

Effects of ICT on Students' Academic Performance in Mathematics in Selected Secondary Schools in Kaduna State

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ABSTRACT

This study investigated the effects of Information and Communication Technology (ICT) on the academic performance of students in mathematics, focusing on selected secondary schools in Kaduna State. The research employed a case study approach to explore how the utilization of ICT tools, such as computers, software applications, and interactive learning resources, impacts students' performance in mathematics. The study utilizes a mixed-methods research design, incorporating both quantitative and qualitative data collection methods. Surveys are conducted to gather quantitative data on students' exposure to ICT, frequency of use, Academic Performance, and study habits. Additionally, in-depth interviews and focus group discussions are employed to obtain qualitative insights into the experiences and perspectives of students, teachers, and administrators regarding the integration of ICT in mathematics education. Findings indicate that ICT usage has a positive and significant effect on the academic performance of students in mathematics. Students who engage with ICT tools report increased confidence and improvement on understanding of mathematical concepts. The research also considers potential challenges associated with the implementation of ICT in mathematics education, such as infrastructure limitations, access disparities, and teacher training needs. The findings aim to inform educational policies, curriculum development, and instructional practices, fostering an environment conducive to leveraging technology for improved mathematical learning outcomes. Recommendations for policymakers, educators, and stakeholders are proposed to address these challenges and optimize the positive effects of ICT on mathematics learning outcomes.

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INTRODUCTION

Educational facilities are the valuable assets which should be available for use in order to aid teaching and learning process. They include all materials resources that are needed to impart formal education. It is a situation where the students find comfort in his/her school or college environment, example of school facilities are land, building, furniture, laboratories, library, water system, recreation materials, educational resources and so on. ICTs are also very important Educational facilities which are seen as information handling tools that are used to produce, store, process, distribute and exchange information (Otuu, 2013). According to UNDP Evaluation

Office, (2001) cited in Otuu (2013), With the ability to collaborate, ICT tools may now create a networked environment that spans the entire planet. This means that ICT has the capacity to enhance the process of instructions thereby leading to efficient and effective teaching and learning.

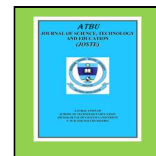
Mathematics is an examinable subject in the Nigerian secondary school curriculum. Its importance is evidenced by its inclusion in the secondary school curriculum by the Ministry of Education. This subject like any other subject has syllabus contents. Educational resources or facilities should cover all printed or electronic books, drawings, photographs, and associated materials utilized

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in the teaching and learning process, whether they are created by humans or not. This will ensure that the syllabus for a certain subject is covered. In Muhammad, Irfanullah, Siraj, Hafiz, Rafid and Rahimullah (2015), secondary schools can employ ICT, just like other post-secondary educational facilities, to give students knowledge and abilities relevant to the twenty-first century (Andoh, 2012). Academic efficiency can be achieved through professional development programmes for educators, Educational equity, accessibility to education, and support in obtaining more effective educational management. Thus, ICT can readily address the three main problems in education which are standards, inclusivity, and accessibility (Muhammad *et al.*, 2015). Consequently, the benefits that could be derived from ICT usage are enormous. For example, ICT can be used to facilitate discussion, save time, self-learning and so on which can be time consuming and sometimes cumbersome through traditional approach.

The use of ICT in education lends itself to more student-centered learning settings. CT in education can help to improve memory retention, increase motivation and generally deepens understanding. It is also believed that the use of ICTs in education could promote deep learning and allow educators to respond better to different needs of different learners. The effective integration of technology into classroom practices poses a challenge to teachers and administrators. 21st century is the age of Information and Communication Technology (Sudhakar *et al.*, 2016). All over the globe, there is a trend to use ICT in the teaching learning process. Teachers in this sector commonly faced a range of barriers that affect the use of ICT. Some of these include dissatisfaction with the internet connection speed, requiring better technical maintenance and support of ICT within school, Teachers lacking sufficient computer skills and difficulty in finding adequate learning materials for teaching.

It is imperative to note that many secondary schools in Nigeria today are using the computers as learning tools. Moreover, today the use of androids and other portable gadgets as instructional materials and learning tools have made the Classroom to become boarder less (Zubair, 2016). According to

Ikwuka and Adigwe (2016), the use of Information Communication Technology in education for training, teaching and instructional delivery has been a priority in most African countries during the last few years, but much progress has not been made despite the aforementioned benefits. In certain nations, a tiny proportion of schools have integrated ICT into the curriculum and have shown high levels of suitable and effective use of ICT to enhance and revolutionize teaching and learning in a variety of subject areas. Even though a large number of secondary school teachers are using ICT to enhance their instruction, many are still unaware of the ICT resources that are available for use in instructional delivery.

