Global Journal of Pure and Applied Mathematics.
ISSN 0973-1768 Volume 12, Number 4 (2016), pp. 3701–3726

http://www.ripublication.com/gjpam.htm

Assessment of Mathematics Lecturers' Competencies in The Application of Information and Communication Technology (ICT) in Mathematics Instruction in Tertiary Institutions

Dr. Justin J. O. Ezeugwu
Department of Science Education, University of Nigeria Nsukka.

Rev. Fr. Dr. G.C. Abiogu
Department of Science Education, University of Nigeria Nsukka.

Dr. Ebere Ibeh
Department of Science Education, University of Nigeria Nsukka.

Dr. Uchenna D. Asogwa
Department of Arts Education, University of Nigeria Nsukka.

Emmanuel Nwangwu
Department of Vocational Teacher Education, University of Nigeria Nsukka.

John Egrinya Afufu
Department of Science Education, University of Nigeria Nsukka.

Abstract

This study assessed mathematics lectures' competencies in the application of Information and Communication Technology (ICT) in mathematics instruction in tertiary institutions in Cross River State. Three levels of competencies (personal,

pedagogical and subject oriented) of mathematics lecturers in the application of ICT in mathematics instruction in tertiary institutions was considered. Institutional type (Universities and Colleges of education) was also looked at in this study. Six research questions and three null hypotheses guided the study. A descriptive survey research design was used for the study. Twenty six mathematics education lecturers participated in the study. The questionnaire required information on personal, pedagogical and subject oriented ICT competencies of mathematics lecturers. The questionnaire was administered to mathematics lecturers and their responses analysed. Mean and standard deviation was used to answer research questions while the null hypotheses were tested using t–test statistics. The results indicated that mathematics lectures apply personal ICT competency in mathematics instructions to a high extent while pedagogical and subject oriented competencies are applied in low extent in mathematics instruction. Institutional types do not have any significant influence on the extent mathematics lecturers apply personal, pedagogical and subject-oriented ICT competencies in mathematics instruction. This revealed that mathematics lecturers required the needed ICT competencies for instructions. Recommendations were made to help facilitate the application of ICT in mathematics instruction at all levels especially in tertiary institutions. The following suggestions were made for further studies; that a similar study should be conducted in other areas in the country and other forms of instruments should also be used as instrument for data collection to assess the ICT competencies of lecturers.

AMS subject classification:
Keywords: Application, ICT competencies, Mathematics lecturers, Mathematics instruction, Tertiary institution.

1. Introduction

The need for qualified teachers has gain dominance in Nigeria because it is considered that teacher education is a means of not only providing teachers with the necessary skills and knowledge needed to adequately carry out their teaching jobs but as well as professional growth (Osunde and Omoruyi, 2004). Agogo (2004) views teacher education as a process of instilling professional competences relevant to the national development in our would be teachers, our economic growth and nation building. Teacher education refers to the policies and procedures designed to equip teachers with knowledge, attitude, behaviour and skills that are required to perform their task effectively in the school and classroom (Kamath, 2009). Teacher education is targeted at the enhancement of teacher proficiency and competence that would empower the teacher to meet the requirements of their profession and face the challenges in the teaching and learning process. The process availed teachers the opportunity to acquire the knowledge, skills and attitude that are required to perform the task of teaching.

Teaching acts is a national deed, performed in accordance with professional principles. It is an essential means of guiding students in securing the amount and quality

experience which will promote the optimum development of their potentials as human beings (Ugwuanya, 2012). Teaching involves providing the learner with experiences such as knowledge, understanding, skills, capacity ability, talents, information, and details required for use in future through guidance and direction. Teaching is what teachers do while students do what is described as learning. Learning according to Olaniyan (2015) is the process by which we acquire and retain attitude, knowledge, understanding, skills and capacity that cannot be attributed to inherited behavioural patterns or physical growth. Peters (2003) views learning as an activity which is deliberately pursued for the purpose of obtaining information, acquiring greater understanding or improving a skill. The essence of teaching and learning is to design teaching events (contents, strategies, among others) and to determine to what extent learners have acquired the intended competences.

Teaching and learning as well as teacher education at all levels have experienced a paradigm shift from the traditional approach that is centred on teacher, text, pupils and the environment towards new approach of teaching and learning through the explosion of Information and Communication Technology (ICT). This new approach that is technologically inclined has been ushered into educational system as a result of science, technological development and globalization in modern world (Afolabi, 2014). Information and Communication Technology (ICT) is the fastest growing sector in recent time. It is the bedrock of national survival in a rapidly changing global setting.

