that Nigeria government should ensure that schools have stable electricity power supply if we're so interested to be recognized by year 2030.

KEYWORDS

ICT Tools, teaching, learning, school

I. INTRODUCTION

The function of mobilizing students for better achievement in mathematics is a function of several variables, especially at this age of science and technology. Nigeria like any other developing countries in the world, is interested in developing her science and technology potentials, so that, her citizens will be self-reliant in the production of goods and services. This is a clear evidence from the resolutions, Communique, Policies, Seminars, and

Workshops on Science Mathematics and Technology, (SMT) activities and programs, sponsored in the past decades by government, professional bodies, associations and the general aims of Mathematics education as contained in the National policy on Education (FRN,2007). In this modern and scientific age, Mathematics is regarded either as a discipline or a service subject, which is expected to be accorded a place of pride in any nation's education curriculum. Akin (2022), obliged that Mathematics is an essential tool for advancement of science and technology, due to this fact, Mathematics is one of the core and compulsory subjects of the junior and senior secondary curricula as stated in the policy on Education (FRN 2007).

The importance accorded Mathematics in the school curriculum reflects accurately the recognition of the vital roles Mathematics plays in Science and Technology, which was embedded in the National Policy of Education (FRN,2013). As a result of this, every stakeholder in Educational sectors, must be alive to see that there is a better improvement in the teaching and learning of Mathematics. The broad aims of Nigerian Education within the overall national objectives are, the preparation in the mind set of Nigerians for useful living within the society and the preparation for higher Education, (FRN,2007). Olojo, (2011) concluded that, a sound Education should be able to fortify students to live effectively in the modern age of science and Technology and that any Nigerian students should be able to compete favourable with their contemporaries in the world but refer is the case. If truly Mathematics is the language of science and Technology, as matter of urgency, it is important to give adequate attention to the teaching and learning of Mathematic, of any nation, because scientific literacy, is the stepping stone to technological development, (Olojo, 2011). However, the most impactful teachers also obtained and implement constructive feedback, different techniques are used to encourage active learning oriented towards students becoming self-directed, independent and critical thinkers, (Hammer et al., 2010)

At this modern age of science and technology, where the uses of mobile phone has being the order of the day, the students who are the major target of classroom activities, seem not to have interest in the traditional methods of teaching and learning of Mathematics. It was observed in the conventional classroom settings that the teacher does all the teaching while the students do all the listening, students are passive rather than being active, spending a lot of time listening, reading or drawing. It was also observed, that individual responses appropriately not enough for better teaching, probably due to time lag or individual teacher's technique of teaching. A close appraisal of the current trends of how teachers in Nigerian schools teaches mathematics shows that teacher-centered (conventional teaching) is the dominant strategy always employed by mathematics teachers to teach Mathematics, where emphasis tends to be rooted on teaching rather than meaningful learning. Jeje (2017), concluded that conventional method of teaching has failed to promote genuine Mathematics understanding because it does not promote students' active participation and independent work. Jeje, (2019), also concluded that, a conventional method of teaching makes students to learn Mathematics mechanically and solve problems mechanically. As a result of this, often times, students cannot transfer the mechanical knowledge to new situations, hence the result will be poor learning. However, Chukwu, (2000) and Adeleke, (2011) have criticized the conventional method used by some teachers because it's only hard working students that can benefit from it. Whereas, good learning is expected to enhance students' ability and to solve problems at appropriate

time. As a result of this, practical teaching needed to compliment conventional method of teaching Mathematics, if we are ready to meet the science and technology global trend because achievement in problem solving is important for students to continue to engage in Mathematics study. For teaching and learning of Mathematics to be actively participated by students, there is a need to introduce Information and Communication Technology (ICT) to the teaching and learning processes of Mathematics. Apart from learning actively, ICT will encourage the teaching and learning of Mathematics to meet 21st century global trend of sustainable Development Goal (SDG), where technology is expected to occupied major human endeavor works. ICT, is defined as a diverse set of technological tools and resources used to communicate, to create, disseminate, store and manage information (gunton,1993; Victoria,2002). What we are interested in, is ICT in education which involves the adoption of general components of information and communication processes. Ajayi, (2008) highlighted that the world of today is considered as a global village through the use of ICT in different Educational, Political, Economic and Social sectors. As a result of this, a meaningful teaching must be tailored through ICT, where learners can actively have participated in the processes of teaching and learning of Mathematics accordingly. Because of this global trend, teachers need to equip and acquaint themselves to make changes brought by technology. Akin (2022), concluded that well-based mathematics instruction enhances students' mathematical understanding and achievement. With the help of ICT, the limitations of distance, have been broken by Technology. A teacher can actively have millions of students at the same time in class at different locations in the world through virtual classroom with the use of phones, android, social networks such as skype, facebook, whatsapp, eskimi, palm chart, and other artificial intelligence (AI) chatbot designed to answer questions, provide information, and assist with various tasks such chatgpt.com, gemini.google.com, copilot.microsoft.com, claude.ai, etc, and other devices or means alike. The teacher and students can easily get connected making it possible for teaching and learning to take place.

