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## **ICT IN TEACHING MATHEMATICS: NIGERIAN TEACHERS' PERSPECTIVE**

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### **ABSTRACT**

*The study was designed to find out the perception of secondary school Mathematics teachers about the use of ICT in teaching Mathematics. The study specifically centred on finding the need of enhancing teacher education programme so as to serve as an avenue of improving teachers' perception and orientation on ICT in Mathematics teaching. It also sought for the most common ICT applications available for Mathematics teachers to use. Barriers to the integration of ICT were also examined. The study adopted a survey design. A sample size of 180 was used. This comprises of Mathematics teachers who were randomly selected from secondary schools in Bichi Educational Zone Kano state – the area of the study. The questionnaire used for data collection had 26 items which covered the scope of the study. The data collected were analysed with mean score with a bench mark of 2.50. Among the findings made were that Mathematics teachers were found to be enthusiastic about the application of ICT in Mathematics teaching but only few were already incorporation it in their teaching. Most Mathematics teachers were discovered to be willing and ready to integrate ICT in their teaching. Again the most common ICT applications used by the few teachers who are already making effort to integrate ICT into their teaching include: word processing packages, spreadsheet, drill/practice tutorials and graphic applications. These applications are less technical and easy to manipulate. Among the leading barriers to the ICT usage in secondary school Mathematics teaching as found out in the study was: lack of enough technical skills for ICT projects, poor electricity power supply in schools and lack of Mathematics laboratories with ICT facilities. Owing to the findings, the following recommendations were made that: Mathematics teachers should*

*be encouraged to embrace the new method of teaching (use of ICT) and pursue it with all the zeal it deserves; in-service training, especially on ICT usage in Mathematics lesson be made compulsory for all Mathematics teachers, Seminars and Conferences be organized by experts for teachers, especially Mathematics teachers on ICT usage in teaching and state government should make frank efforts to provide all the necessary facilities and equipment for the proper ICT usage in teaching secondary school Mathematics.*

**Keywords:** *Challenges, Curriculum ICT, Mathematics, Teachers, Teaching, Training*

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## **INTRODUCTION**

The bedrock of all science related courses is usually credited to Mathematics. It is the foundation of all technological advancement. Being aware of this, the federal government of Nigeria through the National Policy on Education (2013) maintained the compulsory nature of Mathematics in all levels of education up to tertiary level (though as a general course at the tertiary level). Owing to this, the government, at all levels is making serious effort to provide high quality Mathematics education. It is worthy of note that recognizable attempts, by various stake holders, have been made in the past to enhance Mathematics teaching and learning of Mathematics.

One of the laudable attempts made was to introduce ICT usage in the teaching and learning in secondary schools. Ittigson & Zewe (2015) cited that technology is essential in teaching and learning of Mathematics; it improves the way Mathematics should be taught and enhances students' understanding of basic concepts. It is obvious that researches have been conducted on the benefits of ICT usage in Mathematics. According to British Education Communications and Technology Agency (2018), the key benefits include: ICT promotes greater collaboration among students and encourages communication and sharing of knowledge, ICT gives rapid and accurate feedbacks to students and this contributes towards positive motivation; it also allows them to focus on strategies and interpretation of answers rather than spend time on tedious computational calculations; ICT also supports constructivist pedagogy, where

in students use technology to explore and reach an understanding of mathematical concept.

Buttressing the points, Chong (2016) said that higher order thinking can be promoted through the use of technology and this helps to improve their strategies for problem solving. This is indeed in consonance with the recommendations forwarded by the Mathematics Association of Nigeria (MAN) after its 2015 national conference in Enugu state. This implies that students would use more of technology to solve problems instead of manual way of problem-solving. This can only be achieved if the teachers who are the interpreters of the policy in the classroom are very much positive about the ICT usage in their instruction. That is, if the teachers' perspective about ICT usage is in tandem with the policy, then, the policy can be sustained. This is in agreement with the famous aphorism that no nation can rise above the standard of her teachers. No wonder Salman & Adeniyi (2012) opined that the teacher implements any curriculum material and hence determines to a large extent the success or failure of any teaching and learning process. Supporting the idea, Morey (2000) in Salman & Adeniyi (2012) stated that the teacher is the key to the success or otherwise of the child in and outside the school learning. This can be achieved depending on the teachers' perspective on the use of ICT which is now advocated for in order to make better Mathematics teaching and learning. As already noted, National Policy on Education (2013) places emphasis on acquisition of skill, being creative and having the attitude of enquiry and problem solving. It also aims at the development of ability and willingness in the students of carrying out experiments using various mathematical theories and operations. In addition to the reform to meet the demands of modern society, the policy emphasized the ICT for teaching of Mathematics. It is therefore targeted at meeting the standard expected of Mathematics in various parts of the world.