Oluwaronbi (2012) defined Information and Communication Technology (ICT) as electronic based technology that is generally used to retrieve store, process, and package information as well as provide access to knowledge. The development of micro computers, optical disc, the establishment of telecommunication network, television, internet etc. has assisted in broadcasting people's knowledge and facilitating effective communication. ICT is also viewed as a broad based technology (including its method, management and application) that supports the creation, storage, manipulation and communication of information (2006a). Information and Communication Technology in a wider sense is seen to involve all aspects of technological usage and is a needed tool in solving problems as well as enhancing effective teaching and learning.

Undoubtedly, ICT has impacted on the quality and quantity of teaching and learning through its dynamic, interactive and engaging content, and it can provide real opportunities for individualized instruction (Egomo, Enyi & Tah, 2012). Information and Communication Technologies are possibly great supporting tools for educational advancement and reform. When used appropriately, different ICTs help expand access to education, strengthen the relevance of education to the increasingly digital workplace and raise educational quality by helping to make teaching and learning into an attractive active process to real life (Ezenwafor, 2011). At the tertiary levels, Abimbade (1998) reported the benefit of ICT to lecturers in the areas of teaching as: increase the time learners devote to learning; enhance the speed of availability of data and information; provide immediate feedback; assist less qualified lecturers and; increase lecturers efficiency and effectiveness.

In Nigeria, the need to integrate ICT into education and other aspect of life has

become a popular concern for government, institutions, organizations and individuals. The National Universities Commission (NUC) made a laudable achievement in this direction by putting in place physical ICT infrastructures in some selected universities in Nigeria. Even the National Commission for Colleges of Education (NCCE) has mandated all college teachers to be computer literate. This is to ensure a proper integration of ICT in education at the tertiary levels of education to enable the actualization of the higher institution main roles. However, despite this laudable support made by the Federal government and various agencies in investing on ICT usage in education, the education sector in Nigeria still lags behind in this aspect of technology (Owolabi, Oyewole & Oke, 2013). This may have been caused by factors such as poor management of ICT facilities, lack of appropriate competencies and skills in ICT among others.

Regardless of the quantity and quality of technological tools placed in the classrooms, lecturers are the key to how the tools are used. Therefore lecturers are expected to have the competences in using such facilities (Diri, 2013). Teachers should be prepared to provide technology-supported learning opportunities for their students. This can be achieved by the teachers seeing the use of technology and knowing how technology can support students learning as integral skills every teacher should professionally possess. In other words, teachers should be prepared to empower students with the advantages that technology can bring. Schools and classroom should have teachers who are equipped with technology resources and competencies and who can effectively teach the necessary subject content while incorporating technological concepts and skills (United Nations Educational, Scientific and Cultural Organization (UNESCO), 2008). But when teaching and learning process is assessed critically in tertiary institutions in Nigeria, it could be observed that the challenges is no longer in covering contents or adopting appropriate teaching pedagogy, but it is in having access to ICT and using it to embrace teaching and learning (Olaofe, 2005). Jones (2004) opined that no matter what educational systems order and anticipates about teaching and learning, in the end effective teaching and learning is very dependent on the will and competence of teachers. Hence the effective use of ICT in teaching and learning is dependent on the teachers. Teachers play the central role in the learning process, even in an ICT – rich content and environment because ICT tools cannot work efficiently on their own unless proficient and capable hands are available to make use of the tools. Therefore, it is important for all teachers/lecturers to have the necessary knowledge and skills to integrate ICT in their daily teaching practices in order to maximize their ability to help to improve students' digital competence.

UNESCO (2008) defines competency as a set of attributes covering knowledge, skills and attitudes for enabling one to effectively perform the activities of a given occupation or function to the standards expected in employment. UNESCO (2004) is of the view that ICT competence is concerned with the ability to: know when to apply or develop a particular skill in using an ICT resource; be aware of the reasons for using ICT and its effect on both users and content; and have a critical and confident attitude to living with the technology. Therefore, ICT competences in education involve different type of knowledge, skills and attitude needed by teachers to work with ICT in educational settings in order to enhance efficiency in the teaching and learning process.