Since, students no longer found classroom settings interesting, there is a need for teachers to go along with this trend by exploiting this global interest of students. The created and used the "one laptop per child" (OLPC) project created in 2005 by Nicholas Negroponte and colleagues at the MIT Media Lab. initiative as a means of closing the digital divide gap between developed and developing nations on use of ICT (Mua,2016). The introduction of ICT into school's sector and as an instrument in the learning process was driven by global forces which are beyond the school based decision making, (voogt,2010; Voogt,2013; Philip, Oluwagbemi, & Oluwaranti, 2010; Cuban, 2001).

Al-Quahtani& Higgins, (2012) cited that the expansion of technology across a wider range of areas including Educational Institutions, schools and universities and colleges came with the main intention of improving the teaching and learning environment. The major purpose of ICT in education was to transform the teaching and learning process from the traditional instructional teachers-centered endeavor to modern learner- centered approach with active participation of the learner coach. These researchers concluded that the teacher's activities was to organize the classroom to suit the main purpose of learning, give students more opportunities to discovered learning by themselves, so that students can have influence on whatever they learn. Usin, (2009) ascertained that curriculum needs to be rescued from traditional behaviorist approach domination and cognitive-constructivist approach should be introduced to the system, which is in compliance with

internationally accepted and fast growing strategy of impacting meaningful knowledge in educational system. Accordingly, effective teaching is influenced by the way teachers use ICT tools in the teaching and learning process and not how the tools functions (Mishra & Koelher, 2006). The overlap in the technological knowledge and the pedagogical knowledge is termed technological pedagogical knowledge (Mishra & Koelher, 2006). Abdullahi and Sirajo (2022) concluded that effective ICT integration promotes students' attitudes toward Mathematics, as a result of this; there is a need for Mathematics teachers to move with the global trend of technology because, by 2030, computers will be more intelligent and effective than humans. Artificial Intelligence (AI), Machine Learning (ML), and Augmented Reality (AR), are already with us, it's important that teachers and school administrators utilize them effectively. For Nigerians to be relevant with these powerful technology devices, there is a need for Education sectors to change conventional classroom situation to a practical informative communication technology where students will be more active rather than been passive. The most important point is how the teachers will adapt and use technological tools to aid their teaching in other to meet the SDG 4 of 2030 global targets in Education for sustainable development.

II. STATEMENT OF THE PROBLEM

Students who are the target of the classroom activities no longer find classroom environment interesting in typical classroom situation, as students were made to be passive rather than being active. Most times are spent by students during classes for writing, reading or drawing. Usually, students were not given individual attention or response, the teacher does all the teaching alone while the students do all the listening because there is limited opportunities to observe individual learners' reflection, discussion of student's error and misconception of knowledge in Mathematics classes. Although, Mathematics teachers are groomed with series of strategies to impart knowledge to their students but the result has not been encouraging. As a result of the above, the following general question is raised for the study:

- (a) What will be the effects of students introduced to ICT in the teaching and learning of Mathematics especially with regards to sex that has largely remained inconclusive?

A. Purpose of the study

The main purpose of the study was to determine if ICT involvement in the teaching and learning of Mathematics would improve students' participation and perception in the teaching and learning of Mathematics outcomes. The specific objectives of the study are therefore

- (a) Compare the effectiveness of introduction of ICT to Mathematics teaching and learning on students' performance in both internal and external examination.
- (b) Ascertain the performance differential in Mathematics between male and female students introduced to ICT.

B. Research Hypotheses

Based on the objectives of the study, the following hypotheses were generated;

- (a) There is no significant difference in the post test scores of students examined with ICT and those examined with conventional strategy.
- (b) There is no significant difference in the performance of male and female students examined with ICT.

III. METHODOLOGY

The study design adopted in the study was non-equivalent pre-test and post-test control group design, the effects of the independent variables on dependent variables were examined. This is considered to be the blue print of the procedures that the researcher used in other to reach valid conclusions about the presumed relationship among the variables.