Despite the embracement of ICT to some extent and the various efforts put in place by the governments, the statistics have indicated that a poor instructional method of teaching and learning is directly related to the problem of poor performance in mathematics. Olojede, Bolaji, and Musa (2017) attribute this poor instructional method to repeated failure and subpar performance in mathematics.

The subject of enhancing academic achievement with ICT is no longer a subject of conjecture and the numerous benefits that can be tapped are immeasurable. Different studies have shown promising results with the deployment of ICT into the teaching and learning process (Mbah, 2010; Ikwuka & Adigun, 2016; Ishtiaq *et al.*, 2017; Abidin *et al.*, 2018). However, no study was to the best of our knowledge conducted on the impacts of ICT on Mathematics in Kaduna State Schools. The need to promote teaching and learning through the mathematics teacher as well as add value to students' study habits in senior secondary schools cannot therefore be undermined. This in our view constitutes the gap that the current study is attempting to fill.

Purpose of the Study

The primary purpose of the study is to investigate the effects of ICT on students' academic performance in mathematics on selected secondary schools in Kaduna State. Specifically, the study is set with following objectives:

- i. To examine the effect of ICT on the academic performance of

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- Mathematics students in secondary schools.
- ii. To examine the extent to which the use of ICT affects the study habits of students in Mathematics at secondary schools
- iii. To examine the extent to which the improvement in performance due to ICT usage affects the students' academic performance in Mathematics

Research Questions

Three research questions were posed for the study:

- i. How does ICT affect the academic performance of secondary school students in Mathematics?
- ii. To what extent does the use of ICT affect the study habits of students in Mathematics at secondary schools?
- iii. To what extent does improvement in performance due to ICT usage affect the students' academic performance in Mathematics?

Research Hypotheses

The following null hypotheses were formulated at $P \leq 0.05$

H01: ICT has no any significant effect on the academic performance of Mathematics students in secondary schools.

H02: The use of ICT does not have any significant impacts on the study habits of students in Mathematics at secondary school

H03: Improvement in performance due to ICT usage does not have any significant impacts on the students' academic performance in Mathematics

METHODOLOGY

This study used descriptive and analytical statistics designed to assess the effect of ICT facilities for teaching and learning Mathematics on students' academic performance in the selected Secondary Schools in Kaduna State. Research design implies outlining the name of equipment and other materials the research intends to investigate by using and applying them to successfully execute the practical aspect of the research study.

The population for this study was made up of all students and staff members of the selected secondary schools in the study area. In this case, the population comprises both the Teachers and students of the selected Secondary Schools in Kaduna state covering all three Kaduna state's senatorial zones. Kaduna state consist of 738 public senior secondary schools consisting of 173070 students of which 51% are female*. The teachers have an average population of 5,132 teachers of which 37% of them are female. It from this population that the sample for the current study was drawn.



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Fig 1: Map of Kaduna State by Senatorial Districts
 Source: <https://kdsg.gov.ng/senatorial/>

Four hundred and fifty students selected from 6 secondary schools spread across the 3 Senatorial zones in Kaduna state served as sample for the study. The six senior secondary schools were considered appropriate based on the fact that they are equipped with minimal ICT facilities that can sustain the current study. 20% of students from the sample in each school were used for the study which is in accordance with the central limit theorem by Tuckman in Muhammad (2014) who recommended a minimum of 30 subjects as sample for experimental research.

A detailed questionnaire containing details of all variables was used to collect the data for the study. Before the questions were administered, they were subjected to content and face validity by scrutiny of specialists in ICT, Mathematics and Statistics, to determine the appropriateness or otherwise of the questions for the purpose of the research. In this way, an attempt was made to validate the instrument to ensure that it measures what it was supposed to measure.

The Cronbach Alpha analysis was used to determine the reliability of the instrument from a pilot study conducted. The data collected were analyzed, and the result showed a 0.71 reliability coefficient. This indicate that the instrument was reliable and therefore ready for use to conduct the main study.

After obtaining permission from the relevant authorities, the questionnaire was administered to the sampled teachers and students. The teaching members of staff of the cooperating schools in the three (3) Senatorial districts of Kaduna State assisted the researchers in distributing and retrieving complete copies of the questionnaire.

Both descriptive and inferential statistics were used in the analysis of the study.

The descriptive method included jarque-bera, skewness, kurtosis, mean, and standard error. The Probit model is the analytical method used for the inferential analysis. An example of a statistical/econometric model called a Probit model is applied to binary outcome variables in which the response variable is dichotomous, or limited to two possible values (often 0 and 1). The Probit model was employed in the study to examine how ICT (information and communication technology) affects secondary school pupils' academic performance in mathematics.

