



# **Evaluation Of Mathematics Teachers' Information And Communication Technology (ICT) Competencies, Usage And Perception Among Senior Secondary Schools In Katsina State, Nigeria**

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## **ABSTRACT**

The study investigated the Mathematics teachers' ICT competencies, usage and perceptions among senior secondary schools in Katsina state. The population of the study consisted of all senior secondary schools Mathematics teachers of the state. The sample consisted of eighteen (18) Mathematics teachers selected from senior secondary schools owned by Katsina science and technical education board. The research design adopted for the study was a descriptive survey. The instrument used for data collection was a Mathematics Teachers' ICT Competencies, Usage and Perceptions Questionnaire (MTICUPQ) developed by the researcher. Three research questions were raised and answered using frequency and mean statistics. The study revealed that most of the Mathematics teachers have sufficient ICT competencies but they are lacking skills to use ICT in their teaching activities. The study recommend among others that there is need for government to provide Mathematics teachers with ICT tools to enable them put more effort and increase their efficacy in teaching Mathematics to students.

**Keywords:** ICT, Competencies, Usage and Perceptions.

## **INTRODUCTION**

After the 1980s, Information and Communication Technologies (ICT) have become essential for teaching and learning environments day by day. Initially, ICT issues quickly moved from instituting special programs for preparing individuals to become ICT specialists in schools and then to infusing ICT into all aspects of an educator's preparation. With the above-mentioned consequences, many action plans were adopted at national and international levels, as well as investments for ICT in teacher education. Most of the teacher education programs have been redesigning their curricula in order for prospective teachers to become competent users of new technologies when they become teachers (Glenn, 2002; Goktas, 2006). Apart from the strategy of introduction of ICT, some confusion is found about ICT competences to be acquired by teachers. A teacher has to be a professional with respect to the content and pedagogy of the teaching of that content. This includes that the teacher knows (reflectively) the process of designing

teaching strategies and teaching materials, including ICT. And also the teacher selects a diversity of learning tasks, adapted to the students, using modern materials and tools, including ICT. If applicable he uses an electronic learning environment which enables time- and place-independent learning and which supports effective communication about the learning from different locations (<http://www.lerarenweb.nl/lerarenweb-english.html>).

Hogenbirk (2006) points out that the ICT competences of teachers should support the following educational goals: making teaching flexible, creating individual learning paths, enhancing the possibilities of part time education, creating rich learning environments, trying out new teaching concepts, intensifying interaction teacher – students, supporting collaborative learning, motivating students, preparing students for lifelong learning, enhancing the effectiveness of teaching, costs reduction, enhancing the attractiveness of the profession of teachers. Simon and Rubens (2003) mention that, stimulating creativity, possibilities for contacts between experts and students, stimulating students, making learning processes transparent, stimulating learning to learn, developing competences of students are all true about the teachers' ICT competency.

Kirschner et al. (2003) made an overview of the professional competences of a teacher with respect to ICT, they formulated:

- personal ICT competences: teachers should have basic skills in Office applications and applying these skills in communication.
  - ICT as mind tool: teachers should be able to use applications to support meaningful thinking and working.
  - ICT as pedagogical tool: teachers should enhance their knowledge, skills and experience in resource based learning and collaboration in digital environments.
  - ICT as teaching tool: teachers should know the educational possibilities and impossibilities of ICT.
  - social aspects of the use of ICT: teachers should not only be aware of ICT but also deliberately use ICT.
- In a review study one year earlier Van Eck et al. (2002) also mentioned the following ICT competences:
- the use of hardware
  - the use of software
  - the use of ICT in the learning process and the coaching of the students
  - the use of ICT in the neighbourhood of the teaching
  - the use of ICT in further professionalization.

### **Statement of the Problem**

Mathematics has become the central intellectual discipline of all technological societies and it is indispensable in helping the individual to think more clearly about the values involved in this fast changing world (Etukudo, 2007). It is the recognition of the relevance of mathematics that the Federal Government of Nigeria made its study compulsory at the primary and secondary school levels (FME, 2013). Despite the high position Mathematics occupies in all human endeavour and field of study, and emergence of technology in education, students' performance in the subject at both internal and external Mathematics examinations have remained consistently low.

