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EFFECT OF USING ICT ON LEARNING MATHEMATICS IN SELECTED SECONDARY SCHOOLS IN MAKURDI METROPOLIS

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Abstract: -

This study reviewed conceptual, theoretical and empirical literatu re on problem affecting the effective use of information and communication technology in teaching and learning of mathematics in secondary schools. Secondary source of information based on prior studies on the subject are examined in terms of methodology, research findings and recommendations. Descriptive research methodology was used to analyze the content of the theoretical, conceptual and empirical literature for this study. The study was anchored on Radical Constructivism Theory and Social Constructivism Theory. According to the study, technology is developed to solve problems associated with human need in more productive ways. If there is no problem to solve, the technology may not be developed and/or not adopted. Applying this principle to educational technology would mean that educational institution should create and adopt technologies that address educational problems, of which there are many. Majority of the findings from most of the empirical review indicates a positive relationship between teaching and learning of Mathematics and the use of information and communication technology in secondary schools. Those that indicates a negative relationship state that lack of knowledge of the teachers, low level of training and retraining of resource person, lack of relevant equipment, poor infrastructures, such as computers, network and power especially in the rural areas are some of the factors that makes the use of information and communication technology inhibit the teaching and learning of mathematics in secondary schools. It was concluded that the use of ICT in teaching and learning mathematics can make the teaching process more efficient as well as enhance the students' capabilities in understanding basic concepts. It was recommended among others that the government, academic institutions and different stakeholders such as curriculum planners, policy makers, experts, teachers, students and parents to be serious and aware of these issues and their consequence.

Keywords: *Learning, ICT, Mathematics, Schools, Benue, Nigeria*

1.0 INTRODUCTION

The term ICT stands for information and communications technologies, which according to Whitten and Bentley (2018) describes the combination of computer technology (hardware and software) with telecommunications technology (data, image and voice networks) that enable processing, exchanging and management of data, information and knowledge. These equipments allow users to access, retrieve, store, organize, manipulate and present information by electronic means. There are high expectations for ICTs usage in improving the teaching and learning of school Mathematics internationally by educational researchers (Kaput & Roschelle, 1997). Ruthven & Hennessey, (2012) indicates that for the majority of other countries usage remains low and growth is very slow. According to the Teacher Training Agency (2012) the use of ICT in Mathematics should emphasise employing ICT to meet the needs of the learners in Mathematics and not teaching technology skills, as the technology is supposed to support Mathematics teaching. However the ICT skills are needed to be able to manipulate the ICT resources available. Thus a balance should be struck between ICT integration in teaching and learning and ICT literacy. According to Wilson (2010) appropriate uses of ICT tools can enhance Mathematics teaching and learning, support conceptual development of Mathematics, enables mathematical investigations by learners and educators and influence how Mathematics is taught and learnt.

Kerrigan (2012) in Mistretta (2015) has also found the benefits of using Mathematics software to include the following: Promoting learners' higher order thinking skills – Mathematical games and simulations help learners to apply mathematical ideas to problem situations. Developing and maintaining learners' computation and communication skills – Calculators and graphic calculators accelerate the speed of learners when solving mathematical problems which results in more accurate results and improved learners confidence in Mathematics; Introducing learners to collection and analysis of data – Databases and spreadsheets give the learners the confidence of analyzing large amount of data accurately; Facilitating learners algebraic and geometric thinking – Geometric software and algebraic systems offer learners a bridge from the abstract world of Mathematics to the concrete world wherein learners are able to create and observe numerical representations, Symbolic representation and geometric representation; and showing the learners the role of Mathematics in an interdisciplinary setting – Integrated Mathematics packages allow learners the opportunities to explore problem-based learning.

Oldknow and Taylor (2012) indicate that ICTs offer young children the ability to explore and solve problems involving large numbers at an early age, investigate characteristics of shapes using dynamic geometry software and organize large sets of data. They further indicate that ICTs offer educators options for adapting instructions to special needs of learners that is unlikely in a traditional Mathematics class. The educator can always come with activities for different levels of learners that are in class, and learning occurs at the pace of the learners. Therefore the possibilities of engaging learners with special needs in Mathematics are increased and everybody can do Mathematics.