This study considers strictly ethical issues of the research. Approval for conducting the study was obtained from the respective Education Zones of each Senatorial Zones of the secondary schools selected. All teachers and students who are respondents in the study were duly informed about the objectives of the study. Potential participants were told that the method of data collection was a questionnaire that could take about 30 minutes to complete. The purpose of the study was carefully explained to them so as to obtain their permission prior to interview. Participants were given the opportunity to decide whether or not to participate in the research, thus obtaining their informed consent.

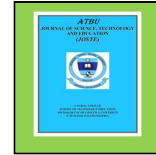
Definition of Variables

Dependent Variable (Response) is Academic performance in mathematics (binary: 1 for success, 0 for failure). Independent Variable is the Use of ICT (binary: 1 for used, 0 for not used). Control Variables consist of other factors that may influence academic performance (e.g., socioeconomic status, previous academic performance, teacher quality, etc). The variables for this study are presented in table 1 below:

Table 1: Variable Definitions and their Binary Values

ICT Variables
Usage a= Daily, b= Weekly, c= Monthly d= Rarely e= Never USRATE (1= use and 0= rarely/do not use)
ICT Tools used: a= Computer/laptop, b= Tablet, c= Smartphone, d= Educational apps, e=Online tutorials, f=Interactive simulations

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Computer/laptop or Tablet or Smartphone CLTS	(use =1 do not use =0)
Educational apps EDUAPP	(use=1 do not use=0)
Online tutorials ONLT	(use=1 do not use=0)
Confidence in using ICT (CONF-ICT)	
a=Very confident b= Somewhat confident c= Neutral d= Not very confident e=Not confident (very or somewhat confident=1, if neutral, not very/not confident=0)	
ICT and Academic Performance(ICT-PERF)	
Improvement (IMP) a). Yes b). No c). Unsure	(Yes=1, if No/unsure=0)
Overall academic performance in mathematics (ACD-PERF) a=Excellent b= Good c=Average d= Below average e= Poor (Excellent/Good =1, If Average/poor =0)	
ICT Positively influences your understanding of mathematical concepts (ICT-UND)	
a= Strongly agree b= Agree c= Neutral d=Disagree e= Strongly disagree (Strongly agree/agree = 1, Neutral/Disagree/Strongly disagree =0)	
ICT and Study Habit (ICT-HAB)	
Easier to study Mathematics through Collaborative ICT-Based activities (WICT)	a= Yes b= No c= No difference (Yes= 1, No/No diff.=0)
Easy to study mathematics independently without ICT (WTICT)	a= Yes b= No (Yes= 1 No=0)
Teacher Involvement (TINV1)	
Teachers incorporate ICT tools in their teaching methods a=Not at all b= Occasionally c=Moderately d= Very much (Very much/moderately =1, Not at all/Occasionally=0)	
Teachers adequately support and guide you in using ICT tools for learning mathematics TINV2	
a= Yes b= No c= Unsure (Yes= 1 No/Not sure=0)	
Gender (GEND) a= Male, b= Female	
Grade/Class: (GRD) a=SSI b= SS II c= SS III d= JSS (SS =1 JSS = 0)	
Interest in study with ICT: (INT)	
Highly interested in the use of ICT tools for studying mathematics b= Interested b= Not interested (Interested =1 Not interested =0)	

Source: Compiled by the Authors

Model Specification

The general Probit model is given as:

$$p(Y = 1) = \Phi(\beta_0 + \beta_1 ICT + \beta_2 Control_1 + \dots + \beta_k Control_k + \varepsilon)$$

Where $p(Y = 1)$ is the probability of success (academic performance), Φ is the cumulative distribution function of the standard normal distribution, $\beta_0, \beta_1, \beta_2$ and β_k are the coefficients to be estimated. Based on the objectives of this study, the above model is transformed and broken into three different models as follows:

Model for the estimation of Objective 1

To examine the effect of ICT on the academic performance of Mathematics students in secondary schools.

$$p(ACDPERF = 1) = \Phi(\beta_0 + \beta_1 USRATE + \beta_2 CLTS + \beta_3 EDUAPP + \beta_4 ONLT + \beta_5 TINV1 + \beta_6 TINV2 + \varepsilon_1)$$

Dependent Variable (Response) is the students' academic performance measured by their results in the last examination. The independent variables are the Usage rate (USRATE), ICT tools (CLTS, EDUAPP and ONLT) whereas Teacher Involvement (TINV1 and TINV2) represent the control variables. $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$ are the coefficients to be estimated. ε_1 is the disturbance term.

