



# Effective Preparation of Mathematics Teachers in ICT towards the Implementation of Mathematics Curriculum in the 21<sup>st</sup> Century

Mark Sanderson Otikor<sup>1</sup>

Department of Curriculum and Instructional Technology  
Faculty of Education  
Ignatius Ajuru University of Education, Nigeria.

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## Abstract

The study was undertaken to find out if mathematics teachers are well prepared in the use of ICT in classroom instruction. Four research questions guided the study. Descriptive survey design was used in the study which was conducted in Obio/Akpor Local Government Area of Rivers State. A sample of 70 mathematics teachers drawn through simple random sampling was used for the study. The instrument adopted for the research is a self-designed questionnaire tagged "Availability and Utilization of ICT in Mathematics Lesson" (AUICTML). The reliability of the instrument was determined using Cronbach Alpha correlation statistics and a value of 0.82 was obtained which showed that the instrument is reliable. In its findings, the study revealed that mathematics teachers were not taught how to use ICT in classroom instruction. It also showed most mathematics teachers do not have functional computer or laptop and hence find it difficult to access the internet. It was recommended that potential teachers should be taught how to use ICT in the delivery of classroom instruction while workshops, in-service training and seminars on the use of ICT should be organised for practicing mathematics teachers. Finally, mathematics teachers should be encouraged to own a set of computer or a laptop for easy access of the internet.

**Keywords:** Effective Preparation, Implementation, Mathematics Teachers, Information and Communication Technology (ICT), Curriculum.

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## INTRODUCTION

Teaching is the process of meeting the educational needs of society through the application of skills, knowledge and attributes desirable of the individuals in the society. To realize the goals of education choice of learning activities must be properly done so that the teacher who is at the centre stage would be properly guided in the implementation of the desired learning experiences. A competent teacher is a lover of knowledge and will always desire to have the development of his students as one of his priorities. According to Imonivwerha, Obiunu and Ogheneovo (2014), a quality teacher has to be knowledgeable and possess mastery of the topic of each lesson and have emotional and psychological competencies.

Mathematics teachers who are doing well have definite attributes that distinguish them. Mathematics is a subject that is generally dreaded by many students and for mathematics curriculum to be attained a mathematics teacher has to exhibit the necessary competence to help the learners who have phobia and traditionally struggle with the subject to gain confidence to solve mathematics problems correctly. In realising this, the qualification and exposure of the teacher must be considered. Teachers who are highly qualified develop self confidence in teaching and become a source of inspiration to the students (Osaat, 2009). It is very true that poorly trained mathematics teachers make mathematics to suffer major setbacks that make it difficult for mathematics curriculum to be attained. Another factor that may impede curriculum implementation and attainment is the fact that most Nigerian teachers are overburdened with large classes which affects classroom management and effective face-to-face contact with the learners. The resultant effect could lead to confusion and frustration in the mind of the teacher thereby reducing his level of effectiveness, originality and creativity. In the present day reality, Information and Communication Technology (ICT) has provided an effective platform for achieving the implementation of Mathematics curriculum.

All the know-how used to manipulate telecommunications are referred to as Information and communications technology (ICT), they may include intelligent building management systems, broadcast media, network-based control and monitoring functions and audio-visual processing and transmission systems. The scope of ICT is broad even though it is often regarded as an extended synonym for information technology (IT). ICT has lately been used to explain the union of many technologies and the utilization of general transmission lines conveying various data and communication formats and types. Although there is no consensus or generally accepted definition of ICT, the term is commonly adopted to mean all the devices, systems, applications and networking components that are combined to allow people and firms (i.e., governments, non-profit agencies, businesses, and criminal enterprises) to work together in the digital planet.

Over the last twenty years, the utilization of ICT has become an essential theme in education. Studies have revealed that ICT can improve teaching and learning outcomes. For instance, in mathematics and science education, researchers have discovered that the utilization of ICT can enhance students' conceptual understanding, team working skills and problem solving (Culp, Honey & Mandinach, 2005). To this end, nearly every curriculum document highlights the significance of ICT and encourages teachers to make good use of them. Nonetheless, teachers must be specially trained so that they can integrate ICT effectively in their practice. Consequently, students, student teachers and teachers in practice must acquire training that could enable them to utilize various software packages and applications most efficiently (Ololube, 2013).