A. Population, Sample and Sampling Technique

The target population for the study included students in 177 public senior secondary schools in Ekiti State. The choice of senior secondary school one (SSS1) students, was considered appropriate for the study because most of these students have access at least to android phone or laptop and those who does not have can operate desktop computer based on the pre-test. The sample for the study consisted of 150 senior secondary school one (SS1) students selected from public senior secondary schools in Ekiti State. Purposive random sampling techniques were used in the selection of towns, schools and classes used for the study. Three co-educational schools were purposively selected from all the senior secondary schools in Ekiti State.

B. Validity of the Instruments

ICT Mathematics Achievement Test (ICTMAT) was subjected to screening by experts in Tests and Measurement and Secondary School Mathematics teachers. Initially, 40-item were constructed by the researcher which covered the whole range of some purposive selected contents in SSS1 syllabus. The draft items and the learning materials were given to five experts: Two experienced Secondary School Teachers who are also seasoned WAEC and NECO examiners, one test and measurement experts, one curriculum planner and one Computer expert teacher who specialized in programming, for vetting. They were required to ascertain the suitability of the items with reference to the selected topics and in terms of lucidity and language. While the adapted ICT attitudinal questionnaire (ICTAQ) contained four sections, section (A) was on respondent's bio-data, (B) contained items of familiarity of students with ICT tools in instructional delivery, while (C) and (D) consisted items on student's utilization of ICT tools for future challenges and students effective use of ICT in learning Mathematics. The ICT attitudinal questionnaire (IAQ) was ensured by giving it to three experts, who are researchers in this area for scrutiny, they also rated each item of the instrument as very adequate, adequate or inadequate. These ratings were assigned values as follows; very adequate =3, Adequate =2 and inadequate =1. The rating

for each expert was 170, 178, and 189 respectively out of the maximum of 200. The scores were regarded as high enough to justify the content validity of the instrument.

C. Reliability of instrument

The reliability of the two instruments was ensured by administering ICTMAT and ICTAQ on the sample from the selected schools. The split-half correlation approach and Spearman Brown prophecy formula was used to calculate the reliability co-efficient of 0.76 for ICTMAT. While, Cronbach Alpha method was used to obtain the reliability co-efficient of 0.78 which is high enough for it to be reliable. The main intention of this study was to find out the effects of ICT on students' learning outcomes in Mathematics. The involvement of ICT strategy in impacting knowledge to students, is the independent variable while dependent variables for the study are the students' achievement scores measured by students' ICT Mathematics Achievement Test (ICTMAT). The regular classroom teachers were used as research assistants for the treatment. Training sessions and demonstration lessons were held for the research assistants to ensure the proper grasp of each group's assignment. Constant checks, pre-treatment and post-treatment briefly helped to ensure that each research assistant was adequately informed of his/her assigned mode of treatment.

The following are some of the ICT tools and facilities requested to be used based on their needs.

Table 1: ICT tools and facilities that could be used for teaching and learning of Mathematics in secondary schools

S/N	FACILITIES/TOOLS
1	Android phone
2	Laptop computer
3	Desktop computer
4	Interactive television
5	Multimedia projector
7	Tape recorder
8	digital cameral
9	Record player
10	Digital audio player
11	Instructional software
12	Internet services
13	Teleconferencing
14	Digital camera
15	Video player
16	Educational board

Required social medias needed for ICT in education to function: Facebook, Youtube, WhatsApp, Yahoo, Messenger, ESKIMI, Palm chat, Gmail, Instagram, Michat etc.

IV. ANALYSIS AND RESULTS

Ho₁: there is no significant difference between the posttest mean performance scores of students taught Mathematics with ICT tools and facilities and those taught using conventional teaching strategy.

Table2. T-test analysis of students' performance scores in ICTMAT for experimental and control group

GROUP	N	Mean	S.D.	SE	DF	T _{cal.}	T _{tab.}	Decision
Experimental	75	27.59	6.25	0.72	148	6.26	1.96	significant
Control	75	21.73	5.15	0.59				

Table 2 showed the students' performance in Mathematics test for both experimental and control groups. From the table, $t_{cal.}$ (6.26) was greater than $t_{tab.}$ (1.96) at significant level of 0.05 with $df=148$. Since $t_{cal.} > t_{tab.}$, the null hypothesis was rejected, which means, there was a significant difference in the performances of experimental and control groups. The significant difference in existence, was in favour of experimental group which recorded the highest mean score of (27.59) as against the control group with 21.73.