The use of inappropriate hardware, the lack of useful software and the difficulty in gaining adequate access to computer system were noted as major obstacles to the use of ICT by teachers and students. The choice and distribution of hardware and software are crucial to the success of computer use in schools. In the establishment of the computer's place in the school curriculum, the school needs to carefully consider the establishment of a library of software able to support the use of the ICT in ways established in the school's computing philosophy. Schools with a small computing resource would probably need to buy software likely to have wide use in the school. Many packages are of limited use and can only be used for a small number of functions within a limited age group. Some packages require individual access to be of use to the teacher. All these are the different factors that militates the use of ICT for effective teaching and learning of Mathematics in secondary schools. The main objectives of the study is examine the effect of using ICT on learning mathematics in selected secondary schools in Makurdi Metropolis. The specific objectives of the study are to; determine the effect of ICT in learning Mathematics in the selected secondary schools in Makurdi and to proffer solutions to the problems of use of ICT in the learning Mathematics.

2.0 Literature Review Conceptual Framework

Information and Communication Technology (ICT)

Information and Communications Technology (ICT) can be regarded as any equipment or interconnected system or sub-system of equipment, which is used for automatic acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission or reception of data or information (Okwelle & Ayonmike, 2014). It is one of the forces that are responsible for changes in nations. It is also one of the great trends of the tail end of the last century. It is changing everything and will continue to change things in the present century.

The National Policy on ICT (2001) in its mission statement emphasized that ICT would be useful for; Creation of wealth, Poverty alleviation, Job creation and Global competitiveness. Globalization has come with a lot of challenges particularly in the developing nations of which Nigeria is one. The world has become borderless due to the advent of new technologies. For example due to the abundance of knowledge the unprecedented cross-border transferability of information and the removal of trade barriers, the occurrence of externalities within nation has significantly increased (Siyanbola, *et al.*, 2012). However, despite the emergence of new technologies and innovation in shaping global economy the participation of developing nations is quite negligible, it is concentrated more in advanced or developed economics of the world, hence there is less competition between developed and developing nations. Information and communication technology (ICT) has transformed the way Nigerians communicate and access information in the last two decades particularly with the advent of global systems or mobile communications and the introduction of the local content policy in the educational sector. In any given society, the level of technology determines the level of economic growth.

Information Communication Technology (ICT) has revolutionized all sectors of the economy including the educational sector where it has made huge impact and there is need for responsible nations to respond to such innovation. Nigeria being a poor country has also recognized the need to key into the ICT world particularly to support industrial development and create more jobs for her citizens. Information Communication Technology's main objectives is contained in The National Policy on ICT (2001); to ensure that ICT resources are readily available for efficient delivery of services and products; to guarantee that the country benefits maximally and contributes meaningfully to the global solution of information age challenges; to empower children, women and the disabled by providing special programmes for the acquisition of ICT skills; to empower the youth with ICT skills and prepare them for global competitiveness; to create IT awareness and ensure universal access in order to promote ICT diffusion in all sectors of National life; to establish an ICT infrastructure and maximize its use national wide; to build a mass pool of ICT literate man power; to develop human capital with emphasis on creating and supporting a knowledge-based society; to set up advisory standard for education, working practices and industry; to establish appropriate institutional framework to achieve the goal stated above; the policy also focuses on the development of competitive man power in ICT and related disciplines.
Saltis, (2000) as cited in Michalsons, (2017) said information communication technology (ICT) refers to the combination of manufacturing and services industries that capture, transit and display data and information electronically. Diebold, (2010) view ICT as technologies that provide easy access to information through Telecommunications. Hilton, (2008) said that ICT has played a major role in data oriented business for a long time, which extract and process information in order to achieve their goals. Andarias, (2016) viewed that technology is considered as an efficient tool when properly used; otherwise it can also become a problem which needs to be solved, rather than the solution. Technology is considered to be only efficient when handled by well-trained personnel and embedded in the workflow of the organization.

Challenges in the use of ICT in learning of Mathematics

Many studies have shown several obstacles that teachers experience in the integration of ICT in their classrooms. Jones (2014) found a number of barriers for the integration of ICT into lessons: lack of confidence among teachers during integration, lack of access to resources, lack of time for the integration, lack of effective training, facing technical problems while the software is in use, lack of personal access during lesson preparation and the age of the teachers.
Snoeyink and Ertmer (2012) have identified these or similar variations as widespread barriers: lack of computers, lack of quality software, lack of time, technical problems, teacher attitudes towards computers, poor funding, lack of teacher confidence, resistance to change, poor administrative support, lack of computer skill, poor fit with curriculum, scheduling difficulties, poor training opportunities, and lack of vision as to how to integrate ICT in instruction.