### **PROBLEM STATEMENT**

However, in spite of the expectations of this policy document, i.e., ICT being used in the secondary school Mathematics learning, there are indications that point to the fact that computers are not widely used into Nigerian secondary school Mathematics. For ICT to be successfully used in the secondary school

Mathematics curriculum, it is good for the teachers to have a clear knowledge of the available software packages they can use in their day-to-day teaching of Mathematics (Chong, 2016). In a study conducted by Forgasz & Prince (2012), 61% of the respondents (Teachers) use spread sheets, 45% used word processing and 30% used internet browsers. In the same survey, it was found that 19% used Geometer's Sketchpads, 19% used CD ROMs that accompanied Mathematics textbooks, 18% used Graphmatica, 14% used Mathematics Blaster and 8% used other mathematics-specific software.

Apart from the lack of knowledge of the available software packages usable by Mathematics teachers, a good methodical knowledge on how to use that software is another issue of concern on the teachers' perception of Mathematics teaching through the use of ICT in secondary schools. Furthermore, Jones (2014) discovered that there exist seven barriers to the use of ICT in a Mathematics lesson. These include the following: Lack of confidence among teachers during integration (21.2% responses), lack of access to resources (20.8%), lack of time for the integration (16.4%), lack of effective training (15.0%), facing technical problems while the software is in use (13.3%), lack of personal access during lesson preparation (4.9%), the age of the teacher (1.8%).

Furthermore, Douglas (2010) pointed out that in despite of government efforts, the way Mathematics is presented is yet to change. This is evidenced in the consistent poor performance of students in Mathematics at the secondary school level. Several studies conducted by many authors on the poor performance of secondary school students, especially in the Senior Secondary School Certificate Examination (SSSCE), revealed that failure rates in Mathematics have been dramatically high.

It is very obvious that many researches has been carried out to explain the reason for this consistent mass failure of students in Mathematics. For instance, a study in other Sub-Sahara African suggests reasons for poor students' performance in Mathematics: Poorly-resourced school, large class, a curriculum hardly relevant to the daily lives of students, a lack of qualified teachers, and inadequate teacher education programme (Ottevanger, Van den Akker, & de Feiter, 2017).

More so, some other studies dwelt much on the possible ways to solve this problem without considering the teachers' perception on ICT usage in

Mathematics teaching in secondary school. For instance, a report on Developing Science, Mathematics and ICT (SMICT) Education in Sub-Saharan Africa suggested that teachers should change their role as mere presenters of knowledge with the use of drill a student centred and participatory teaching & learning (Ottevanger, Van den Akker, & de Feiter, 2017). This is in compliance with the National Policy on Education (2013) which suggests that “teachers should start every lesson with a practical problem to help students acquire the habit of analytical thinking and the ability to apply knowledge in solving practical problem and also make use of the calculator and computer (ICT) for solving and investigation of real life situations.

On the whole, this new method of teaching and learning of Mathematics in secondary school requires more than expectations contained in the policy. It also requires more than finding out numerous factors responsible for the poor performances of the students in Mathematics in secondary school. It has more to do with the perception of the teachers on ICT usage in teaching Mathematics. The teachers who interpret the policy seem to be passive in the use of ICT in the class. This is why this study was geared towards finding the perception of Nigerian Mathematics teachers in the use of ICT in improving the teaching and learning of Mathematics. It is quite true that some schools, especially private schools in Enugu state, have invested more money in procurement of computer and establishment of computer labs, but it is still doubtful whether these computers are put to adequate use by teachers in their instructions. Thus, the issue of whether there is need for Mathematics teachers to be trained on how to effectively use ICT in their daily teaching routines becomes a point of attraction (Douglas, 2010). Therefore, this study specifically sought to find out:

- 1) If enhancing teachers’ education programmes would enhance teachers’ perception in teaching of Mathematics through the use of ICT.
- 2) The most common ICT applications used by Mathematics teachers in their instructions.
- 3) The barriers to the use of ICT in Mathematics teaching.

### **SIGNIFICANCE OF THE STUDY**

The importance of this study was for a clear understanding of the need for integration of ICT in Mathematics teaching and learning to both the teachers and the students. It will also educate the Mathematics teachers on the most

common ICT applications and how they are used in the classroom. This would certainly, if properly adhered to, change for good the perception of Mathematics teachers on the use of ICT in of Mathematics teaching. Finally, this study would reveal the barriers to the use of ICT in improving Mathematics teaching and learning.