The variety of ICT facilities utilised in the teaching and learning process according to Bamidele (2006) and Ofodu (2007) include; radio, television, overhead projectors, computers, optical fibres, CD-Rom, fax machines, internet, digital multimedia, electronic notice board, slides, etc. It appears a number of these facilities are not adequately provided for teaching and learning. The efficient use of the range of gadgets of ICT in teaching and learning rests on the availability of these gadgets and the competences of the teachers using them. It is sad to note that in classrooms in Nigeria, traditional ways of teaching and learning have not been enhanced. Adopting a new modern way of teaching and learning that has been welcomed by developed and developing countries, enhances ones membership of a global village which the world has become. This of course, has given rise to the evolving change of teaching and learning resources.

The need to brace up with the modern ways and systems of education through the acquisition and utilisation of ICT in Nigeria secondary schools cannot be wished away. Nigeria is over twenty years behind in embracing the utility of ICT in primary and secondary schools. Another worrisome issue is the fact that current education programmes in Nigeria colleges of education and universities do not give adequate computer practical training for teachers to be able to use computer assertively in the teaching and learning process in their subjects. Research have revealed that a good number of secondary schools may have inadequate or no ICT equipment for the ever growing number of students in schools and where they may be available, students are not allowed to have access to the facilities. For mathematics curriculum to be successfully implemented ICT facilities must be made available in primary and secondary schools. Teachers should be practically trained in ICT in order to effectively use modern gadgets in teaching.

The most important issue in teacher preparation and a fundamental variable is bringing potential teachers into real-life classroom settings early and placing them under mentor teachers. It is absolutely necessary to ensure that a future teacher truly learns how to teach and develops the capabilities to teach. It is not good enough to teach prospective teachers the content of their teaching subjects and send them to schools for teaching practice without the daily guidance of a committed mentor. Therefore the professional development of mathematics teachers in the effective use of Information and Communication Technology in their own classes under the watch of an ICT specialist cannot be over emphasized.

### **Statement of Problem**

Mathematics is one of the compulsory subjects in Nigerian Primary and Secondary schools; this is because of its important role in the sciences, social sciences, business, technical education, etc and consequently in nation building. Despite this significant role, the implementation of Mathematics curriculum using the traditional methods has been a major task to Mathematics teachers. Fortunately, technology has presented an improved way of teaching Mathematics for better understanding thereby demystifying the seeming difficult nature of Mathematics. Most of the experienced teachers in the Primary and Secondary schools are digital migrants who may find it difficult to operate digital tools; again can the digital natives who may be newly employed find such equipment in the classroom?

### **Purpose of Study**

The purpose of this study is to find out if Mathematics teachers are well prepared in the use of ICT in classroom instruction. Specifically, the objectives were to:

- Determine how many Mathematics teachers were trained in the use of ICT
- Determine how many Mathematics teachers can effectively utilise ICT in the classroom
- Determine how many Mathematics classrooms or laboratories are equipped with ICT gadgets
- Determine the Implementation of Mathematics Curriculum Using ICT

## **Research Questions**

Based on the above objectives, the following questions were put forward:

- To what extent do Mathematics teachers received adequate training in the use of ICT?
- To what extent do Mathematics teachers effectively utilise ICT in the classroom?
- To what extent do Mathematics classrooms or laboratories equipped with ICT gadgets?
- To what extent do the implementation of mathematics curriculum determined by the use of ICT?

## **LITERATURE REVIEW**

### ***Importance of Mathematics***

The basic part of mathematics which are addition, subtraction, measuring, multiplication, weighing, division, estimation, counting, buying and selling, notation, etc are continuously applied in real life every day. According to Gocken (2014) mathematics consists of the most routine activities and comprises some of the most significant functions of a human being's day. He reiterated that a person uses basic mathematics at least once every hour of every day. These fundamentals form the starting point of teaching and learning of mathematics. At this initial stage the learner develop ideas about quantity, size, weights, area, volume, height, etc. The idea of estimation and approximation when properly taught and applied will help the learner on how to make the right choices in order to avoid waste. Economical and moderate life style is a sine qua non to a joyful life, mathematics implant the will power for cost-effective living. Mathematics has to do with critical thinking (Otikor, 2016) hence it sharpens the learner's understanding and broadens his thinking abilities. Furthermore, it develops a flair for unconventional and easier ways of problem solving and also generates persistence and the tenacity to fight on until the problem is solved and the aim achieved.