A study in Ghana among pre-service and in- service mathematics teachers explored the influence of computer attitudes, competencies and access of the teachers on their levels of ICT integration using the will, skill and tool concept. The study reported low levels of ICT integration levels as a result of low competencies and access levels of ICT. Furthermore, the study showed fairly high levels of positive computer attitudes and indicated among others to be a necessary condition to prepare teachers for new teaching methods which are flexible and involve appropriate use of ICT. Of equal importance to ICT integration is teacher preparation programmes. Research have shown that such programmes have not adequately modeled the use of technology in their method courses (Adamy and Boulmetis,2016) or incorporated effective approaches to technology integration into a single technology courses (Brown and Warschauer, 2016).

Technology is developed to solve problems associated with human need in more productive ways. If there is no problem to solve, the technology may not be developed and/or not adopted. Applying this principle to educational technology would mean that educational institution should create and adopt technologies that address educational problems, of which there are many. Furthermore, a technology will not be adopted by educators where there is no perceived need or productivity gain. This is what Lankshear, Snyder and Green (2010) refer to as the "workability" principle.

Therefore, when discussing applications of computer technology to education the question must always be asked, "what educational problem needs to be addressed? This question needs to be asked at all levels of decision making from the teacher planning a programme, to a school administrator purchasing hardware and software, to an educational system officer developing policy and strategic plans. At the teacher level the question becomes: am I satisfied with the educational opportunities I am able to offer children in school classrooms? While teachers should never be completely satisfied, and they will always strive to do better, the question really is whether what they provide adequately develops the potential of the students and adequately prepares them for a productive life in the society.

Prospect of use of ICT in Schools

As shown by literature, the use of information and communication technology in schools is taken very seriously by governments and educational systems around the world. As educational systems move towards the mainstream use of ICT in teaching and learning there appear to be more critical steps and vital ingredients needed for the successful infusion of ICT into educational environments. Although stand alone computers have been in most schools for more than two decades now, networked ICT is relatively new for many schools as they continue to grapple with how to use ICT to enhance teaching and learning environments. Since the development of the first computers many have argued that computers should be used to support learning. These argument have amplified as computers have evolved into powerful relatively low cost technology available today. However, there is considerable debate over how computers should be used in schools (Riel, 2018).

Studies in Sub-Saharan Africa, South America and Some European countries have shown enormous efforts put in place by governments and other international organisations in the procurement of ICT tools and establishment of infrastructures. Recently, the incorporation of ICT in the teaching and learning processes is still a major problem faced by teachers (Voogt & Tondeur, 2015; Ajayi, 2008). Still, the teaching approach commonly used by teachers in secondary schools is the talk and chalk approach where the teacher do most of the talking and pedagogic work while the student is regarded as passive recipients of information (Voogt & Tondeur, 2015). This problem can be traced from teacher training programs which have a significant impact on teacher use of ICT in teaching (Mishra and Koelher, 2006). Agyei and Voogt (2012) stated that teachers in many countries are offered just basic ICT courses at the pre- service training to prepare them on how they can integrate ICT in their various classrooms concerning their subject discipline. As a result, this has placed so many doubts whether pre-service teachers are prepared for the new teaching method which focuses on student centered learning, teacher flexibility and the use of ICT.

Nkwenti (2010) concluded from his review of in-service ICT programmes for Cameroonian teachers that only 1.2 percent of teachers had undergone on-the-job ICT training on the practical use of ICT and more than 60 percent of the training skills acquired to use ICT in pedagogy are theoretically driven.

A study by Cuban (2001) in Silicon Valley higher secondary schools in the United States of America shows that it is quite fascinating that policy makers and curriculum planners implementing ICT in schools are still to make changes in the standard school timetable utilised by teachers. In practice, on a daily basis secondary schools' subjects are divided into periods with each lasting from forty-five to an hour depending on the curriculum documents. This always makes it difficult for teachers to engage in innovative classroom practices in integrating ICT in their classroom because of the limited time they have with the students (Agyei & Voogt, 2012; Cuban, 2001). Consequently, the school structure and curriculum act as a significant barrier to ICT use as a pedagogic tool in classrooms.
After substantial worldwide implementation ICT in schools, studies have found out that those teachers who are more proficient in using ICT focus on the internet search and word processing instead of project-based teaching (Cuban, 2001; Agyei & Voogt, 2012; Li, 2007). In another word Cuban (2001) firmly affirms that technically, the use of new technology amends the way teachers usually do. He continues by demonstrating in his study carried out in Silicon Valley secondary schools that the majority of the teachers who were considered ICT competent used computers for grade recording, administrative purposes, communication with parents and other colleagues, and research practices. This in effect is not encouraging for policy makers and those that advocate for computer usage in schools.