### **RESEARCH QUESTIONS**

The researcher formulated the following research questions to guide the study:

- 1) What are the needs of enhancing the teacher education programme so as to improve the perception of Mathematics teachers on ICT usage in teaching secondary school Mathematics?
- 2) What are the most common ICT applications used by Mathematics teachers in the classroom?
- 3) What are the possible challenges of ICT usage in Mathematics teaching in secondary schools?

### **TEACHER EDUCATION PROGRAMME FOR MATHEMATICS TEACHERS**

Among other goals, National Policy on Education (2013) stated that “teacher education shall provide teachers with the intellectual and professional background adequate for their assignment and to make them adaptable to changing situation”. Apart from all teachers in educational institutions being professionally trained, the policy went further to say that teachers’ education programs “shall be structured to equip teachers for the effective performances of their duties” The policy went further to maintain that information Technology (IT) training shall be incorporation into all teachers training programs.

Against this backdrop, the policy expects that all teachers, especially Mathematics teachers, in attempt to adapt to the changing technological world, should be ICT complaint. That is, they should have positive perception on ICT usage in teaching Mathematics. This will in turn help them to teach students to learn the mathematical skills, values, understanding, aptitude, attitudes and insights; needed to succeed in their careers of choice and daily living. According to Douglas (2010), said that this policy is based on the premises that all students can learn Mathematics and that all need to learn Mathematics” The students are

expected at senior secondary school level to acquire the necessary mathematical skills so as to apply their knowledge in the solution of everyday problem. Secondly, they are expected to be able to further their education in such areas as Mathematics, Sciences, Engineering, Medicine, Commerce, Industry and other related professions.

The expectation of secondary school Mathematics placed a lot of implications for teachers' education program. Therefore, in order to meet the target of the National Policy on Education (2013), i.e. the teachers being able to integrate ICT for the improvement of Mathematics teaching, much emphasis needs to be laid on the perception of teachers on ICT usage in teaching Mathematics. At the moment, ICT is yet to be fully integrated into teacher education programme. If this is done, teachers' perception of the use of ICT in secondary school Mathematics teaching can be improved. Since some of the Mathematics teachers did not have the opportunity of being exposed to ICT training during their teacher training days, in-services training is advocated for, in order to fill in the gap and change their perception about ICT usage in teaching exercise.

### **MOST COMMON ICT APPLICATIONS PACKAGES USED IN THE CLASSROOM BY MATHEMATICS TEACHERS**

The ICT usage in teaching and learning of Mathematics in school is still sounding strange to many, including some Mathematics teachers. The reason for this ugly situations ranges from not being trained in ICT during their teacher training days; to lack of knowledge of possible ICT application to be used in a classroom situation. Some example of ICT applications used in classroom include, portable, graphic calculators and computerized graphing, specialized software, programmable, Drill/practice tutorials, internal activity and computer in general( Moseley & Higgins 2016).

Students can gather and manipulate data with portables devices with the aid of databases and spreadsheet which are used for numerical work. With the use of portable devices for the study of Mathematics, fieldwork can be possible instead of only classroom activities. In the separate studies conducted by Clements & Hennessy (2010) in Scanlon (2011), it was observed that using calculators (graphic) and computerized graphing in Mathematics can hasten the processes

involved in graphing, thereby making it easier for people to analyse and delineate the relationship between data.

According to Hennessy, Fung, & Scanlon, (2011) further stated that Specialist software such as Computer Algebra System (CAS), Dynamic Geometry System (DGS) and Mathematics Curriculum software improves students' skills and understanding in algebra, allow students to manipulate and measure shapes leading to higher level of learning among them. Programmable toys or floor robots are among the first application of ICT to Mathematics. These programmable toys are controlled by software on programming. It has been reported that wherever this software is used, tremendous changes are also recorded teaching of Mathematics (BECTA, 2018). Logo on its own helps students to acquire problem solving skill, improves their thinking abilities, especially mathematical thinking and finally learn the concept of geometry Clements (2010).

Finally, ICT encourages practical method of teaching which gives the students the opportunity to understand Mathematics concept. According to Ittigson & Zewe (2015) said that this approach promotes higher order thinking and better problem solving strategie. Owing to this, teachers can make maximum use of the relevance of ICT in teaching and learning of Mathematics so as to achieve the set goals and objectives.