Model for the estimation of Objective 2

To examine the extent to which the use of ICT affects the study habits of students in Mathematics at secondary schools

$$p(STDHAB=1) = \Phi(\beta_0 + \beta_1 WICT + \beta_2 WTICT + \beta_3 IMP + \beta_4 TINV2 + \varepsilon_2)$$

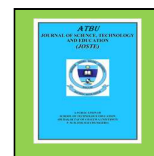
Dependent Variable (Response) is the study habits of students (STDHAB). The independent variables are the study of Mathematics through Collaborative ICT-Based

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activities (WICT) and study of mathematics without ICT (WTICT) whereas Improvement due to use of ICT (IMP), Teacher Involvement (TINV2) represent the control variables. $\beta_1, \beta_2, \beta_3, \beta_4$, are the coefficients to be estimated. ε_2 is the disturbance term.

Model for the estimation of Objective 3
 $p(\text{ACDPERF} = 1) = \phi(\beta_0 + \beta_1 \text{IMP} + \beta_2 \text{CONFICT} + \beta_3 \text{INT} + \beta_4 \text{GRD} + \varepsilon_3)$

Dependent Variable (Response) is the students' academic performance measured by their results in the last examination. The independent variables are Improvement due to use of ICT (IMP), students' confidence in the use of ICT (CONFICT) while the level of interest in the use of ICT (INT) and the students' level (GRD)

RESULTS AND DISCUSSION

Descriptive Statistics

Table 2: Descriptive Statistics

Stats.	ACDPERF	CONFICT	CLT	EDUAPP	GEND	GRD	IMP
Mean	0.56888	0.640000	0.597778	0.493333	0.577778	0.866667	0.673333
Std Dev	0.49578	0.480534	0.490892	0.500512	0.494463	0.340313	0.469516
Skewness	-0.278209	-	-	0.026669	-	-	-
		0.583333	0.398811		0.314945	2.157277	0.739170
Kurtosis	1.077400	1.340278	1.159050	1.000711	1.099190	5.653846	1.546373

Source: Field Survey and Computation using E-View 10

Table 3: Descriptive Statistics

Stats.	ONLT	STDHAB	INT	TINV1	TINV2	WICT	WTICT	USERATE
Mean	0.62888	0.535556	0.502222	0.51111	0.488889	0.553333	0.406667	0.580000
Std Dev	0.483640	0.499289	0.50055	0.500433	0.500433	0.497701	0.491758	0.494108
Skewness	-0.53359	-0.142583	-0.00889	-0.04446	0.044455	-0.21456	0.380013	-0.324176

Source: Field Survey and Computation using E-View 10

Tables 2 and 3 present the descriptive statistics of the variables in this paper. From the table, the means of the responses show that on average for all the variables, the binary response option success (1) formed the majority of the responses except for EDUAPP, TINV2, and WTICT where the response option failure (0) formed the majority. The values of the skewness are slightly left-skewed except for variables such as EDUAPP, TINV2 and WTICT though not heavily skewed in that direction. This indicates that, the bulk of that data is still centered on the mean, but there may be a few

observations on the lower end of the scale that are pulling the distribution to the left. For the Kurtosis, there is mild positive kurtosis for all the variables except for GRD, suggesting a distribution with slightly heavier tails than the normal distribution but not extremely so. But for the kurtosis value of 5.653846, there is significant positive kurtosis, indicating a distribution with very heavy tails and a sharp peak, which may be indicative of more extreme values or a distribution that is more concentrated around the mean. For the jarque bera.

Estimated Model for Objective 1

Table 4: Results for Model 1

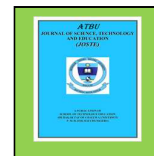
Dependent Variable: Academic Performance (ACDPERF)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
USERATE	0.295047	0.120888	2.440664	0.0166
CLT	0.393699	0.124734	3.156309	0.0025
EDUAPP	0.223182	0.116359	1.918042	0.0551

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ONLT	0.318935	0.111533	2.859563	0.0042
TINV1	0.029319	0.113503	0.258311	0.7962
TINV2	0.137845	0.118623	1.162039	0.2452