A qualitative study was carried by Chigona and Chigona (2010) to examine the level of ICT adoption amongst educators in the Western region of South Africa after a project aimed at introducing technologies to schools, at the same time equipping teachers with ICT skills. This project was launched in 2001 with the primary goal to ensure that by the beginning of 2012, every teacher would be entitled to use ICT in delivering their lesson properly. From a review by Chigona and Chigona (2010), for the use of ICT in classrooms to realize full impact in the teaching and the learning process, it will require from the educators to take advantage of new capabilities and approach to pedagogy which can only be experienced through the effective use of ICT.

Theoretical Framework Radical Constructivism Theory
We realized that students build their mathematical concepts of what they learn through active cognitive and adaptive process (Von Glasersfeld, 1995). According to this perspective, students should be involved in critical reflection on learning mathematics. The teaching and learning processes undergo through assimilation, accommodation, adaptation, and reconstruction (von Glasersfeld 1990). The students learn mathematics through active construction of the meaning of concepts they learn through individual re-organization, re- presentation, and re-construction and social negotiation with peers, elders, and teachers (Belbase 2016). ICT helps to robustly present this platform for students to achieve this. However, there are some major issues of radical constructivism in teaching and learning mathematics that arise from mathematically weak students, application of teacher-centered pedagogy, untrained teachers, the existing curricula, our diverse social and cultural context and general lack of hands-on resources for classroom practice. In our understanding, the theory of radical constructivism focuses on the cognitive process of learning and teaching mathematics which is entirely a mental process. For the success of teaching and learning mathematics in the classroom, students are trained to go through individual and collective mental processes to make sense of concepts they learn and build upon them further concepts.

However, it is challenging in our classroom teaching and learning due to large class size and limited or no classroom resources. We consider that mental actions and processes are mediated through what students and we (teachers) do in the classroom. Although constructivism has emerged as one of the greatest influences on the practice of education, our mathematics teachers have not embraced constructivist-based pedagogy. We are habituated to quick fixes and shopping mall approach to school improvement (Powell, Farrar & Cohen 2015) without considering the actual process of learning mathematics. According to the students' cognitive, affective and developmental stage, radical constructivist teachers should follow the various teaching techniques focusing more on individual and group presentations, discussions, tests, debates and student decisions, and application of mathematical models for solving the problems using the platform provided by ICT.

Theory of radical constructivism accepts that students build their concepts of what they learn through active cognitive and adaptive process. Students may give their reflection and argument about the content, process, and product in teaching and learning and they construct the knowledge of mathematics (Leo, 2010). However, these phenomena are related to social and cultural adaptation of knowledge and knowing.

Nexus between ICT and Teaching and Learning of Mathematics

Just as teachers hold beliefs about mathematics that may influence how they teach or structure the learning environment, teachers also hold beliefs about the use of technology. For example, the studies conducted by Li (2007); Kynigos and Argyris (2004) on the nature of beliefs about technology use in the mathematics classroom portrayed some difficulties in the different aspects of learning situations in different ways, and the impact of using computers on their beliefs about teaching mathematics. Li's (2007) study reveals contrasting beliefs between students and teachers. For example, the students commented that they wanted to learn in a more effective, efficient and fun way, which suggests that technology, may help weak students by increasing their confidence levels. On the other hand, no teacher in the study considered the advantage of computer technology as an alternative to the traditional approach of teaching to improve weak students' learning. Kynigos and Argyris (2004) study established the complexity of issues that play a pertinent role in forming beliefs and practices in the aspects of teacher intervention in the classroom, the emerging social roles and the possible influences of the school and the educational system. Their study also revealed that the type of intended innovation and the use of exploratory software played a major role in the kind of mathematical activity going on in the classroom.