### **Mathematics Teachers Training in the Use of ICT**

Information and Communication Technologies (ICT) which are becoming more invasive in communities around the world are also gaining entrance into schools (Ikitde and Udoh, 2015). With several worldwide advancements in ICT it is necessary that educators acquire a thorough working understanding of these media and their impact on the performance and retention of attention of their students. The capacity to utilise digital technology, communication tools,

internet and/or networks properly to resolve information problems in the bid to function in an information era is absolutely necessary. Therefore training Mathematics teachers in the use of ICT in this swift technology age should be given adequate attention so that the subject, its teachers and most importantly its students would not be left behind. Agyei and Voogt (2010) reported that pre-service teachers have little or no knowledge on the use of ICT due to lack of training and this could serve as a major barrier to effective implementation of mathematics curriculum.

### ***Preparation of Mathematics Teachers in the use of ICT***

One of the most significant issues confronting today's teacher education programs is the training of tomorrow's teachers to utilise technology (Waits & Demana, 2000). There is an urgent need to consciously integrate and enforce the use of technology in the training of potential teachers. Correct and all inclusive use of technology impact all aspects of mathematics education: what to teach in mathematics, how to teach and learn mathematics, and how to assess mathematics. Powers and Blubaugh (2005) assert that innovations in the mathematics curriculum should include the utilization of technology which has been advocated in the recent past. Therefore future mathematics teachers must to be thoroughly versed in the effects and usage or application of technology.

### ***Availability of ICT for Classroom and laboratories Instruction***

According to Yusuf (2005) the field of education especially, secondary education has been undoubtedly affected by access to internet, which has affected research, teaching and learning. The internet has the ability to enhance, compliment and reinforce academic work. Going by the technological advancement and its adoption in research, teaching and learning in the developed countries it is absolutely necessary to provide and encourage the use of internet in our classrooms. It was estimated in the later part of 2008 that 100% public schools in the United States of America had at least one instructional computer with internet access and students' ratio to instructional computers with internet access was 3:1 (U.S. Department of Education, National Center for Education Statistics, 2010). In Nigeria, not many schools can be proud of the availability and use of internet in the teaching learning process. Ukpebor (2010) in his research discovered that the level of internet access in schools in Nigeria is very poor. This is because the majority of the schools he carried out his study do not have access to the internet and the few who does, do not regularly allow students to have right to use the technology. However, there are schools that have computer laboratories equipped with computers but there is no internet access. According to Ajayi (2008), the efficient use of ICT in teaching and learning lies on the availability of these facilities and teachers proficiency in utilizing them. ICT in senior secondary school is having the challenge of availability and use (Oden, 2018). One of the factors that impede the availability of ICT in the class and laboratories are irregular power supply. ICT cannot thrive in an environment where electric power supply is insufficient.

## ***Implementation of Mathematics Curriculum Using ICT***

Aduwa-Ogiegbaen and Iyamu (2005) stressed that the importance of ICT is quite evidence from the educational point of view. Despite the fact that the chalkboard, textbooks, film and radio/television have been utilised for educational purpose over the years, none has relatively impacted on the educational development like the computer. It is expedient for mathematics educators to realise that the use of ICT in teaching and learning in mathematics is gradually replacing the traditional method and the need to adopt and adjust to the new technological methods is absolutely necessary. To actually implement the mathematics curriculum, changes in its content, instructional practices and assessment must be looked into in order to take advantage of the communication and information storage and retrieval strengths of the internet and to appropriately assess the types of learning these strengths engender (Apagu & Wakili, 2015). Apart from changes that are needed in the curriculum to integrate the use of ICT, a number of barriers which the mathematics teachers and potential teachers of mathematics are facing need to be urgently addressed. Such obstacles like lack of knowledge about procedures to integrate ICT in lesson and lack of training opportunities for ICT integration knowledge attainment (Agyei & Voogt, 2011; Ottevanger, van den Akker & de Feiter, 2007). Summarily, teachers of mathematics must be properly trained in the utilisation of ICT as a first step towards a successful implementation of mathematics curriculum.

