

Mathematics teachers' competencies in the use of information and communication technology (ICT) in classroom instructions in Bayelsa state of Nigeria: a case study of yenagoa education zone

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Abstract

Introduction: This study examined mathematics teachers' competencies in the use of Information and Communication Technology (ICT) in classroom instructions in Yenagoa Education Zone of Bayelsa State. The study looked into three levels of competencies (personal, pedagogical and subject-oriented) of mathematics teachers in the use of ICT. Factor like gender was considered in the study. Four research questions and one hypothesis guided the study. A survey research design was used for the study. Thirty seven (37) senior secondary school mathematics teachers participated in the study by providing data which were sought through the use of ICT competence test questions. The test instruments required information on personal, pedagogical and subject-oriented ICT competencies of the teachers. The test instrument was administered to the teachers and their responses cumulated. Data were analyzed using SPSS V16 package. Mean and standard deviation were used to answer the research questions while t-test statistics was used to answer the null hypothesis. Results revealed that most mathematics teachers were fairly competent in the levels of ICT competencies while a small proportion of teachers were not competent in the use of ICT. There was no significant difference in the responses of male and female teachers. This indicated that teachers lacked the necessary ICT competence level needed for classroom usage. Recommendations were made in respect to the teachers level of competencies that once a while, in-service training should be organized for serving teachers till all become ICT competent. ICT should be a compulsory course in all teacher-training Institutions. ICT competency should also be made one of the compulsory requirements for teachers' promotion. The following suggestions were made for further studies: A similar study should be carried out covering other subject areas and other zones of Nigeria and other forms of instruments should be used as instrument for data collection to find out the ICT competencies of teachers.

Keywords: information and communication technology, yenagoa.

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INTRODUCTION

Background to the Study

Mathematics education is one of the most important things in our life. It cuts across all spheres of our lives due to its usage and importance. Its importance goes a long way as it is one of the core compulsory subjects of the junior and senior secondary school curricula (Federal Republic of Nigeria (FRN), 2004). The importance of mathematics in the curricula reflects accurately the recognition of the vital role it plays in contemporary society. It is a National Policy of Nigeria to produce literate and numerate citizens characterized by ability to:

Think logically and scientifically for themselves, express themselves clearly so as to be understood by others, make relevant judgments in the light of available evidence, discriminate among different kinds of values and formulate, analyze, interpret and solve routine and non-routine, familiar and non-familiar mathematics, physical, health, social, economic, political and personal adjustment problems which keep arising as a result of the rapid changes and chances in our world (Federal Republic of Nigeria (FRN), 2004). Some of these characteristics have been achieved prior to the introduction of Information and Communication Technology (ICT) in mathematics education. Information and Communication Technology is usually called ICT and is often used as a synonym for Information technology (IT) but it is a more general term that stresses the role of telecommunication (telephone lines and wireless signals) in modern information technology. Nworgu, (2006) on the other hand sees Information and Communication Technology (ICT) also as a broad based technology (including its methods, management and application) that supports the creation, storage, manipulation and communication of information. In this case, Information and Communication Technology is seen in a wider sense to involve all aspects of technological usage. Ali (2006) however, described ICT as the use of scientific tools and techniques for developing, documenting and communicating information when needed, especially as they concern solving problems or providing needed services in the various areas of human endeavor. Information and Communication Technology (ICT) therefore, are information and communication tools needed in solving problems as well as enhancing effective teaching / learning. Competence according to Harvey (2004) is the quality of being well qualified physically and intellectually. This author also sees competency as the acquisition of knowledge, skills and abilities at a level of expertise sufficient for one to be able to perform in an appropriate work setting (within or outside academia). Competencies are the knowledge and skills required of a teacher in order to teach in the school, which include high levels of knowledge, values, skills and personal dispositions, sensitivities and capabilities and the ability to put those combinations into practice in an appropriate way (Kiymet, 2010). These contributions imply that “competence” does not just involve ability to know but also the ability to be able to put into use what one knows in an appropriate way. For ICT to effectively achieve its prior objective in teaching/learning of mathematics, it largely depends on the competence of the mathematics teacher. UNESCO (2008) identified three aspects of competence standards for teacher professional development which include technological literacy,