Technology is developed to solve problems associated with human need in more productive ways. If there is no problem to solve, the technology may not be developed and/or not adopted. Applying this principle to educational technology would mean that educational institution should create and adopt technologies that address educational problems, of which there are many. Furthermore, a technology will not be adopted by educators where there is no perceived need or productivity gain. This is what Lankshear, Snyder and Green (2010) refer to as the „workability" principle. Therefore, when discussing applications of computer technology to education the question must always be asked, "what educational problem needs to be addressed? This question needs to be asked at all levels of decision making from the teacher planning a programme, to a school administrator purchasing hardware and software, to an educational system officer developing policy and strategic plans. At the teacher level the question becomes: am I satisfied with the educational opportunities I am able to offer children in school classrooms? While teachers should never be completely satisfied, and they will always strive to do better, the question really is whether what they provide adequately develops the potential of the students and adequately prepares them for a productive life in the society.

Empirical Review

Chong, Sharaf & Jacob (2005) carried out a Study on the use of ICT in Mathematics Teaching. According to the study, The introduction of laptops in the teaching of mathematics and science in English under the Teaching and Learning of Science and Mathematics in English Programme has been implemented by the Ministry of Education since 2003. The preliminary observations found that teachers are not fully utilizing these facilities in their teaching. A survey was conducted to study the barriers preventing the integration and adoption of information and communication technology (ICT) in teaching mathematics. Six major barriers were identified: lack of time in the school schedule for projects involving ICT, insufficient teacher training opportunities for ICT projects, inadequate technical support for these projects, lack of knowledge about ways to integrate ICT to enhance the curriculum, difficulty in integrating and using different ICT tools in a single lesson and unavailability of resources at home for the students to access the necessary educational materials. To overcome some of these barriers, this paper proposes an e-portal for teaching mathematics. The e-portal consists of two modules: a resource repository and a lesson planner. The resource repository is a collection of mathematical tools, a question bank and other resources in digital form that can be used for teaching and learning mathematics. The lesson planner is a user friendly tool that can integrate resources from the repository for lesson planning.

Rebecca and Anne (2010) examined ICT Use to Improve Mathematics Learning in Secondary Schools. According to the study, today's students are expected to learn about and use digital-technology in mathematics to prepare them for their future, the work force and the challenges of everyday life. However, international studies show that secondary mathematics teachers are still not effectively integrating computer technology in their classroom. This paper presents the findings from a doctoral study on the extent to which mathematics teachers in government high schools in New South Wales, Australia have integrated computer technology into their teaching. The sample contained 114 mathematics teachers from 26 public secondary schools in New South Wales, Australia. A statistical model, logistic regression analysis was used to examine mathematics teachers' beliefs, attitudes, knowledge (use of software packages;

professional development experiences and needs in computer technology) and factors that encourage or hinder the use and not use of computers in the classroom. The findings of the study indicate that the strongest predictors that are positively associated with computer use are training on EXCEL and the need for ongoing support for the inclusion of technology in mathematics teaching. This paper concludes with recommendations as to how school leaders can support mathematics teachers to fully adopt computer technology use in teaching and learning.

Nwigbo and Madhu (2016) examined the Impact of ICT on the Teaching and Learning Process. According to the study, the impact of ICT for teaching and learning process has become pertinent as it facilitates teaching and learning process, create conducive learning environment, and help learners develop creative thinking and self confidence. This paper focuses on the use of ICT in schools by students and teachers to support the processes of learning and teaching. It describes the ways in which teachers could and/or should facilitate student use of computer systems and how they can progress. The use of information and communication technology in schools is taken very seriously by governments and educational systems around the world as it provides access to a variety of information sources, forms and types; help in the preparation of reports and the organization of events; helps to put down the barriers between information held on several systems, thus creating a borderless communication and information environment by allowing users to access different database, thus having access to millions of information at their finger tips. This paper thus suggests that effective introduction of ICT in the teaching and learning process is an indispensable means of improving it.

Nwoke and Ikwuanusi (2016) examined the Impediments To Integration Of Ict In Teaching And Learning Of Mathematics In Secondary Schools in Imo state. Based on the objective of the study, two research questions and a hypothesis guided the study. A sample of 150 mathematics teachers comprising of 60 males and 90 females were used for the study. Descriptive survey research design was adopted in carrying out the research. A four point type likert questionnaire instrument with reliability coefficient of 0.77 determined through test- retest method was used in data collection. Generated data was analyzed using mean, standard deviation and t-test statistical tools tested at 0.05 level of significance. The study revealed among other factors, teachers negative attitude, competence, and confidence, poor policy implementation, lack of time ,lack of personnel, etc, hindered the implementation of ICT in teaching and learning of mathematics in secondary schools. Based on the result, it was recommended among other things that, mathematics teachers should be exposed to workshops and seminars to develop positive attitude, build confidence and competence towards ICT in teaching and learning of mathematics in secondary schools in Imo State.