Source: Field Survey and Computation using E-View 10

USERATE has a Coefficient (0.295047), meaning that, a one-unit increase in USERATE is associated with an increase of 0.295047 units in Academic Performance. The z-Statistic (2.440664) and Prob. (0.0166) show that, USERATE is a statistically significant predictor of Academic Performance. Computer/Laptop and Androids Phones (CLT) has a coefficient (0.393699) which means a one-unit increase in CLT is associated with an increase of 0.393699 units in Academic Performance. The z-Statistic (3.156309) and the associated p-value (0.0025) suggests that CLT is likely a statistically significant predictor of Academic Performance. Use of Educational APPs (EDUAPP) has a coefficient (0.223182) signifying that a one-unit increase in EDUAPP is associated with an increase of 0.223182 units in Academic Performance. The p-value (0.0551) is slightly above the common significance level of 0.05. Depending on your chosen threshold, you might consider this

marginally significant. Online Tutorials (ONLT) has a coefficient (0.318935) implying that a one-unit increase in ONLT is associated with an increase of 0.318935 units in Academic Performance. The z-Statistic (2.859563) and p-value (0.0042) suggest that ONLT is likely a statistically significant predictor. Teachers Involvement (TINV1 and TINV2)-The coefficients for TNV1 and TINV2 are 0.029319 and 0.137845, respectively. These variables are not statistically significant predictors as their p-values (0.7962 and 0.2452) are higher than the common significance level. In summary, the interpretation involves considering the coefficients, z-statistics, and p-values for each variable to assess their individual contributions and statistical significance in predicting Academic Performance. For all the variables in this model, only TINV1 and TINV2 which are control variables appear to statistically not significant. Thus, based on the results, the Null hypothesis H01 is rejected.

Estimated Model for Objective 2

Table 5: Results for Model 2

Dependent Variable: Study Habit				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
WICT	1.424618	0.124928	11.40349	0.0000
WTICT	-0.264500	0.126977	-2.083052	0.0372
IMP	0.477820	0.119231	4.007507	0.0001
TINV2	-0.077536	0.120560	-0.643137	0.5201

Source: Field Survey and Computation using E-View 10

The results in table 5 is for a regression model with Study Habit as the dependent variable and several independent variables (WICT, WTICT, IMP, TINV2). Collaborative study with ICT (WICT) has coefficient (1.424618) implying a one-unit increase in WICT is associated with an increase of 1.424618 units in Study Habit. The z-Statistic (11.40349) and very low p-value (0.0000) suggest that WICT is a highly significant predictor of Study Habit. Study without ICT (WTICT) has coefficient (-0.264500) showing one-unit increase in WTICT is associated with a

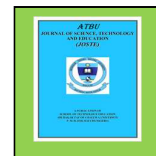
decrease of 0.264500 units in Study Habit. The z-Statistic (2.083052) and the p-value (0.0372) below 0.05 suggest that WTICT is statistically significant in predicting Study Habit. Improvement on understanding Mathematical Concepts due to use of ICT (IMP) has a coefficient (0.477820) meaning that a one-unit increase in IMP is associated with an increase of 0.477820 units in Study Habit. The z-Statistic (4.007507) and the very low p-value (0.0001) indicate that IMP is a highly significant predictor of Study Habit. Teacher involvement in Supporting and Guiding Student (TINV2) has a

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Coefficient (-0.077536) meaning that a one-unit increase in TINV2 is associated with a decrease of 0.077536 units in Study Habit. The z-Statistic (-0.643137) and the p-value (0.5201) suggest that TINV2 may not be a statistically significant predictor as the p-value is higher than the common significance level of 0.05. In summary,

WICT, WTICT, and IMP appear to be statistically significant predictors of Study Habit, based on their coefficients, z-statistics, and p-values. However, TINV2 does not seem to be a significant predictor, as its p-value is higher than 0.05. Thus, based on the results, the Null hypothesis H02 is rejected.

Estimated Model for Objective 3

Table 6: Results for Model 3

<i>Dependent Variable: Academic Performance (ACDPERF)</i>				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
IMP	0.438415	0.115502	2.497056	0.0041
CONFLICT	0.264807	0.112260	2.358872	0.0037
STSFN	0.430200	0.129247	3.328519	0.0009
GRD	0.390497	0.144880	2.695322	0.0070

Source: Field Survey and Computation using E-View 10

Table 6 shows the results for a regression model with Academic Performance (ACDPERF) as the dependent variable and independent variables (IMP, CONFLICT, STSFN, GRD). IMP has a Coefficient (0.438415) showing that, a one-unit increase in IMP is associated with an increase of 0.438415 units in Academic Performance. The z-Statistic (2.497056) and the p-value (0.0041) suggest that IMP is a statistically significant predictor of Academic Performance. Confidence due Use of ICT (CONFLICT) has a coefficient (0.264807) implying that, a one-unit increase in CONFLICT is associated with an increase of 0.264807 units in Academic Performance. The z-Statistic (2.358872) and the p-value (0.0037) suggest that CONFLICT is statistically significant in predicting Academic Performance. Interest in learning using ICT (INT) has a Coefficient (-0.430200) showing that, a one-unit increase in INT is associated with an increase of 0.430200 units in Academic Performance. The z-Statistic (3.328519) and the very low p-value (0.0009) indicate that INT is a highly significant predictor of Academic Performance. Grade Level of Students (GRD) has a coefficient (0.390497) meaning that, a one-unit increase in GRD is associated with an increase of 0.390497 units in Academic Performance. The z-Statistic (2.695322) and the p-value (0.0070) suggest that GRD is statistically significant in predicting Academic Performance. In summary, IMP,

CONFLICT, INT, and GRD all appear to be statistically significant predictors of Academic Performance based on their coefficients, z-statistics, and p-values. The signs of the coefficients indicate the direction of the relationship between each independent variable and the dependent variable. Thus, based on the results, the Null hypothesis H03 is rejected.