However, three approaches of ICT competence standards for teachers have been identified by UNESCO (2008) which includes; technological literacy, knowledge deepening, and knowledge creation. These approaches generate six components of educational system which are; policy and vision, curriculum and assessment, pedagogy, ICT, organization and administration, and teachers' professional development. Teachers' technology literacy in ICT competences have to do with increasing the extent to which new technology is used by teachers, by incorporating technology skills into the school curriculum. Teachers' knowledge deepening ICT competencies is concerned with increasing the ability of teachers to use knowledge to add value to the society and the economy. Teachers' knowledge deepening ICT competencies deal with the ability of teachers applying ICT knowledge to solve complex, real-life problems. While teachers' knowledge creation ICT competences has to do with the ability of teachers to innovate, produce new knowledge aimed at making the competences teachers and other ICT users to mount ICT tools at various level. This is by teachers being able to produce applications in various disciplines that make use of ICT to support teaching and learning

In Nigeria, ICT competencies are classified into personal, subject-oriented and pedagogical (Abolade & Yusuf 2005, Akudolu 2008, Diri, 2013). These authors further said that; Personal competence deals with skills, knowledge and understanding of when, when not, and how to use ICTs effectively in teaching a particular subject. It encompasses skills in the function, use and capability of ICTs in supporting the teaching process. Teachers should have basic skills. Knowledge and understanding in office applications and how to apply these skills in communication, how to add comment on a bog, print information from a computer among others.

Subject-oriented competency deals with the knowledge of the functions of ICT, operations, use, and features of ICTs, including speed and automation function, and how ICTs can support teaching and learning. It also encompasses the ability to adapt ICT in educational practice. Competence in using subject specific ICTs courseware such as ICT mathematical and statistical packages, coral draw, sourcing for solutions to mathematical problems, among others in mathematics class during instruction, and the ways of handling information through ICTs. Teachers need to develop competencies in using ICT as a educational tool in the class as well as in developing learner's ICT capability and; Pedagogical competency deals with the ability to plan, prepare, teach, assess, and evaluate lessons in which ICTs could be seen to be supporting a range of suitable learning outcomes. It refer to those skills, abilities and attitudes that teachers hold pertaining to the nature of teaching and how teaching should be carried out using ICTs. Competent in the usage of ICT programs, computer model of real life situation, planning of database among others in the classroom during the instructional process. There is need for teachers to develop pedagogical ICT competencies in the instructional integration of ICT in subjects across the curriculum to ensure that ICT based education is promoted. As Williams, Foulger and Wetzel's (2009) ascertained that preservice teachers who have explored the pedagogical use of selected technologies expressed higher willingness to use ICT in their future classrooms. It is the extent of the application of these personal, subject-oriented and pedagogical ICT competencies in mathematics education among

lecturers of tertiary institutions (that is Universities and Colleges of Education) that this study intent to assess.

The term assessment in the field of education could be referred to as a process of evaluating performance to ensure the attainment of stated educational objectives as well change in perception, values and behaviour. According to Scriven (2011), assessment is a judgment which can be justified according to specific weighted set goals, yielding either comparative or numerical ratings. Assessment is the process of analyzing information from different sources in order to develop a deep understanding of what one achieve as a result of ones' educational experiences as well as assessing the competencies of mathematics lecturers in the application of ICT in mathematics education.

This is because in mathematics instruction, ICT tools make it possible to investigate and experiment with mathematical ideas, discover patterns and relations and be stimulated in mathematical thinking (Fuglested, 2011). This implies mathematics complexities and ICT tools work hand in hand; hence ICT helps in stimulating thinking in mathematics which reduces the complexities. Diri (2013) ascertained that the nature of mathematics teaching and learning has changed considerably because of the availability of Information and Communication Technology. This is noticeable due to the many processes such as modeling, estimation, search for mathematical information among others which the use of ICT has ease when compared to what was obtainable in the past. The involvement of ICT tools like calculators, use of ICT programs such as games, spreadsheet, graph plotting, and geometry sketch pad among others have also facilitated and stimulated class activities and performance in mathematics. ICT can assist in the organization and structure of the course and course materials thereby promoting rethinking and revision of mathematics curriculum and instructional strategies even at the tertiary levels. ICTs increase teachers' emphasis on individualized instruction and as such enable the teachers spend more time with individual students (Egomo, Enyi & Tah, 2012).

Research Findings have also indicated that the extent to which teachers integrate ICT in their teaching and students' learning is affected by several factors, among which is teachers' competence in ICT applications (Tayo & Adedayo, 2013). In the same vein, Yusuf (2005) affirms that teachers' competence is a particular concern when new subjects or media are introduced into the school system. It is believed that the level of ICT competencies among lecturers in tertiary institutions in Nigerian is determined by a number of other factors including institutional type (that is Universities and Colleges of Education). This is why Onasanya, Shehu, Oduwaiye and Shehu, (2010) ascertained that the level of competencies and skills acquisition of colleges of education lecturers in the use of ICT facilities and equipment is worrisome; the authors further said that Universities lecturers' possessed more ICT competencies and skills than lecturers in Colleges of Education. Similarly, educational qualification seems to influence the level of ICT competencies possessed by lecturers because Ololube, (2006) has reported that ICT utilization competencies vary with teachers. Professionally qualified teachers seem to be more dominant with high ICT competency rate than their non-professional counterparts. This is perhaps attributable to their exposure to basic theories and practice of educational technology (Ololube, 2006).