Ho₂: There is no significant difference in the mean performance scores of male and female students taught Mathematics with ICT tools and facilities.

Table 3 t-test analysis of male and female students' performance in ICTMAT

	N	MEAN	S.D.	S.E.	DF	T _{CAL}	T _{TAB.}	DECISION
Male	70	29.89	4.00	0.48	148	12.38	1.96	Significant
Female	80	21.61	4.15	0.46				

Table 3 showed the Analysis of male and female students. Performance in ICTMAT. From the table, t_{cal} (12.36) is greater than t_{tab} (1.96) at significant level of 0.05 with $df=148$. Since $t_{cal.} > t_{tab.}$, The null hypothesis was rejected, which implies that, there was a significant difference in the performance of male and female students in the post test score. The significant difference exist was in favour of male students with the higher mean score of (29.89) as against the female students with mean score of (21.61)

V. DISCUSSION

The study revealed that, students taught mathematics with ICT tools and facilities performed better than students taught with conventional teaching strategy. The finding also revealed that most students in SSS1 and teachers were familiar with the usage of ICT tools and facilities; they are used to android phones, computers, computer accessories, touch pad, joystick, Mozilla Firefox, internet explorer PlayStation etc. They could send messages through WhatsApp, palm chart, eskimi, twitter, YouTube, Facebook, yahoo, Gmail, yahoo etc. Most especially playing games using phone and computer, all these entry behavior, assisted the experimental group to accessed the ICT tools and facilities used for the research and in return, it gives the experimental group opportunity to perform better than students taught with conventional teaching strategy. The involvement of ICT tools and facilities in the teaching and learning of Mathematics, corroborates the findings of

Oshin & Badmus, (2012), they concluded that instructional strategies like ICT strategies to improve teaching and learning, will equipped the students with necessary knowledge and skills that may help them to cope with new challenges in our modern innovative world. Apart from the above findings, the study also revealed that male students performed better than female students in the usage of ICT tools and facilities.

VI. CONCLUSION

If Nigeria is so interested in meeting the target of vision 2030, our schools should be ready to be ICT compliance, mostly at this time that global world is already technologically induced and the negative effects of pandemics such as covid-19 on education activities of the world, where, school's activities were paralyzed. Mathematics teachers should be ready to incorporate ICT tools and facilities to complement their classroom teaching, most especially in this area of lessons and assignments. This will elude the students' fair of teacher centeredness wish enables students to learn Mathematics mechanically rather than being practical. Involvement of ICT tools and facilities in Mathematics classes will enable students to be more practically involved in the process of learning. Introduction of ICT in our schools will enable Nigerian students to compete favorably with their contemporaries in the world because it will cater for individual difference, readiness on the part of the learners, learners learning at their own pace, testing of learners' prerequisites, it will assist teachers to be more alive to their responsibilities and above all, Nigeria will find a position among countries that will be relevant by year 2030. From the findings, the researcher concluded that, the involvement and usage of ICT tools and facilities to support teaching and learning process of Mathematics will enhance students to learn Mathematics in a better way, this also corroborate Ekpo, 2010 who concluded that the understanding of ICT in Nigeria schools is that ICTs tools and facilities will be used to support learning process, if properly integrated and adopted.

RECOMMENDATIONS

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

- (a) Introduction of one student per computer should be introduced to Nigeria schools to assist students to be more practical in their learning. This will assist teaching and learning of Mathematics to be more learner-centered classroom method rather than being teacher- centered strategy of learning.
- (b) ICT tools and facilities should be made available in schools with electricity power.
- (c) Mathematics teachers should be well train and retrained on the usage of ICT tools and facilities.
- (d) Nigeria Curriculum should be structured in such a way; it will give room for practical learning through ICT.