knowledge deepening and knowledge creation. These three approaches generate six components of the educational system which include policy and vision, curriculum and assessment, pedagogical, ICT, organization and administration, and teacher professional development. Technological literacy involves the approach to prepare learners and citizens that are capable of taking up new technologies to support social development and improve economic productivity with improved basic literacy skills. Knowledge deepening involves the application of school knowledge to solve complex problems encountered in real world problems. While knowledge creation involves the increase in productivity by creating individual that is continually engaged and benefit from knowledge creation and innovation. These various approaches could be attributed to personal, pedagogical and subject oriented competencies, where personal competence involves a teacher’s ability to use basic ICT tools. Pedagogical competence involves the use of presentation software and other digital media to supplement a lesson, while subject-oriented competence involves the use of ICT as a didactic tool in the classroom. This set of competencies aims to prepare teachers to become users of various ICT to help the student and the teachers benefit from the technology. In Nigeria, secondary schools have been affected by the introduction of ICT which is in line with the MDGs goals and ICT development in secondary schools. This was conceived in respect to the federal government initiative of distributing laptops in selected secondary schools in the country, including some schools in Bayelsa state. A total of 360 laptops were distributed to students from eight secondary schools in the state (Isaac, 2011). The distributions of laptops were meant to meet up with the ICT policy of the federal government to the states. This has posed more challenges to the teachers who are to use them. This is because observations show that teachers are not fully utilizing these facilities in their teaching. In respect to these, prior consideration has not been taken towards the ability of the teachers to ascertain if they know these tools been distributed to the schools. Therefore, the objective of ICT development in our schools can only be achieved if the teachers that are to use the ICT tools are competent enough to use them. Policy makers in education in Nigeria focused their efforts mainly on equipping the schools with technological resources without providing in-service training to teachers. Competence will be needed for successful integration of ICT in the teaching and learning process. One thing is to possess the basic skills another is to successfully achieve predetermined objectives which are the responsibility of competence. Therefore, mathematics teachers require the needed ICT

competences for there to be successful achievement of the objectives of the ICT policy. The required teachers' ICT-competencies to be developed include ICT literacy, content development, and pedagogical teaching approaches using ICT. Therefore, new technologies require new teacher roles, new pedagogies, and new approaches to teacher training. The successful integration of ICT into the classrooms will depend on the ability of teachers to structure the learning environment, embrace new technology with new pedagogy, to develop socially active classrooms, encouraging cooperative interaction, collaborative learning, and group work. This requires a different set of classroom management skills to be developed. The readiness of mathematics teachers to use ICT in the classroom need to be examined properly. That is, their ICT skills and degrees of competencies for the use of ICT tools in the teaching/learning of mathematics need to be examined properly. Therefore, this study cuts across mathematics teachers' competencies in the use of ICT in classroom instructions.

STATEMENT OF THE PROBLEM

The Federal Government of Nigeria has equipped its schools with ICT facilities so as to achieve the aims and objectives of the country's ICT policy but the ICT competencies of teachers in the schools are not yet known. This poses a great danger to the aspiration and expectation of the Federal Government who has invested so much in ICT. Secondly, with the recommendation of the use of a lot of ICT instructional materials for the teaching and learning of various topics in mathematics, which largely depend on the level of ICT competencies possessed by mathematics teachers and its actual usage in classroom instruction, teachers are at the center of these educational innovation implementation and when they are not competent to carry on with the implementation, the innovation becomes a failure. So for there to be an envisaged success of the ICT policy, there is need to ascertain if teachers who are expected to implement the policy are competent in doing so. Therefore, with the need mounted on the teacher to use these ICT tools in teaching and learning of mathematics, the problem of this study posed as a question is: What is the competency level of mathematics teachers in the use of ICT in classroom instruction across local government areas in Bayelsa state, with special reference to its capital city, Yenagoa Education Zone?

PURPOSE OF THE STUDY

The main purpose of this study is to find out the ICT competencies possessed by mathematics teachers in classroom instructions. Specifically, the present study seeks to determine the following:

1. Personal ICT competencies possessed by mathematics teachers for classroom instructions in the education zone.
2. Pedagogical competencies possessed by mathematics teachers for classroom instructions in the education zone.
3. Subject-oriented competencies possessed by mathematics teachers for classroom instructions in the education zone.
4. Influence of gender on mathematics teachers' personal competencies possessed in ICT for classroom instruction.