Lecturer's ICT competence enables appropriate decisions on ICT application; new technologies requiring new lecturers' roles, new pedagogies, and new approaches to lecturers' training to be acquired. The successful integration of ICT in the classrooms at the tertiary levels of education depends on the ability of the lecturers to structure new pedagogy, to develop socially active classrooms encouraging cooperative interaction, collaborative learning, and group work. It is essential that the pedagogy of ICT becomes the main focus of academic staff development and this will build upon in a constructive manner in order to allow instructors to achieve full benefits of using ICT in their daily tasks (McCarney, 2004). This will enhance the successful achievement of the objectives of the Nigerian national policy for ICT which include; to facilitate the teaching and learning processes and to promote problem-solving, critical thinking and innovative skills among others (Federal Ministry of Education, 2010).

The actualization of the above objectives in Cross River State can only be possible in mathematics education at the tertiary institutions if Universities and Colleges of Education lecturers possess the ICT competencies for the application of ICT in mathematics instruction. But the extent mathematics lecturers apply personal, pedagogical and subject oriented ICT competencies in mathematics instruction in tertiary institutions in Cross River State is not yet known. Hence, the purpose of this study is to assess mathematics lecturers' competencies in the application of Information and Communication Technology (ICT) in mathematics instruction in tertiary institutions in Cross River State.

2. Statement of the Problem

The federal government of Nigeria and various agencies such as National Universities Commission (NUC), National Commission for Colleges of Education (NCCE) among others agencies of the tertiary institutions, has invested on ICT usage in education to achieve the objectives of the country's ICT policy and for Nigerian lecturers to be part of the community of experts of ICT supported teaching. This is based on the fact that Information and Communication Technology (ICT) is now used as tools, tutor and tutee in mathematics education and other programs of education.

Despite these laudable efforts, in Cross River State the ICT competencies of lecturers in tertiary institutions in the application of ICT in the teaching and learning situation are still not known. Evidence abound that the level of ICT application during instruction varies among lecturers in the tertiary institutions due to some factors such as lecturers ICT competencies and institutional type among others. This makes it paramount to continually seek for strategies that could enhance the application of ICT in instructions since ICT competencies among lecturers have been viewed in literatures as a prerequisite in the application of ICT in instructions. Therefore, the problem of this study is: what is the competency level of mathematics lecturers in the application of ICT in mathematics instructions in tertiary institutions in Cross River State?

3. Research Questions

The following research questions were posed to guide the study.

1. To what extent does mathematics lecturers apply personal ICT competency in mathematics instruction in tertiary institutions in Cross River State?
2. To what extent does mathematics lecturers apply pedagogical ICT competency in mathematics instructions in tertiary institutions in Cross River State?
3. To what extent does mathematics lecturers apply subject oriented ICT competency in mathematics instruction in the tertiary institutions in Cross River State?
4. What is the influence of institutional type on the extent mathematics lecturers apply personal ICT competencies in mathematics instruction in Cross River State?
5. What is the influence of institutional type on the extent mathematics lecturers apply pedagogical ICT competencies in mathematics instruction in Cross River State?
6. What is the influence of institutional type on the extent mathematics lecturers apply subject oriented ICT competencies in mathematics instruction in Cross River State?

4. Hypotheses

The following null hypotheses were formulated to guide the study and will be tested at 0.05 level of significance.

1. Institutional type (Universities and Colleges of Education) do not have any significant influence on the extent mathematics lecturers apply personal ICT competencies in mathematics instruction.
2. Institutional type (Universities and Colleges of Education) do not have any significant influence on the extent mathematics lecturers apply pedagogical ICT competencies in mathematics instruction.
3. Institutional type (Universities and Colleges of Education) do not have any significant influence on the extent mathematics lecturers apply Subject oriented ICT competencies in mathematics instruction.

5. Research Method

5.1. Design of the Study

This study adopted descriptive survey research design. The design according to Nworgu (2006b) is one in which a group of people or items is studied by collecting and analyzing data from only a few people or items considered to be representative of the entire group.

Nworgu noted that descriptive survey studies is aimed at collecting data on, and describing in a systematic manner the characteristics, features or facts about a given population. This design is considered appropriate because the researcher intent to collect and analyzed data on the group of mathematics education lecturers in tertiary institutions in Cross River State in order to ascertain the extent of their competencies in the application of ICT in mathematics instruction, after which the result could be generalized to all the mathematics education lecturers in other tertiary institutions.