REFERENCES

- [1] Adeleke, I. A. (2012). Modern Days' Educational Media as ICT-Based Technology and its Effects on Teaching and Learning Process. *Ikere Journal of the Science Teacher (IJST)*, 7(1) pp.36-40.
- [2] Ajayi, L. (2008). Towards effective use of information and communication technology (ICT) for teaching in Nigerian colleges of education. *Asian Journal of information Technology*, 5(5), 210-214.
- [3] Akin, A (2022). The effectiveness of web-based mathematics instruction (WBMI) ON K-16 students 'mathematics learning: Meta-analytic research. *Education and information Technologies*, 27(6),8015-8040.
- [4] Al-Quahtani, A.Y. and Higgins, S.E. (2013). Effects of traditional, blended and e-learning on students' achievement in higher education. *Journal of Computer Assisted Learning*, 29: 220–234.
- [5] Chukwu, A. C. (2000). Factors Affecting Science Development in Nigeria. , 1(1),pp. 149 – 156.
- [6] Cuban, L. (2001). *Over sold and under used: Computers in the classroom*. Cambridge, Mass: Harvard University Press.
- [7] Ekpo, C., M. (2010). ICT in Nigerian school system shifting from theory to practice. A key note address presented at the 31st Annual Conference and Convention of State Colleges of Education, Minna, 20th-26th September, 2010.
- [8] Federal Republic of Nigeria (FRN, 2007). *National Policy on Education (4th Ed.)* Lagos: NERDC Press.
- [9] Federal Republic of Nigeria (FRN, 2013). *National Policy on Education (4th Ed.)* Lagos: NERDC Press.
- [10] Gunton, T. (1993). *Dictionary of information technology*. Penguin, London.
- [11] Jeje, O. S. (2006). Mathematics attitude of male and female students in junior secondary school in Ikole Local Government Area. *Nigeria, International Journal of Research in Education*.3(2), 191-184.
- [12] Jeje, O.S, & Gbenro, S.O.(2019). Influence of Textbook and Peer-Provided Activities on Learning Outcomes of At-Risk Mathematics Students In junior Secondary Schools. 4 (2), 11-19.
- [13] Jeje, O.S, & Olofinlae, O., O. (2019). Effects of Mathematics Laboratory Programmed Instruction Strategy on Students' Performance³ in Junior Secondary School III in Mathematics. *Ikere Journal of the Teachers (IJST)*, 9(1), 40-45.
- [14] Kozama, R., McGhee, R., Quellmalz, E., & Zalles, D. (2004). Closing the Digital Divide: Evaluation of the world links program. *International Journal of Educational Development*, 24(4), pp. 361-381.
- [15] Mishra, P. & Koelher, M. J.(2006). Oshin, Olayemi Oyenike & Badmos Ayodeji Muideen (2012). Familiarity, Utilization and Effective Use of ICT in Instructional Delivery. *Ikere Journal of the Science Teacher (IJST)*, 7(1) 32-35.
- [16] Mishra, P., & Koelher, M. J. (2006). Technological Content Knowledge: A framework for teacher knowledge. *Teacher College Record*, 108(6) pp. 1017-1054.
- [17] Mua R. K. (2016). The use of ICT in the Teaching and Learning Process in Secondary Schools. A case study of two Cameronian Schools. Unpublished Master's thesis, department of Education, Institute of Jyvaskkla.

- [18] Negroponete, N. (2005). One Laptop per Child (OLPC): Transforming Education through Technology. Cambridge, MA: MIT Media Lab.
- [19] Olojo, O.J. (2006). The Effect of Home Assignments on the performance of Students in Mathematics. Ikere. *Journal of Science Education*, 2 (1), pp. 90-97.
- [20] Olojo, O.J. (2011). Effects of cooperative, competitive and individualistic instructional strategies on senior secondary school students' learning outcomes in mathematics. Unpublished PhD Thesis, University of Ado-Ekiti.
- [21] Philip, A., Oluwagbemi, O., & Oluwaranti, A.S.(2010). An Evaluation of the Impact of Information and Communication Technologies Diffusion in Nigeria's Higher Educational Institutions, *Journal of Information Technology Impact*, 10(1) pp. 25-35.
- [22] Usin, S. (2009). *Procedia-Social and Behavioural Sciences*. Information and Communications Technology (ICT) IN TEACHER Education (ITE) Programs in the world and Turkey. (A comparative review), 1(1),331-334.
- [23] Voogt, J. (2010). Teacher factors associated with innovative curriculum goals and pedagogical practices: differences between extensive and non-extensive ICT, using science teachers. *Journal of Computer Assisted learning* 2(6),453-464.
- [24] Voogt, J.(2008). Satisfying pedagogical practices using ICT. In NN. Law, W. J. Pelgrum & T. plomp. *Pedagogy and ICT use in schools around the world. Findings from the IEA SITES 2006 STUDY* 221-250.
- [25] Voogt, J., & Pelgrum, H. (2005). ICT and curriculum change. *Human Technology: an interdisciplinary . Journal on Humans in ICT Environments*, 1(2)0,157-175.
- [26] Voogt, J., Fisser, P., Pareja Roblin, N., Tondeur, J. and Van Braak, J.(2013). Technological pedagogical content knowledge. A review of the literature. *Journal of Computer Assisted Learning*, 2 (9) 109-121.