There is urgent need for Mathematics teachers to incorporate technology in teaching and learning process in order to go along with the current global development. Literatures reviewed indicated that developed nation have gone far in the area of integrating Information and Communication Technology (ICT) in teaching practices more especially in Mathematics. But the case is reversed in the Nigerian education system. There is little or no report indicated the use of ICT in the teaching process at the secondary school level. Despite that the world now is migrating from analogy system to digital and Nigeria secondary school teachers are left behind (Olajede et al, 2017). Secondary school level of education is the crucial level for indicating literacy level of the nation in which majority of the citizens are expected to attain. That is why Federal Government of Nigeria made it compulsory for every child to attend at least up to upper basic education which is junior secondary school level. Based on that, this study is set to investigate the level of secondary school Mathematics teachers' ICT competency, there perception about ICT and ICT utilization in the teaching of Mathematical concepts.

### **Objectives of the Study**

The objective of this study is to identify the level secondary school Mathematics teachers' ICT competency, their perception about ICT and level of its integration in teaching Mathematics. The following are the specific objectives;

1. To identify the level of Mathematics teachers' ICT Competencies
2. To investigate the extent of ICT usage among Mathematics teachers'
3. To assess the Mathematics teachers' perceptions about ICT

### **Research Questions**

The following questions were raised for the study and answered;

1. What is the level of Mathematics teachers' ICT Competencies?
2. What are the level of ICT usage among Mathematics teachers?
3. What are the perception of Mathematics teachers about use of ICT?

## **LITERATURE REVIEW**

### **The Concept of ICT Competency**

Competency refers to the ability resulting from individual's knowledge, skills, characteristics, and attitude in carrying out work to achieve success. Competency is made up of knowledge, skills, and attitude. Knowledge refers to what individual has learned in class, from experience, and from understanding of a particular subject. Skill refers to the ability to capitalize on knowledge to perform work in an appropriate and accurate way. Attitude refers to stance, feeling, or internal characteristics of individuals that express a sense of realizing the benefit and value of a particular thing.

ICT competency refers to knowledge, skills, and ability to take advantage of ICT for the purpose of gathering, processing and presenting information in support of activities among different groups of people for working (UNESCO, 2008; NICS, 2010; Albirini, 2006), relaxing and communicating purposes (European Commission, 2004). It also serves as a basic skill in the information-based society (Cha et al., 2011). Individuals who are regarded as having ICT competency must be able to produce necessary documents, find out solutions to problems, choose proper ICT tools for problem solving and effective work. They must also be able to collect and share information in an ethical way, and possess fundamental ICT knowledge as well as develop and use novel ICT tools in an effective way.

### **Frameworks of ICT Competency.**

ICT competency is composed of three major dimensions: knowledge, skill, and attitude (Belgium, 2005; UNESCO, 2008). Details of these dimensions are as follows.

- 1) Knowledge refers to the knowledge that users have in terms of ICT and the value that users realize with regard to ICT on a daily basis. It also involves the understanding of technology and benefits of using technology in daily life. The understanding includes the knowledge of ICT and its relevant contents.
- 2) Skill refers to the ability to capitalize on ICT knowledge and skills in performing work through the following skills: 1) information access and processing, 2) information evaluation 3) information production, 4) information Management, 5) information communication and 6) the use of the Internet network.
- 3) Attitude refers to the understanding of the benefits and consequences of the use of ICT and the understanding of the use of ICT in developing societies as well as the realization of the value and responsibility for communication and other purposes. It also involves the critically evaluative skills that lead to social and ethical competencies.

Belgium (2005) stated that social and ethical competencies can enhance attitude to such an extent that encompasses honesty and responsibility for the use of novel technology. Moreover, social and ethical competencies drive users to follow ethical agreements with a view to utilizing ICT properly and ethically as well as helping others when they face some difficulty using ICT.

### **ICT Competent Teacher**

Nowadays not only ICT but more generally the use of all modern media plays a prominent role. So, if we make an overview of the competences of the teacher, we prefer to speak of media competences instead of

ICT competences. Of course we restrict these to the modern digital media, and then not only the use of (educational) software, but also (new) hardware.

Using the term ‘media’ means that it is about means that support the teachers’ main professional task in the classroom: supporting the learning processes of the students by his or her teaching. (Media is the Latin word for means.)

1) The ICT or Media competence is the effective use of software and hardware in teaching.