Sivakova, Jasminka, Marija and Biljana (2017) studied ICT- the Educational Programs in Teaching Mathematics. According to the study, the range of information and communication technology in teaching mathematics is unlimited. Despite numerous researches about the opportunities and application of the ICT in teaching mathematics and in the world, however, many aspects remain unexplored. This research comes to knowledge that will be applicable to the educational practice. The findings will serve as motivation for more frequent use of the ICT in teaching mathematics from first to fifth grade as a mean for improving of the educational process. Through application of the ICT in the educational programs in teaching mathematics the technological improved practice is investigated and discussed and it helps overcoming of the challenges that arise when trying to integrate the ICT in the educational curricula in mathematics. The biggest challenge are the findings about the possibilities of the application of the ICT in the educational programs in math from first to fifth grade as well as their dissemination, all aimed to improving of teaching mathematics from the first to the fifth grade. The application of the most ICT in the educational programs of mathematics affects the training of the students for easier adoption of the mathematical concepts and the mathematical procedures and in the easier identification and resolving problem situations.

Panthi & Belbase (2017) studied the Teaching and learning issues in mathematics in the context of Nepal. The study discussed the major issues of mathematics teaching and learning in Nepal. The issues coming from theories such as social and radical constructivism suggest that teachers are not trained to use such approach in teaching mathematics, and there is a lack of teaching aids and materials and technological tools. The issues related to social aspects are gender issues, language issues, social justice issues, and issues related to the achievement gap. The cultural issues are related to the diversity of language and ethnicity. The issues related to political aspects are equity and access, economic status, pedagogical choice, and professional organizations and unions. The issues related to technology include the technological skills, use of technology, and affordance. Finally, we suggest that all the stakeholders should pay attention to resolving these issues by improving the curriculum, training teachers, resourcing the classroom with locally made and new technological tools.

Papert (1980) studied on ‘Children, computer and powerful idea’. He understood the importance of digital media and how it could be used to enable children to learn better within a constructivist learning environment. He believed that in order for children to assemble and modify their ideas, the traditional tools such as pencils, copies and texts were inadequate. He felt that computers were the appropriate tool to enable the learner to take control of the learning process. He found that a complementary relationship exists between technology and constructivism, the implementation of each one benefiting the other. Recent attempts by educators to integrate technology in the classroom have been within the context of a constructivist framework.

3.0 RESEARCH METHODOLOGY

This study used a survey research design. The population of the study is two secondary schools in Makurdi Metropolis purposively chosen from both private and public secondary schools. They are made up of both junior and senior secondary school students of Mount St Gabriel Secondary School and Special Science Senior Secondary School Makurdi with a population of one hundred and fifteen (115) students purposively chosen due to large sample size.

The data for the study was collected using questionnaire, coded and analyzed using computer-based Statistical Package for Social Sciences (SPSS version 20.0 for Microsoft Windows). The validity and the reliability of the instrument was established using the factor analysis. It was established that the instrument is valid and reliable as the validity score that considered Kaiser-Meyer- Olkin (KMO) and Bartlett's Test of Sphericity is above the threshold and the Cronbach Alpha Coefficient for reliability is above 0.7.

Table 1: Kaiser-Meyer-Olkin and Bartlett's test

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.895
Bartlett's Test of Sphericity	Approx. Chi-Square	.798
	df	1
	Sig.	.037

Source: SPSS Result, 2019

A pilot test was conducted. The input variable factors used for this study were subjected to exploratory factor analysis to investigate whether the constructs as described in the literature fits the factors derived from the factor analysis. From Table 1, factor analysis indicates that the KMO (Kaiser-Meyer-Olkin) measure for the study's three independent variable items is 0.895 with Barlett's Test of Sphericity (BTS) value to be 1 at a level of significance p=0.037. Our KMO result in this analysis surpasses the threshold value of 0.50 as recommended by Hair, Anderson, Tatham, and Black (1995). Therefore, we are confident that our sample and data are adequate for this study.

Table 2: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.807	.866	2

Source: SPSS Result, 2019

As shown by the individual Cronbach Alpha Coefficient the entire construct above falls within an acceptable range for a reliable research instrument of 0.70. The Cronbach Alpha for the individual variables is 0.807 and is found to be above the limit of acceptable degree of reliability for research instrument.