Scope of the study

The study is focused on finding out mathematics teachers' competence in the use of Information Communication Technology (ICT) in classroom instruction in senior secondary schools in Yenagoa Education Zone of Bayelsa State of Nigeria. Bayelsa state has a riverine and estuarine setting. A lot of her communities are almost (and in some cases) completely surrounded by water, hence making these communities inaccessible by road. The content scope of this work covered the standard ICT competencies as stipulated by UNESCO (2008). The competencies include: Personal competency, Pedagogical competency and Subject-oriented competency.

Research Questions

The following research questions guided the study:

1. What is the personal ICT competency possessed by mathematics teachers in classroom instruction?
2. What is the pedagogical competency possessed by mathematics teachers in classroom instruction?
3. What is the subject-oriented competency possessed by mathematics teachers in classroom instruction?
4. What is the influence of gender on mathematics teachers' personal competencies possessed in ICT for classroom instruction?

Result of Hypothesis

The following null hypotheses guided the study, and each will be tested at 0.05 level of significance. H_{01} : There is no significant difference between the mean scores of personal ICT. competencies possessed by male and female mathematics teachers in the use of ICT in classroom instruction. A lot of literatures reviewed in this study show that there are discrepancies in opinions and the extent to which mathematics teachers in the schools in the state and many other states in Nigeria possess the necessary ICT competencies for teaching and learning in mathematics education.

METHODOLOGY

In this study, a survey research design was adopted. The area of study is Yenagoa Education Zone of Bayelsa state. Bayelsa State is a state in southern Nigeria in the core Niger Delta region, between Delta State and Rivers State. Its capital is Yenagoa which is the most developed city in the state. The language spoken here is Ijaw language and dialects of the Ijaw language such as Nembe, Atissa, Akassa, Ogbia, etc. Yenagoa Education Zone has twenty five (25) secondary schools. The researchers choose Yenagoa Education Zone because ICT tools and facilities can be accessible in the zone and so the issue of non-availability of ICT facilities will not in any way affect the study. The population for the study is made up of all mathematics teachers in Yenagoa Education Zone of Bayelsa state numbering 37 (thirty seven). No sample was drawn because the entire population was used. The instrument for data collection is titled "mathematics teachers' ICT competencies in classroom instruction" (MATICT). The test instrument is

meant to find out ICT competencies possessed by mathematics teachers in classroom instruction. The instrument contains two (2) sections – A and B and it comprises of 30 test items. The instrument was prepared by the researchers with the help of UNESCO ICT teacher's competency standard module and ICT competency test. The competency test was structured to cover personal, pedagogical and subject-oriented competencies. The instrument was validated by specialist who is mathematics teachers in the department of science education University of Nigeria Nsukka, and found to have a reliability coefficient of 0.706 using Kuder-Richardson formular (K-R20). Kuder-Richardson formular (K-R20) was considered necessary since the items were scored as either right or wrong. Data collected were analyzed using mean and standard deviation in answering the research questions. The null hypothesis was answered using t-test statistics at 0.05 level of significance with the use of SPSS V16.

RESULTS

The following results were obtained according to the tables that follow:

Research Question 1

What is the level of personal ICT competencies possessed by mathematics teachers in classroom instruction?

Table 1: Mean and Standard Deviation responses on the personal ICT competencies possessed by mathematics teachers (N = 37)

S/N	Items	Mean	SD	Remark
1	Software programs or hardware devices setup to protect computers while online are called	2.24	1.06	FC
2	Adding comments to a blog or forum is called	2.70	1.13	C
3	Which of the following can be use to print an information from a computer?	2.73	1.07	C
4	Symbols such as smile, frown and surprise used to express feeling in an e-mail message are called	2.46	1.17	FC
5	Which of the following is an unacceptable way of using the computer network?	2.76	1.12	C
6	Which of the following is not an output device?	2.43	1.07	FC
7	Clickable words on a web page that directs you to another web page or file are called	2.49	1.10	FC
8	Which of the following is an example of an image file?	2.35	0.98	FC
9	The arrow, blinking line or box on the computer screen is called	2.24	1.14	FC
10	Which of the following is not ICT hardware?	2.54	1.07	C
	Personal	2.49	0.47	FC

Table 1 shows that teachers are competent in items 2, 3, 5, and 10 which has mean score rating, ranging from 2.50 to 3.49 i.e. 2.70, 2.73, 2.76, and 2.54 respectively. While teachers are fairly competent in items 1, 4, 6, 7, 8, and 9 which has mean score rating from 1.50 to 2.49 i.e. 2.24, 2.46, 2.43, 2.49, 2.35, and 2.24 respectively. The overall

mean score of personal ICT competence of mathematics teachers is 2.49 which indicate that mathematics teachers are fairly competent in personal ICT competence.