This is more than simply the use of software tools. So we include the use of tools as smart boards and voting systems, see Bastiaens (2007).

2) The critical ICT or Media competence is to be able to select critically appropriate media to support the teaching learning process. Relevant words are: educational, humane, social.

The teacher should be able to select the right media tools. The right selection includes not only the right selection from an educational perspective (implied by the majority of other competence overviews), but the right selection from a humane and social perspective. The Internet suffers more and more from sites with no values and standards. The teacher is a role model for the students. His behaviour is an important example for the students. Furthermore, he should teach his students to become critical. The Internet is sometimes manipulative and dishonest. Computer games are sometimes aggressive. The medium gives a wrong image of reality, digital harassment is inadmissible. The teacher should educate his students to become adult users of the medium.

3) The lifelong learning competence is also the extension in the teacher’s repertoire of available media for supporting learning processes.

The use of ICT in the teacher’s profession is the outcome of both bottom-up and top-down approach. This implies that that ‘once a media competent teacher always a media competent teacher’ is not valid. The development of IT tools continues. The same applies for the professionalization of the teacher. Every year new possibilities arise, leading to adaptations of teaching content and curriculum. So, ICT competences of teachers are, ‘by definition’, lifelong learning competences. In this aspect, the teacher is fully comparable to the worker in the IT sector see also (Van Veen, 2005).

## RESEARCH METHODOLOGY

**Research Design:** The study adopted descriptive survey design. This method was chosen because it describes and interprets what prevails, or conditions and relationships as they were with the intent of employing data to justify current conditions and practices or to improve them (Koul, 1984). This enabled the researcher to determine the level of mathematics teachers’ ICT competencies among senior secondary school teachers in Katsina state.

**Population of the Study:** the population of this study comprises all Mathematics teachers in senior secondary school in Katsina state. There are four hundred and twenty three (423) mathematics teachers across the state. (Source: Department of Research and Statistics, Ministry of education, Katsina State)

**Sample of the Study:** the study employ multi-sample stages, in the first stage, the study is purposively select senior secondary school Mathematics teachers from Katsina state science and technical education board as the sample of the study. There are eighteen (18) secondary schools owned by the Katsina state science and technical education board with the total number of sixty (60) senior secondary school Mathematics teachers distributed across the three (3) geo-political zones of the state. The zones are; Katsina Central (Katsina), Katsina South (Funtua) and Katsina North (Daura) each has six (6) Secondary schools with twenty (20) Mathematics teachers. In the second stage, three (3) schools from each zone will purposively be selected making total number of nine (9) schools to participate in the study. In the final stage, the total number of eighteen (18) Mathematics teachers will be selected randomly using simple random sampling by balloting, in which two (2) mathematics teachers from each selected school will be choose. The details of the sample is presented in the Table below.

**Table 1: Sample for the Study**

S/No	Geo-Political Zones	Schools	No. of Mathematics Teachers
1	Katsina	i. A	2
		ii. B	2
		iii. C	2
2	Funtua	i. A	2
		ii. B	2
		iii. C	2
3	Daura	i. A	2
		ii. B	2
		iii. C	2
<b>TOTAL</b>		<b>NINE (9)</b>	<b>18</b>

**Research Instrument:** The research instrument of the current study is the ICT competency questionnaire, which consists of two parts. The first part deals with background information of teachers and the second part has to do with ICT competency of teachers. The instrument was developed based primarily upon the ICT competency framework of UNESCO, which is made up of ICT knowledge, ICT skills, and ICT usage. The questionnaire is a 5 -point Likert- scale and consists of 30 questions altogether.

**Instrument Development:** The development of the current research instrument was divided into four stages. The first stage was concerned with the synthesis of relevant documents and literature in relation to ICT competency. The purpose of this stage was to define the components and the scope of the ICT competency for data collection process and for formulating operational definition and the structure of the variables to be measured. The second stage dealt with the construction of the table of specification for creating questionnaire items based on the operational definition. This will help ensure that the questionnaire would fit the target context and participants of interest. Thirty questionnaire items were then examined by my advisor and were once again revised as the first draft. The third phase was to reexamine the first draft of the questionnaire by having five ICT experts check the content validity of the questionnaire in terms of the comprehensiveness of the content, the appropriateness for the target respondents, and the clarity of the language used. Then the questionnaire was revised and improved in accordance with the suggestions and comments from the experts. The final stage dealt with the pilot of the questionnaire and final revision of the questionnaire for actual implementation. The questionnaire will be pilot tested with 10 teachers who are not the target participants in order to ascertain the reliability of the instrument.