Table 3: Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item- Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
LOM	36.2500	95.776	.621	.845	.560
ICT	35.0500	170.576	.521	.900	.690

As shown in Table 3, an item-total correlation test is performed to check if any item in the set of tests is inconsistent with the averaged behaviour of the others, and thus can be discarded. A reliability analysis was carried out on the variables of the study values scale comprising two (2) items. Cronbach's Alpha showed the questionnaire to reach acceptable reliability, $\alpha = 0.807$. All items appeared to be worthy of retention, resulting in a decrease in the alpha if deleted. There is no exception to this in all the variables of the study as none of the items if deleted will improve the overall Cronbach alpha statistics. As such, none of the variables was removed. A correlation value less than 0.2 or 0.3 indicates that the corresponding item does not correlate very well with the scale overall and, thus, it may be dropped.

Models Specification

The functional relationship between the variables of the study, the model is expressed in implicit and explicit function as shown below:

LOM = f (ICT) - - (1)

Where,

LOM = Learning of Mathematics

ICT = Information and Communication Technology

In explicit form, the functional relationship between the variables of the study can be shown below:
$LOM = b0 + b1ICT + U_t$ - - (2)
Where,
$b0$ = Regression constant
$b1$ = coefficients of independent variables. U_t is the error term

***A priori* expectations**
(X_1) = ICT; *a priori* expected to have a positive effect on effect on Learning of Mathematics.
The Ordinary Least Square regression (OLS) analysis was used to assess the nature and degree of relationship between the dependent variable and a set of independent or predictor variables. However, the probability value o the estimates will be used to test the one hypotheses of this study.
Decision rule: The following decision rules were adopted for accepting or rejecting hypotheses: *If the probability value of bi* [*p* (bi) > critical value] we accept the null hypothesis, that is, we accept that the estimate bi is not statistically significant at the 5% level of significance. *If the probability value of bi* [*p* (bi) < critical value] we reject the null hypothesis, in other words, that is, we accept that the estimate b1 is statistically significant at the 5% level of significance

4.0 RESULTS AND DISCUSSION

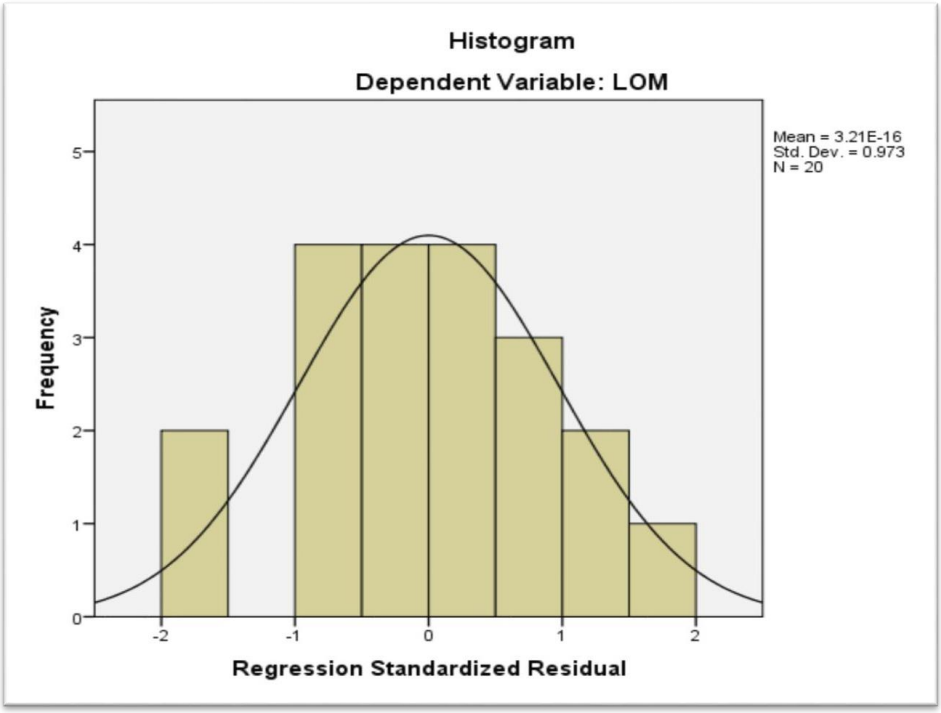

Figure 1: Regression Standardized Residual

Figure 1 above shows a histogram of the residuals with a normal curve superimposed. The residuals look close to normal, implying a normal distribution of data. Here is a plot of the residuals versus predicted dependent variable of learning of Mathematics (LOM). The pattern shown above indicates no problems with the assumption that the residuals are normally distributed at each level of the dependent variable and constant in variance across levels of Y.