Research Question 2

What is the level of pedagogical competencies possessed by mathematics teachers in classroom instruction?

Table 2: Mean and Standard Deviation responses on the pedagogical competencies possessed by mathematics teachers (N = 37)

S/N	Items	Mean	SD	Remark
11	Which of the following ICT programs cannot be used to implement cooperative learning in the classroom?	1.86	0.89	FC
12	Computer-based models of real-life situation are called	2.00	0.94	FC
13	In planning a database, one of the following is the first step to take	1.95	0.94	FC
14	The first thing to consider when developing a multimedia presentation is	2.00	1.03	FC

15	Which of these creates a digital file of an image?	2.22	1.06	FC
16	Word processing features that allows information to be organized in rows and columns are	2.03	1.12	FC
17	To run power hungry programs such as video editing software, the computer needs a lot of	1.92	1.19	FC
18	The connecting of computers so that information can be shared is called	1.46	0.87	NC
19	The instructions which control what a computer does is called a computer programs	2.19	1.08	FC
20	The part of a computer that controls the flow of information and manages tasks is the Pedagogical	1.78	0.82	FC
		1.94	0.39	FC

Table 2 shows that teachers are fairly competent in items 11, 12, 13, 14, 15, 16, 17, 18, 19, and 20 which has mean score rating, ranging from 1.50 to 2.49 i.e. 1.86, 2.00, 1.95, 2.00, 2.22, 2.03, 1.92, 2.19 and 1.78 respectively. While teachers are not competent in item 18 which has mean score rating below 1.50 i.e. 1.46. The overall mean score of pedagogical ICT competence of mathematics

teachers is 1.94 which indicates that mathematics teachers are fairly competent in pedagogical ICT competence.

Research Question 3

What is the level of subject-oriented competencies possessed by mathematics teachers in classroom instruction?

Table 3: Mean and Standard Deviation responses on the subject-oriented competencies possessed by mathematics teachers (N = 37)

S/N	Items	Mean	SD	Remark
21	What software would you most likely use to solve algebraic problems?	1.49	0.73	NC
22	Which of the following would you use to compute the average score of four tests using a spreadsheet?	1.46	0.80	NC
23	The stimulation of a real or imagined environment that appears as a three-dimensional (3-D) space is called	1.59	0.76	FC
24	Which of the following programs can one use to draw on the computer?	1.62	0.92	FC
25	Which of the following would be the most reliable source of information for mathematical problems?	1.54	0.80	FC
26	Which of the following is not an ICT statistical package?	1.65	0.82	FC
27	Which of these is the best way to find websites containing information about quadratic equation?	1.41	0.69	NC
28	In the internet addresses " www.unn.portal.edu.ng ", the "edu" represents	1.95	0.97	FC
29	When you save a document from a webpage to your computer it is called	2.22	0.89	FC
30	Which of the following activities would be best accomplished using a database? subject oriented	1.57	0.83	FC
		1.65	0.41	FC

Table 3 shows that teachers are fairly competent in items 23, 24, 25, 26, 28, 29, and 30 which has mean score rating, ranging from 1.50 to 2.49 i.e. 1.59, 1.62, 1.54, 1.65, 1.95, 2.22 and 1.57 respectively. While teachers are not competent in items 21, 22, and 27 which has mean score rating below 1.50 i.e. 1.49, 1.46, and 1.41 respectively. The overall mean score of subject-oriented

ICT competence of mathematics teachers is 1.65 which indicates that mathematics teachers are fairly competent in subject-oriented ICT competence.

Research Question 4

What is the influence of gender on personal ICT competencies possessed by mathematics teachers in classroom instruction?