## **METHODOLOGY**

This research employed descriptive survey design. According to Ukwuije and Obowu-Adutchay (2012)), a survey research design is one in which crowd of people or items are considered by collecting and analyzing data from only a small group of people or items well thought-out being representative of the whole group. The population of the study consist of 342 teachers in the senior secondary schools in Obio/Akpor local government area in Rivers State. A sample of 70 mathematics teachers was drawn from the 14 public schools, using simple random sampling. The instrument for data collection is a self-designed questionnaire tagged “Availability and Utilization of ICT in Mathematics Lessons” (AUICTML). The instrument was validated by research experts in both Educational Curriculum and Measurement and Evaluation in Ignatius Ajuru University of Education and it has four items rated scale: Strongly Agreed = (SA), Agreed = (A), Disagreed (D), Strongly Disagreed (SD). Cronbach alpha correlation statistics was used to determine the reliability of the instrument and a value of 0.82 was obtained which suggest that the instrument was reliable. The questionnaire was administered to the respondents through personal contact thereby creating room for explanation as the need arises. The completed instrument was retrieved by the researcher. Statistical Package for the Social Sciences (SPSS) version 23 was used for data analysis. Mean and standard deviation were used to answer the research questions. The 4-point Likert scale used had SA = 4, A = 3, D = 2 and SD = 1. The criterion mean which was used for decision making was obtained thus:  $\frac{4+3+2+1}{4} = \frac{10}{4} = 2.5$ . This means that any variable that is greater than 2.5 is accepted otherwise it is rejected.

## RESULTS

Table 1: Descriptive statistics of respondents' information

Demographic Variables		Frequency (N)	Percentage (%)
Gender	Male	39	55.7
	Female	31	44.3
	Total	70	100.0
Age	30-39 years	20	28.6
	40-49 years	16	22.9
	50-60 years	23	32.9
	Above 60 years	11	15.7
	Total	70	100.0
Years of Experience	Less than 15 years	26	37.1
	More than 15 years	44	62.9
	Total	70	100.0

The information in Table 1 shows that 39 male teachers representing 55.7% participated in the study while the female participants were 31 representing 44.3%. Data from the table also indicated that 20(28.6 %) respondents were between the ages of 30-39 years, 16(22.9%) were between 40-49 years, 23(32.9%) were between 50-60 years while those who were above 60 years were 11(15.7%). Furthermore, respondents whose years of experience was less than 15 years were 26 representing 37.1% while 44 representing 62.9% had more than 15 years of experience.

### Research Question 1: To what extent do Mathematics teachers received adequate training in the use of ICT?

Data in table 2 revealed that respondents agreed that they have not been taught how to use ICT when they were in school as students. This is clearly shown in the mean (2.1286) and a standard deviation of (.74057). They also accepted the fact that the use of ICT was not compulsory during their teaching practice days as evidenced in the mean (2.4571) and standard deviation (.79282). The data further revealed that the respondents rejected the fact that their knowledge of ICT came from friends or relatives which the mean (2.4143) and a standard deviation (.60176) clearly indicated. Training on the use of ICT being organized for teachers was rejected as shown by the mean (2.3429) and standard deviation (.91502). Finally, the respondents affirmed through the mean (2.3857) and standard deviation (1.21932) that they have not practice the use of ICT in classroom or laboratory.

Table 2: Mathematics Teachers Training in the Use of ICT

S/N	Item statement	Mean	SD	Remark
1	I have been taught how to use ICT as a student	2.1286	.74057	Reject
2	The use of ICT was compulsory during my teaching practice	2.4571	.79282	Reject
3	My knowledge of ICT came from friends or relatives	2.4143	.60176	Reject
4	Training on the use of ICT are organized for teachers	2.3429	.91502	Reject
5	I have practiced the use of ICT in classroom/laboratory	2.3857	1.21932	Reject

**Research Question 2: To what extent do Mathematics teachers effectively utilise ICT in the classroom?**

The information presented in Table 3 indicated that respondents were exposed to the internet through the cyber cafe and that they were always afraid using the internet. This was shown by the mean (3.5714, 2.9286) and standard deviation (.60365, 1.08108) respectively. Data in Table 3 also revealed that respondents have not used functional ICT facility neither do they interact with ICT facilities at home nor have a functional computer or laptop. The confirmation is seen in their mean (2.0286, 2.2286 and 1.3714) and standard deviation (1.10298, 1.15685 and .81953) respectively.

Table 3: Exposure of Mathematics Teachers to the Use of ICT

S/N	Item statement	Mean	SD	Remark
6	I have used functional ICT facility	2.0286	1.10298	Reject
7	I only interact with ICT facilities at home	2.2286	1.15685	Reject
8	I have a functional computer or laptop	1.3714	.81953	Reject
9	I was exposed to the internet through the cyber cafe	3.5714	.60365	Accept
10	I am always afraid using the internet	2.9286	1.08108	Accept

**Research Question 3: To what extent do Mathematics classrooms or laboratories equipped with ICT gadgets?**

Data in Table 4 indicated that there were not enough computers to teach learners, this was confirmed by mean (2.4857) and standard deviation (1.27112), projectors were not available as shown by mean (3.4714) and standard deviation (.69619), no computer laboratory as revealed by mean (2.0000) and standard deviation (1.14208), schools were not connected to internet this was shown by mean (2.3803) and standard deviation (1.19960), and CCTV or disc were not available for teaching whose mean (1.8857) and standard deviation (1.26883) clearly indicated.