Table 1: Statistical Significance of the model

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	144.477	1	144.477	.840	.037[b]
	Residual	3096.473	18	172.026		
	Total	3240.950	19			

a. Dependent Variable: LOM
b. Predictors: (Constant), ICT
Source*: SPSS 20.0 Result Output, 2019*

The result of the statistical significance of the model is presented in Table 13. The F- ratio in the ANOVA table above tests whether the overall regression model is a good fit for the data. The table shows that the independent variables statistically significantly predict the dependent variable F (1, 18) = 0.840, p =0.037[b] (i.e., the regression model is a good fit of the data).

Table 2: Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.852[a]	.824	.785	13.11588	2.777

a. Predictors: (Constant), ICT
b. Dependent Variable: LOM
***Source**: SPSS 20.0 Result Output, 2019*

Table 20 shows the model summary. The coefficient of determination R^2 for the study is 0.824 or 82.4%. This indicates that 82.4% of the variations in the model can be explained by the explanatory variables of the model while 17.6% of the variation can be attributed to unexplained variation captured by the stochastic term. The Adjusted R Square and R^2 show a negligible penalty (78.5%) for the explanatory variables introduced by the researcher. The Durbin Watson statistics is 2.777 shows that there is a minimal degree of negative autocorrelation in the model of the study; hence the estimates of the model can be used for prediction.

Table 3: Regression coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	.836	.525		.155	.045		
	ICT	.282	.307	.211	.916	.037	1.000	1.000

a. Dependent Variable: LOM
Source: SPSS 20.0 Result Output, 2019

As shown by the result of the multiple regression, Information and Communication Technology (ICT) has a positive effect on Learning of Mathematics (LOM) in selected Secondary Schools in Benue State Nigeria and the relationship is statistically significant (*p<0.05)* and in line with *a priori expectation*. This means that a unit increases in Information and Communication Technology (ICT) will result to a corresponding increase in Learning of Mathematics (LOM) in selected Secondary Schools in Benue State Nigeria by margin of 21.1%. Using the probability value of the estimate, p (b1) < critical value at 0.05 confidence level. Thus, we reject the null hypothesis. That is, we accept that the estimate b1 is statistically significant at the 5% level of significance. This implies that Information and Communication Technology (ICT) has a significant effect on learning of Mathematics in selected secondary schools in Makurdi Metropolis, Benue State Nigeria.

This finding is in line with that of Sivakova, Jasminka, Marija and Biljana (2017) who studied ICT- the Educational Programs in Teaching Mathematics. According to the study, the application of ICT in the educational programs of mathematics positively affects the training of the students for easier adoption of the mathematical concepts and the mathematical procedures and in the easier identification and resolving problem situations.

5.0 CONCLUSION AND RECOMMENDATIONS

This study examined the effect of using ICT on learning mathematics in selected secondary schools in Makurdi Metropolis. According to the study, the use of ICT in teaching mathematics can make the teaching process more effective as well as enhance the students' capabilities in understanding basic concepts. The study indicates that the use of ICT is positively related to the learning of Mathematics. Nevertheless, implementing its use in teaching is not without problems as numerous barriers may arise. The types of barriers have been identified in the study. We highlighted different issues of learning mathematics and the idea of resolving them in a practical way. We have suggested different measure in addressing these matters. However, we might not be dealing with these issues wholly, or we may not be able to achieve the goal right away because these are the emergent issues depending on the emergent situations. In our opinion, the depth of studies in each of these issues may give more feasible ideas to solve them.

Based on the findings of this study, it is recommended that:

1. Management of the selected secondary schools in Makurdi Metropolis should ensure the full implementation of the

use of Information and Communication Technology (ICT) as it impacts on educational standards is a fertile background for making efficient use of it other science subjects. ICT can enhance teaching by enhancing what is already practiced or introducing news and better ways of learning.

2. Various ways of improving the use of ICT by the school management and the other stakeholders should be encouraged so that the bottleneck involved in the implementation of ICT in the study area should be curbed. The government, academic institutions and different stakeholders such as curriculum planners, policy makers, experts, teachers, students and parents to be serious and aware of these issues and their consequence. It needs a collective effort of all to resolve them. A strong commitment, dedication, and desire of all are must to address these problems and improve the quality and equity in mathematics teaching and learning by the use of Information and Communication Technology.

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