DISCUSSION

The major goal of education is to enhance academic performance through acquisition of skills and knowledge that will add value to learners in their career progression. In this study we report among other considered variables the effect of ICT on academic performance in mathematics at the senior secondary school level in Kaduna state, Nigeria.

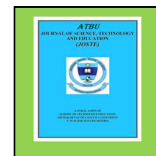
The impact of ICT on academic performance in mathematics in our present study, is on a positive direction implying a very strong potential for academic excellence following the use of ICT. This findings and indeed in the literature is not surprising judging from what ICT brings to the table when it comes to facilitating teaching and learning. ICT among other things helps to teach mathematical facts, skill, knowledge, concepts and recovery of mathematical understanding more effectively. It also helps to improve students' and teachers' capacity (NCTM, 2000; Aydin & Tasci, 2005). ICT has been shown to make mathematics

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teaching healthier and helps to increase performance of students (Safder et al., 2011; Gera a& Verma, 2012; Joshi, 2017). The findings from this study is strikingly instructive judging from the fact that in Nigeria, the Unified Tertiary Matriculation Examination (UTME) is a derivative of ICT known as Computer-Based Test (CBT) which is undertaken by every student that seeks admission to a tertiary institution. Therefore, whatever will make learning seamless and enhance excellence in academic achievement through ICT is a welcome development. Other examination bodies like WAEC and NECO are in the pipeline to make ICT an integral part of their examination. In the website of WAEC, the leading examination body in Africa has announced a major update that is set to revolutionize how exams are conducted. Going forward, the statement reads that “starting from February 2024, WAEC will introduce computer -based testing for private candidates” (Vanguard, 2023). Therefore, getting teaching and learning vis-à-vis studying with the aid of ICT facilities will undoubtedly make students stay in step with global best practice where examination process is not only up to date but also efficient and reliable. In addition, it will make students get the best examination experience possible.

Baring sundry challenges associated with the social media maneuverings of ICT which is outside the realm of profitable study for academic excellence, the authorities are unanimous that ICT is a significant predictor of study habits whose profound potential is a huge boost to teaching and learning and by extension enhance academic performance. In a study on the impact of ICT on students' study habits in a Cameroonian university, it was found that students have a positive attitude towards ICTs as such use them to facilitate learning and male students are more favourably disposed towards ICT usage in their studies. The study further found that ICT constantly change their study habits based on the type of ICT they use to ease studies (Mbah, 2010; Ntui & Eyong, 2014; Fagbohun, 2018; Ubi, 2023). In the present study, we have found a statistically significant difference in predicting Study Habit. Improvement on understanding Mathematical Concepts due to use of ICT. However, teacher's

involvement is not a predictor of study habit even with ICT.

As to the question of teacher's involvement in students' study habit, finding from numerous studies seems divergent. For example in a study conducted by Muhammad *et al* (2021) on teacher students teaching strategies bothering on the effect of study habits among students of tertiary institution in Pakistan, it was found out that teachers involvement in students' live creates a positive influence for them to excel academically. In another study in Ghana, it was found that teacher variables and study habits are good predictor of academic achievement (Churcher et al., 2016). However in study by Ebele and Olofu (2017) the teachers' role in study habits was not amplified but a significant relationship was shown to exist positively between study habits and academic achievement. In our study, no nexus was found between teachers' involvement and students' study habits. This finding is not surprising judging from the fact that most schools in Kaduna state no longer operate boarding facilities where students are directly under the supervision of teachers often referred to as Reading master. Therefore, students are solely left under the direct control of their parents or guardian and to determine the students' study habits in parents custody remains open for further investigation. Nonetheless in this study, we have found that teachers' involvement is not a significant predictor of students' study habits.