Table 4: Availability of ICT for Classroom and Laboratory Instruction

S/N	Item statement	Mean	SD	Remark
11	There are enough computers to teach learners	2.4857	1.27112	Reject
12	Projectors are not available in my school	3.4714	.69619	Accept
13	We have a computer laboratory	2.0000	1.14208	Reject
14	The school is connected to the internet	2.3803	1.19960	Reject
15	CCTV or disc are available for teaching	1.8857	1.26883	Reject

**Research Question 4: To what extent do the implementation of mathematics curriculum determined by the use of ICT?**

Information in table 5 shows that respondents have not used computer to teach students in the classroom as depicted by mean (2.0714) and standard deviation (1.19566). They rejected the statement that teachers connect to the internet during classroom instruction as confirmed by the mean (1.8571) and standard deviation (1.34365). With a mean (1.9429) and standard deviation (1.17813) the respondents insisted that students have no opportunity to use ICT in the classroom

or laboratory. Table 5 further showed that Using ICT can improve teachers' effectiveness in the classroom or laboratory as evidenced by mean (2.2143) and standard deviation (1.26883). Finally, respondents have not explained 3-dimensional problems easily using ICT because it has a mean (2.2143) and standard deviation (.77334).

Table 5: Implementation of Mathematics Curriculum Using ICT

S/N	Item statement	Mean	SD	Remark
16	I have used a computer set to teach students in the classroom	2.0714	1.19566	Reject
17	Mathematics teachers connect to the internet during classroom instruction	1.8571	1.34365	Reject
18	Students have the opportunity to use ICT in the classroom or laboratory	1.9429	1.17813	Reject
19	Using ICT can improve my effectiveness in the classroom or laboratory	2.8143	1.26883	Accept
20	I have explained 3-dimensional problems easily using ICT	2.2143	.77334	Accept

## DISCUSSION

This study has investigated effective preparation of mathematics teachers in ICT towards the implementation of mathematics curriculum in the 21<sup>st</sup> century and the findings of the study revealed that mathematics teacher were not taught how to use ICT during their undergraduate programme. When they were engaged to teach mathematics in the secondary schools, training on the use of ICT was also not organised and this is in line with Agyei and Voogt (2011) who reported that pre-service teachers have little or no knowledge on the use of ICT due to lack of training and this could serve as a major barrier to effective implementation of mathematics curriculum. The study further revealed from its findings that most teachers do not have functional ICT facilities at home thereby, have limited access to internet. There was also some level of apprehension on the use of internet. Ukpebor (2010) in his research also discovered that the level of internet access in schools in Nigeria is very poor. The apprehension may be due to the fact that they do not have the opportunity to interact with computers and laptops. On the availability of ICT for classroom and laboratory instruction it was gathered that ICT facilities were not available in most government owned secondary schools, no computer laboratory and consequently schools were not connected to the internet. This finding tallied with the work of Oden (2018) who revealed that ICT in senior secondary school is having the challenge of availability and use. Finally, the findings revealed that teachers do not use ICT to teach students in the classroom since there is no internet connectivity. The teachers affirmed that if they were well trained in the use of ICT in classroom instruction and the facilities are available that their effectiveness in classroom instruction delivery would be greatly enhanced and this in turn would guarantee the effectiveness of mathematics curriculum implementation (Ottevanger et al., 2007).

## CONCLUSION

In conclusion, there is urgent need to train mathematics teachers on the use of ICT in classroom instruction. Serving teachers do not have personal functional computers or laptop and their only hope of interacting with these facilities which is its availability in their schools were dashed. If teachers could use ICT in delivering classroom instruction, the curriculum could be better

implemented and its effect would have gone a long way to address the issue of poor performance of students in mathematics examinations.

### **Recommendation**

Based on the conclusion above, it is therefore recommended that:

- Teachers in training should use ICT to teach during their micro teaching examinations.
- More so, the use of ICT should be seriously emphasized during teaching practice.
- Teachers should be encouraged to own a set of computer or a laptop through organized hire purchase and the payment which should be well spread could be deducted at source to ease off the burden of paying lump sum.

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<sup>1</sup> **Mark Sanderson Otikor** is of the Department of Curriculum and Instructional Technology, Faculty of Education, Ignatius Ajuru University of Education, Nigeria.