**Data Collection:** The data collection is through the use of questionnaire. The questionnaires should be distributed to the participants by the researchers with the help of research assistants in their respective schools. After a week the researchers followed-up and retrieved the filled questionnaires for analysis.

**Data Analysis:** The analysis of data was carried out using descriptive statistics of frequency and mean.

**RESULTS**

**Research question 1; What Is the Level of Mathematics Teachers' ICT Competency?**

**Table 2 : Mean Scores of Mathematics Teachers' Responds on their Level of ICT Competencies.**

s/no	Items	I know how to do this very well	I know how to do this well	I know how to do this partially	I haven't done this but I could find out how	I do not think I could do this	Mean (x)
1	Identify the functions of the main components (i.e. monitor, CPU, keyboard, mouse) of the computer.	12	3	2	1	-	4.44
2	Identify the functions of the computer peripherals (i.e. printer, scanner, modem, digital camera, speaker, etc.)	10	4	2	1	1	4.10
3	Properly connect main components, configure peripherals and install drivers when required	4	3	4	4	3	3.05
4	Configure computer settings of various software and hardware	3	2	3	4	6	2.55
5	Perform some task using operating system	4	3	5	3	3	3.11
6	Organize and manage computer files, folders, and directories	5	3	3	4	3	3.16
7	Use storage devices (i.e. hard disk, diskette, CD, flash memory, etc.) for storing and sharing computer files. Create back-ups for important files.	5	3	3	4	3	3.16
8	Protect the computer from virus, spyware, adware, malware, hackers, etc.	2	2	4	4	6	2.38
9	Use online and offline help facilities for troubleshooting, maintenance and update of applications	2	2	3	5	6	2.38
	Overall Mean	47	25	29	30	31	3.19

From the table 2 above, revealed that statement of items 1, 2, 3, 5, 6 and 7 with the mean of 4.44, 4.10, 3.05, 3.11, 3.16 and 3.16 respectively indicated higher level of mathematics teachers' competencies on the use of ICT gadgets. While statement on item 4 with the mean of 2.55 indicated average level of ICT competency and statement of items 8 and 9 with the mean of 2.38 each indicated low level of competency on the use of ICT. From the overall Mean of 3.19, the result revealed that mathematics teachers has higher level of ICT competencies.

**Research question 2:** *What is the level of ICT usage among Mathematics teachers'?*

**Table 3: Mean Scores of Mathematics Teachers' Response on their Level of ICT Usage in teaching productivity.**

s/no	Items	I can use it very well	I can use it well	I can use it partially	I can attempt	I couldn't use it	Mean (x)
10	Use a word processor to enter and edit text and images	4	3	4	3	4	3.00
11	Format text, control margins, layout, and tables	3	2	4	4	5	2.66
12	Print, store and retrieve text documents from a word processor	5	4	3	3	3	3.27
13	Use a calculation spreadsheet to enter data, sort data and format cells into Tables	3	2	2	4	7	2.44
14	Make computation, use formula and create graphs	2	2	3	5	6	2.38
15	Print and store data tables using a spreadsheet application	2	2	1	7	6	2.27
16	Use a presentation package to add text and sequence a presentation	1	2	2	6	7	2.11
17	Enhance slide presentations by adding sound, customizing animation and inserting images	2	1	2	6	7	2.16
18	Print presentation handouts and store slide presentations	2	2	2	6	6	2,33
19	Make effective class presentations using the slides and LCD projector	1	1	2	7	7	2.00
20	To acquire digital images and other media from web sites, CD, flash drives, etc.	2	2	1	6	7	2.22
21	Crop, scale, color correct and enhance digital images	1	2	2	7	6	2.16
22	Play various media files using appropriate media players	2	2	1	6	7	2.22
23	Stitch together video footages and soundtracks and add simple enhancements – transitions, titles, etc	-	1	2	5	10	1.16
24	Attach and configure scanners, cameras, cell phones to acquire digital images	4	2	5	3	4	2.94
25	Store digital images using optical media (CD, DVD, flash disk) and online repositories	4	3	4	4	3	3.05
	Overall mean	38	33	40	82	95	2.43