Table 4: Mean and Standard Deviation responses on personal ICT competencies of mathematics teachers with respect to gender

S/N	Items	Sex	N	Mean	SD	Remark
1	Software programs or hardware devices setup to protect computers while online are called	Male	25	2.48	1.12	FC
		female	12	1.75	0.75	FC
2	Adding comments to a blog or forum is called	Male	25	2.56	1.16	C
		female	12	3.00	1.04	C
3	Which of the following can be use to print an information from a computer?	Male	25	2.56	1.08	C
		female	12	3.08	1.00	C
4	Symbols such as smile, frown and surprise used to express feeling in an e-mail message are called	Male	25	2.40	1.19	FC
		female	12	2.58	1.16	C
5	Which of the following is an unacceptable way of using the computer network?	Male	25	2.68	1.11	C
		female	12	2.92	1.16	C
6	Which of the following is not an output device?	Male	25	2.56	1.00	C
		female	12	2.17	1.19	FC
7	Clickable words on a web page that directs you to another web page or file are called	Male	25	2.48	1.12	FC
		female	12	2.50	1.09	C

8	Which of the following is an example of an image file?	Male	25	2.28	0.98	FC
		female	12	2.50	1.00	C
9	The arrow, blinking line or box on the computer screen is called	Male	25	2.16	1.11	FC
		female	12	2.42	1.24	FC
10	Which of the following is not ICT hardware?	Male	25	2.56	1.00	C
		female	12	2.50	1.24	C
11	Personal	Male	25	2.47	0.47	FC
		Female	12	2.54	0.49	C

The result from table 4 indicates that male teachers are competent in item 6 while female teachers are also competent in items 4, 7, and 8. Male and female teachers are both competent in items 2, 3, 5, and 10. Also, male teachers are fairly competent in items 4, 7 and 8 while female teachers are fairly competent in item 6. Male and female teachers are both fairly competent in items 1 and 9. The overall mean score of personal ICT competence of male teachers is 2.47 which indicate that male teachers are fairly competent, while female teachers has a mean

score of 2.54 which indicate that female teachers are competent. Despite the diversity in the level of ICT competencies of both genders, the data above indicates that female teachers seem to perform better than their male counterpart.

Research Hypothesis no.1

There is no significant difference between the mean score of personal ICT competencies possessed by male and female mathematics teachers in the use of ICT in classroom instruction.

Table 5: Independent sample test on personal ICT competencies of mathematics teachers with respect to gender

Gender	N	X	SD	df	t	Sig(2tailed)	Decision
Male	25	2.47	0.47	35	-0.42	0.68	NS
Female	12	2.54	0.49				

*significant at p<0.05

Table 5 above revealed that $t(35) = -0.42$ is not significant at 0.68 and also no significant at 0.05 level of significance. Therefore the null hypothesis is not rejected which indicates that there is no significant difference between the mean score of personal competence possess by male or female teachers.

SUMMARY OF FINDINGS

- From the findings, it was discovered that mathematics teachers are fairly competent in their personal ICT competencies.
- It was discovered that mathematics teachers are fairly competent in their pedagogical ICT competencies.
- It was also discovered that mathematics teachers are fairly competent in their subject-oriented ICT competencies.
- The finding in the hypotheses testing show that despite the diversity in the level personal competencies of both genders, female teachers performed better than their male counterparts and there was no significant difference between the mean score of personal competence possess by male or female teachers.

CONCLUSIONS

The findings of this study served as the basis for making the following conclusions:

- The mathematics teachers in the Yenagoa education zone are fairly competent in all aspects of competency levels i.e. (personal, pedagogical and subject-oriented) in the use of ICT in classroom instruction
- The mean score ratings by gender (male and female) shows that female teachers have approximately equal mean scores with their male counterpart in the personal competency levels investigated. This implies that there was no significant difference between male and female teachers in their personal competency levels.

RECOMMENDATIONS

To ensure the success of the ICT policy and proper utilization of the facilities that have been provided, the following recommendations were made:

- Periodically, in-service training should be organized for serving teachers for all to becomes ICT compliant.
- ICT should be a compulsory course in all teacher-training Institutions.
- ICT qualification should be introduced in line with other educational qualification as criteria for teachers’ recruitment.
- ICT competency should also be made one of the compulsory requirements for teachers’ promotion.

- To ensure the integration of ICT in mathematics classroom or in the educational curriculum, every teacher training-institution should include, as a most, elements for developing ICT competencies of teachers and learners.

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