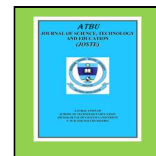
The controversy surrounding gender and academic achievement span from previous studies and no conclusion has been reached by mathematics educators on the issue. A number of studies has shown no bias in gender as a predictor of academic performance in secondary school mathematics (Hyde et al., 2008; Lindberg et al., 2011; Alordiah et al., 2015; Oliweh & Oyem, 2021) while others suggest in their findings that girls outperform boys in elementary mathematics and boys perform better than the girls in secondary school mathematics (Easton et al., 2017; Ellison & Swanson, 2018; Podolsky & Zarate, 2019; Lyons et al., 2022). Therefore, the controversy rages on with no end in sight. As to integration of ICT in mathematics learning, our findings suggest no significant difference between male and female in mathematics performance. This

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has been corroborated by Abidin et al.,(2018) in a study involving gender-related differences in the use of technology in mathematics classroom who found that affordances of technologies influence boys and girls attitudes and appropriate pedagogical approaches with equitable technologies are important in engaging students in learning mathematics. Therefore, gender has no effect on academic performance in the learning of mathematics.

CONCLUSION AND RECOMMENDATIONS

The study on the effects of Information and Communication Technology (ICT) on the academic performance of students in mathematics in selected secondary schools in Kaduna State provides valuable insights into the intersection of technology and education. Based on the analysis of quantitative and qualitative data, the findings suggest a positive correlation between the use of ICT tools and students' academic performance in mathematics. Students who engage with technology exhibit increased improvement, motivation through boosting their study habit and comprehension of mathematical concepts. Despite the positive outcomes, challenges in the implementation of ICT in mathematics education exist, including infrastructure limitations to schools with ICT facilities, access disparities, energy to browse the internet, restriction of studies to those students who are digital compliant for which generalization for the current study can be made and the need for teacher training and re-training in the form of professional development. These challenges can hinder the full realization of the potential benefits of technology in the classroom. Based on the conclusions drawn from the study, the following recommendations are proposed:

1. Policymakers should prioritize investment in ICT infrastructure in secondary schools. Adequate provision of computers, internet connectivity, and necessary software is crucial for creating a technologically-enabled learning environment.
2. Efforts should be made to ensure equitable access to ICT resources for all students, addressing socio-economic disparities. Initiatives such as providing laptops, internet connectivity, and digital learning materials can help bridge the digital divide.

3. Comprehensive training programs should be implemented to empower teachers with the necessary skills and confidence to effectively integrate ICT into their teaching practices.
4. Educational policymakers should collaborate with educators to design curriculum modules that align with both technological advancements and pedagogical goals.
5. Regular monitoring and evaluation mechanisms should be established to assess the impact of ICT integration on academic performance. This includes gathering feedback from teachers, students, and parents to inform ongoing improvements and adjustments.

REFERENCES

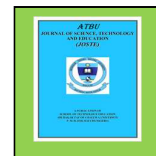
- Abidin, Z., Mathrani, A. & Hunter R. (2018) Gender related Differences in the Use of Technology in Maths Classrooms: Students Participation, Learning Strategies & Attitude. *International of Information & Learning Technology* 35(2) doi: 10.1108/IJILT-11-2017-0109.
- Alordiah, C.O., Akpadak, G. & Oviogbodu, C.O. (2015) Influence of Gender, School Location & Socio-Economic Status on Students' Academic Achievement in Mathematics. *Journal of Education & Practice*, 6(12)130-136.
- Aydin, C.H. & Tasci, D (2005) Maximizing Research for e-Learning: Reflection from an Emerging Country, *Educational Technology & Society* 8(4) 244- 257.
- Aduwa-Ogiegbaen, S. E. andlyamu, E. O. S. (2005). Using Information and Communication Technology in Secondary Schools in Nigeria: Problems and Prospects. *Educational Technology & Society*, 8 (1), 104.
- Churcher, K., Asiedu, L.O & Boinde, B. (2016) Teachers teaching Styles and Students Study Habits on Academic Achievement in Mathematics among Junior High Schools in Upper East Region, Ghana, *International Journal of Administration* 8(1)31-51.