### **BARRIERS TO ICT USAGE IN THE CLASSROOM**

Several studies have been conducted on the challenges to the use of ICT and change of orientation and Mathematics teachers' perception on ICT usage in the Mathematics teaching in secondary schools. As already stated earlier Jones, (2014) identified seven factors to be responsible for this. These include:

- 1) The age of the teacher
- 2) Inaccessibility of computer during lesson
- 3) Inadequate on the time timetable for the use of ICT in the classroom
- 4) Lack of technical know-how especially if the software is in use
- 5) Low confidence among teachers during classroom instruction with ICT.
- 6) Lack of effective training



7) Lack of access to resources

Similarly, Snoeyink, & Ertmer, (2017) in their own study discovered the following as the barriers to the use of ICT in Mathematics teaching: lack of computer, lack of quality software, lack of time, technical problems, teachers' attitude (perception) towards computers, poor funding, lack of teacher confidence, resistance to change, poor administrative support, lack of teacher skills, poor fit with curriculum, scheduling difficulties, poor training opportunities, and lack of vision as to how to integrate ICT in instruction.

## METHODS

This study used a survey research design to examine the Nigerian Mathematics teachers' perception in ICT usage in secondary school Mathematics in Kano State. This design was considered appropriate owing to the fact that it was meant to collect opinions of Mathematics teachers using a sample, on their perception about ICT usage in secondary school Mathematics. This is in line with what Ozofo, (2012) described survey design to be. That is a method of gathering information from a sample of individuals. This sample represents the entire population under study. The study was conducted in Enugu state. A sample of 180 secondary schools Mathematics teachers was randomly selected for the study. The researcher employed a structured 26 itemed-questionnaire for data collection from the respondents. The questionnaire used a four Likert scale which has the following responses: Strongly Agreed, Agreed, Disagreed and Strongly Disagreed. Appropriate experts in Mathematics Education and Measurement & Evaluation in Bayero University Kano (BUK) validated the instrument. The reliability of the instrument was 0.87. This was adjudged as highly reliable. The data so collected were analysed with mean score with a bench mark of 2.5. This implies that any mean value below 2.5 is considered negative while any mean value equal or above 2.5 is considered positive.

## RESULT ANALYSIS

**Table 1 – Response on the Mathematics Teachers perception on ICT usage**

S/N	Items	Response				
		SA	A	D	SD	X
1	I fully use ICT in my teaching programmes	28	31	76	45	2.23
2	I use ICT in my specific units of instruction	40	58	51	31	2.99

<b>3</b>	I frequently use ICT with the students	42	39	61	38	2.47
<b>4</b>	I have not used ICT before in my teaching	48	41	56	35	2.57
	<b>Grand mean</b>					<b>2.56</b>

From table 1 above, the mean value of 2.23 of item 1 which is less than the bench mark value of 2.50 indicates that ICT has not been fully integrated into Mathematics instruction in secondary school. The situation is quite different in item 2 with mean value of 2.99, where those who have made attempt of integrating ICT into Mathematics instruction, have gone to the extent of including it into the specific instructional units. Furthermore, item 3 shows that Mathematics teachers do not use ICT frequently with the students. The mean value of 2.47 is an indication of this. On the last item, however, the mean value shows that Mathematics teachers have used ICT but not to a great extent due to certain barriers. On the whole, the grand mean concluded that though ICT has not been fully integrated by Mathematics teachers, efforts are being made by them to embrace the change. This implies that they have open mind towards ICT usage in Mathematics teaching in secondary schools.

**Table 2 – Most common application packages on ICT for Mathematics teachers**

S/N	Items	Respondent					
		SA	A	D	SD	X	
	As a Mathematics teacher, I have used the following in my teaching:						
<b>1</b>	Word processing packages	40	58		51	31	2.99
<b>2</b>	Portable	26	23		54	77	1.99
<b>3</b>	Graphic calculator	56	66		34	24	2.86
<b>4</b>	Spreadsheet	48	41		56	35	2.57
<b>5</b>	Simulation programmes	23	32		58	67	2.06
<b>6</b>	Drill/practice tutorials	58	49		40	33	2.73
<b>7</b>	Internet activity	42	39		61	38	2.47
<b>8</b>	Graphical applications	47	63		39	31	2.70
<b>9</b>	Databases	24	53		64	39	2.34

<b>10</b>	Flash presentations	28	31	76	45	2.23
<b>11</b>	Desktop publishing	37	41	59	43	2.40
	<b>Grand mean</b>					<b>2.48</b>

In table 2 above, teachers expressed their level of usage of most common applications for Mathematics instruction. Such applications like word processing (item 1), graphic calculator (item 3), spreadsheet (item 4), drill/practice tutorials (item 6) and graphical applications (item 8) were the most commonly used by the few Mathematics teachers who attempted integrating ICT into teaching of Mathematics. This is evidenced by the mean value of all these items which are all above 2.50. The table 2 also indicates that every other application was not frequently used by the teachers in their Mathematics instruction. Their mean values are all below 2.50. On the whole, the grand mean indicates that most of the applications for Mathematics instruction are not frequently used by the teachers.