Table 3 above, revealed that statement of items 10, 12 and 25 with the mean of 3.00, 3.27 and 3.05 respectively indicated higher level of mathematics teachers' use of ICT in teaching productivity. While statement on items 11 and 24 with the means of 2.66 and 2.94 indicated average level of usage of ICT in teaching productivity and statement of items 13, 14, 15, 16, 17, 18, 19, 20, 21, 22 and 23 with the means of 2.44, 2.38, 2.27, 2.11, 2.16, 2.33, 2.00, 2.22, 2.16, 2.22 and 1.16 respectively indicated low level of mathematics teachers use of ICT in teaching productivity. The overall mean score of 2.43 shows that there is low usage of ICT gadgets in teaching and learning among mathematics teachers in Katsina state. Research question 3: What are the perception of Mathematics teachers about use of ICT?

**Table 4: Mean Scores of Mathematics Teachers' Response on their Perception about use of ICT.**

s/no	Items	Strongly Agree	Agreed	Un decided	Dis-agree	Strongly dis-agree	Mean (x)
26	Integration of ICT can increase the quality and ease the process of teachers' instruction in their classes.	7	4	2	3	2	3.61
27	Mathematics teacher can be better professionals by benefiting from the eases of technology.	8	3	2	1	3	3.50
28	Helps students develop greater interest in learning	5	4	2	4	3	3.22
29	Helps students to work at a level appropriate to their learning needs	7	4	1	3	2	3.44
30	Helps students develop skills in planning and self-regulation of their work.	6	5	2	3	2	3.55
	Overall Mean	33	20	9	14	12	3.46

Table 4 above, shows that statement of items 26, 27, 28, 29 and 30 with the mean of 3.61, 3.50, 3.22, 3.44 and 3.55 respectively indicated strong positive perception of mathematics teachers about the use of ICT in teaching and learning process. Overall mean of 3.46 revealed positive perception of mathematics teachers about the use of ICT.

**Findings of the Study**

1. The study revealed that Mathematics Teachers possessed higher level of ICT competencies.
2. The study found out that most of the Mathematics Teachers are not obtained used of ICT in discharging their professional duties.
3. The study revealed positive perception of mathematics teachers about the use of ICT.

**DISCUSSION OF THE RESULT**

Results in Table 2 above, revealed that mathematics teachers possessed higher level of ICT competencies. It was revealed that most of the teachers have gained their mastery of ICT skills in a variety of ways. This result is in line with the study of Rosenfeld and Martinez-Pons (2005), which revealed that adequate ICT competencies is critical important to successful ICT usage in the classrooms. Yuksel, Sona and Zehide (2009) found out that the majority of the participants perceived themselves as competent in both basic ICT competencies and advanced ICT competencies. Result in table 3 revealed that most of mathematics teachers are not obtained used of ICT in their teaching practices due to their deficiencies in technological pedagogical knowledge. This result is in line with study of Khadija, Kehinde and Abduljabar (2007) who found out that most of mathematics teachers do not utilized ICT tools for teaching mathematics as the frequency for these responses was 14(28%) with the of 1.88. Result of table 4 also shows positive perception of mathematics teachers' about the use of ICT. This result is in line with the study of Yuksel,



Sona and Zehide (2009) which revealed that most of the participant teacher educators expressed positive perceptions about the integration of ICT into teacher education programs.

## CONCLUSION

The study was conducted to identify the level of Mathematics teachers' information and communication technology (ICT) competencies, usage and perception among senior secondary schools in Katsina State. The study found out that Mathematics teachers in the selected secondary schools belong to Science and Technical Board of the state have higher ICT competencies but they are lacking skills of integrating of ICT in teaching Mathematics. Although they expressed positive perception about integration of ICT in Mathematics lessons.

## RECOMMENDATIONS

Based on the findings of this study, the following recommendations were made;

1. The NCC and other non-governmental organizations who are experts on ICT should organize a seminars or workshops to secondary school teachers on how to integrate ICT in teaching and learning activities.
2. The Mathematics Teachers must be able to communicate and utilize some ICT tools effectively with their students to extricate fear that may show up amongst them.
3. The government should properly encourage the teachers by providing them ICT tools to enable them put more effort and increase their efficacy in teaching mathematics to students.

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