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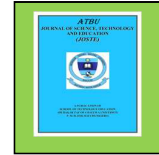
- Ebele, U.F & Olofu, P.A. (2017) Study Habits and its Impact on Secondary School Performance in Biology in the Federal Capital territory, Abuja, *Educational Research & Reviews* 12(10) 583-588.
- Ezeugbor (2008). Entrancing Teachers Efficiency in University Education through the Use of ICT. *Sokoto Educational Received* Vol.10 (2) 104.
- Fagbohun, M. (2018) ICT on Students' Study Habits in Iganmode Grammar School, Ota, Ogun State, Nigeria, *Library Philosophy & Practice (e-journal)*, 2134.
- Germ, M. & Verma, S. (2012) Role of ICT in Teaching to Reduce Helplessness in Mathematics *international of Science & Research* 3(10), 2012-2014.
- Ikwuka, O. I and Adigwe J. E.H. (2016). Effect of ICT on Secondary School Students' Academic Performance in Christian Religious Studies in Oshimili North Local Government Area. *IJSET International Journal of Innovative Science, Engineering & Technology*, 4(5). 2348 – 7968.
- Ishtiaq H., Kaiser S., Naseerud Din M. and Farhan S. (2017). Effects of Information and Communication Technology (ICT) on Students' Academic Performance and Retention in Chemistry at Secondary Level. *Journal of Education and Educational Development*, 4(1)
- Jamison, D. and P. Moock (1994) "Farmer Education and Farmer efficiency in the Nepal. "The Role of Schooling", world Development, 12.
- Joshi, D.R. (2017) Influence of ICT in Maths Teaching, *International Journal of Innovative Research & Growth* 3(1) 7- 11.
- Kurgat, S.J. (2014). Availability and Use of Instructional Materials and Facilities towards Enhancing Students' Performance in Economics in Secondary Schools: A Case of Rift Valley Province, Kenya. *Journal of Education and Practice* www.iiste.org ISSN 2222-1735 5(33).
- Leny, N., Budi, E.S., and Muhammad, S. (2015). Economic Education Laboratory: Initiating a Meaningful Economic Learning through Laboratory. *Journal of Education and Practice*, 6(33), 2222-1735.
- Muhammad S.K., Irfanullah K., Siraj, D., Hafiz M. I., Rafid K. and Rahimullah J. (2015). The Impacts of ICT on the Students' Performance: A Review of Access to Information. *Research on Humanities and Social Sciences*, 5(1), 2224-5766.
- Mbah, T.B. (2010) The Impact of ICT on Students' Study Habits: Case Study of University of Buea, Cameroon, *Journal of Science & Technology Education Research* 1(5) 107 – 110.
- Muhammad, B.A. (2014) An Evaluation of the Efficacy of Conceptual Instructional method of teaching Practical Chemistry: The case of secondary schools in Zaria Educational zone Kaduna State, Nigeria. *African Journal of Education*
- Muhammad, A.K., Abdulai, M., Gbulam, M.S. & Shahid, H.M. (2021) Teacher-Students Teaching Strategies: Effects on Study Habits among Students in Pakistan Tertiary Institution, *Elementary Education Online*, 20(5) 5257 – 5265.
- Ndu, Odio and Okeke (1997), *Dynamic of Educational Administration and management*. Awa: Macks Publisher Ltd.
- NCTM (2000) Principles and Standards for School Mathematics www.nctm.org
- Ntui, A.I & Eyong, I.U. (2014) ICT Usage & Undergraduate Students' Study Habits in Cross River State, Nigeria. *Library Philosophy & Practice (e-journal)*, 1187.
- Olojede, A.I., Bolaji, C., Musa, M. (2017). Effects of Information Communication Technology on Senior Secondary School Students' Geometry Retention and Performance in Bauchi State Nigeria. *International Journal of Mathematics Trends and Technology (IJMTT)*, 48(3), 2231-5373 <http://www.ijmtjournal.org>
- Olubor, R.O. (1998) Problem of Learning in Public Today Secondary Schools:

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- Implication for Homes and Schools in the Nigerian Teachers. *J. Teacher Education NCE, Kaduna, 6(1), 222-226.*
- Otuu O.O.(2013). Impact of Information Communication Technology (ICT) on Secondary School Education in Anambra State with a Particular Reference to Some Selected Secondary Schools in Ogbaru LGA. Post Graduate Diploma in Education Thesis submitted to the National Teachers Institute Kaduna.
- Persons, T. (1997). General Social System Theory. Foundations Development Applications. New York. Gorge Breazillar.
- Sheenan, J. (1973). *The Economic of Education*. London: George Allen LTD.
- Travidic, B. (1993) Assessment of Evolving French Government Telematics Policies. Unpublished Thesis, Temple University, Philadelphia, P.A.
- Ubi, G.M.(2023) Impact of ICT usage on Students Academic Performance in UNN, Enugu State, *International Journal of Information System & Informatics 4,43-53*
- Uga, O. (2013) School Plant Planning and maintenance, in Segun Adesina (ed), Introduction to Educational Planning. The Ife: University of Ife Press Ltd.
- Vanguard (2023) WAEC to Begin CBT Feb 2024, vanguard Newspaper, Nov.13
- Zubair, Z. (2016.). Effect of Internet-Based Tools on Performance of Senior Secondary School Students in Biology in Kaduna State, Nigeria. *Ph.D Thesis submitted to the School of Postgraduate Studies Ahmadu Bello University, Zaria.*

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