**Table 3 – Response on the challenges to ICT usage in the classroom**

<b>S/N</b>	<b>Items</b>	<b>Resp.</b>				
		SA	A	D	SD	X
	As a Mathematics teacher, I face the following barriers in using ICT in my teaching:					
<b>1</b>	Lack of Available computer software	60	46	47	27	2.77
<b>2</b>	Inadequate time in the school timetable for ICT usage	61	45	31	43	2.69
<b>3</b>	Lack of enough technical know-how for ICT projects	68	66	43	3	3.11
<b>4</b>	Lack of training for teachers on ICT usage	71	41	24	44	2.80
<b>5</b>	Poor knowledge of how to use ICT to improve curriculum	57	62	41	20	2.87
<b>6</b>	Lack of auxiliary teachers or substitutes when teachers go for training	58	49	40	33	2.73
<b>7</b>	Inaccessibility of necessary technology by the students at home	42	39	61	38	2.47

<b>8</b>	Inaccessibility of necessary technology by the teachers at home	47	63	39	31	2.70
<b>9</b>	Lack of electricity power supply in schools	78	67	21	14	3.16
<b>10</b>	Lack of Mathematics laboratories with ICT facilities	78	56	31	15	3.09
<b>11</b>	Lack of maintenance due to bureaucracies	59	43	37	41	2.67
	<b>Grand mean</b>					<b>2.82</b>

In table 3 above, all the 11 items amounted to the noticeable challenges to ICT usage in Mathematics instruction. The mean values indicate that the chief barriers include: Lack of enough technical know-how for ICT projects, lack of electricity power supply in schools and lack of Mathematics laboratories with ICT facilities. The grand mean value of 2.82 is a serious over all indication that ICT integration into Mathematics instruction in secondary school is facing a lot of challenges and setbacks. These barriers account for the Mathematics teachers ill-feeling and rigid to the change brought in by ICT.

## CONCLUSION AND RECOMMENDATIONS

The use of ICT in secondary school Mathematics teaching in Nigeria, especially in Kano state, has been advocated for by all concerned. Many approaches have been followed to see that it becomes a reality. Teachers are the vehicle of curriculum implementation and no amount of effort made that will be effective without the teachers having a positive attitude towards the change. In this study therefore, it has been found out the ICT was yet to be fully integrated into the teaching of Mathematics in secondary schools in Enugu state. It was also discovered that the teachers of Mathematics showed readiness and open mind to accept the use of ICT in their Mathematics instruction. This readiness was shown on the way few teachers who already have access to ICT incorporated it in their specific instructional units.

Furthermore, this study revealed a lot of applications for Mathematics teaching which are unknown by the teachers. Many teachers have not used the known one in their instruction for the first time. This makes ways for apathy and lack

of confidence discovered when ICT integration is mentioned. This situation was evidenced by the surprise shown by many teachers when they asked for the meaning of many of the applications indicated for Mathematics instruction.

Finally, the study found out that there are so many challenges to ICT usage in the teaching of Mathematics. These challenges range from lack of available computer software, inadequate time in the school timetable for ICT usage, lack of training for teachers on ICT usage, poor knowledge of how to use ICT to improve curriculum, lack of auxiliary teachers or substitutes when teachers go for training to inaccessibility of necessary technology by the students at home. The chief of them all were: lack of adequate technical support for ICT projects, lack of electricity power supply in schools and lack of Mathematics laboratories with ICT facilities. These are the challenges Nigerian Mathematics teachers are facing in attempt to employ ICT usage in Mathematics teaching.

Following the above discoveries, the following recommendation were made: that Mathematics teachers should be encouraged to embrace the new method of teaching (use of ICT) and pursue it with all the zeal it deserves; that in-service training, especially on ICT usage in Mathematics teaching be made compulsory for all Mathematics teachers; that seminars and conferences be organized for teachers by experts in the use of ICT in teaching, especially Mathematics teachers; and state government should make frank efforts to provide all the necessary facilities and equipment for the proper ICT usage in teaching Mathematics in secondary schools.

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