5.2. Area of the Study

The study was conducted in Cross River State. Cross River State is one of the 36 states in Nigeria and also one of the six states in the South–South Geopolitical zone of the country. The state has Calabar as its capital. The state is bounded in the north by Benue and Ebonyi states, in the south by Akwa Ibom state and Atlantic Ocean, in the east by Cameroun, and in the west by Ebonyi state. For educational and administrative purposes the state is divided into three educational zones, they are; Ogoja, Ikom and Calabar education zones. Ogoja zone comprise of Ogoja, Bekwarra, Obudu, Obanliku and Yala local government areas; Ikom zone comprise of Obubra, Ikom, Boki, Etung, Yakurr, and Biase local government areas; and Calabar zone comprise of Calabar municipality, Calabar south, Odukpani, Akamkpa, Abi, Akpabuyo and Bakassi local government areas The state is made up of eighteen (**??**) local government areas namely Ogoja, Bekwarra, Obudu, obanliku, Yala, Obubra, Ikom, Boki, Etung, Yakurr, and Biase local government areas. Others include: Calabar municipality, Calabar south, Odukpani, Akamkpa, Abi, Akpabuyo and Bakassi.

The State has four major tertiary institution of learning namely, University of Calabar (UNICAL), Cross River University of Technology (CRUTECH) with three Campuses in Calabar, Obubra and Ogoja, Cross River State College of Education Akamkpa and Federal College of Education, Obudu. There are other new private tertiary institutions like Elder Oyama Memorial College of Education Oval-Obubra. There are many secondary and primary schools both publicly and privately owned in the state. Cross River State is chosen for this study because more frequently mathematics lecturers in tertiary institutions in the state make use of technologies but the extent mathematics lecturers apply personal, pedagogical and subject oriented ICT competencies in mathematics instruction in tertiary institutions is not yet known.

5.3. Population of the Study

The population of the study is made up of all the (26) mathematics education lecturers in the six (5) tertiary institutions in Cross River state. (Personnel Department of the various Tertiary Institutions in Cross River State).

5.4. Sample and Sampling Technique

All the twenty six (26) mathematics education lecturers of the five (5) tertiary institutions in Cross River state was used in this study. Therefore, no sampling process was carried

out as the entire population constitutes the sample for the study. This is because the population is manageable.

5.5. Instruments for Data Collection

The Instrument that was used for data collection for this study is a questionnaire titled "Questionnaire for Mathematics Lecturers' ICT Competencies in Mathematics Education" (QMATICT). The instrument was adapted from Akudolu (2008). The researcher rephrases the items to include the subject mathematics; "Use of the keyboard" was rephrased to "Using the keyboard during mathematics instruction" among others. The instrument is divided into two sections; section A and B. Section A contains demographic information of the respondents (lecturers) such institutional type. Section B comprises of a 30 item instrument structured to cover personal, pedagogical and subject-oriented competencies. Each of the three clusters contains ten (10) items. It was designed on a four point liker scale of very high extent (VHE), high extent (HE), low extent (LE) and very low extent (VLE) to determine the extent mathematics lecturers apply personal, pedagogical and subject oriented ICT competencies in mathematics instruction in the tertiary institutions.

5.6. Validation of the Instrument

The initial draft of the instrument, the purpose of the study, as well as the research questions and hypotheses were given to experts for face validation. The experts comprises of three lecturers; two from Measurement and Evaluation and one from Mathematic Education in the department of Science Education, Faculty of Education, University of Nigeria, Nsukka. These experts were asked to scrutinize the instrument with respect to; clarity of terms, simplicity of vocabulary, relevance of terms to the study and make necessary suggestions for the improvement of the quality of the instruments. Their comments and suggestions helped in modifying the items to suit the problem under investigation.

5.7. Reliability of the Instrument

The reliability of the instruments was ascertained by administering the questionnaire (QMATICT) to ten (10) mathematics education lecturers in University of Port-Harcourt, River State and Federal College of Education Technical Umok, River State who were not part of the sample. The responses of the respondents were subjected to reliability analysis using Cronbach Alpha ($\propto$) method to determine the internal consistency of the instrument. The choice of Cronbach Alpha is because the instrument is polytomously scored. The reliability coefficients of the various clusters of the research instrument are A 0.89, B 0.91, C 0.87. And the reliability coefficient of 0.89 was obtained as the overall reliability.

5.8. Method of Data Collection

The researcher administered the questionnaires to mathematics education lecturers in all the tertiary institutions in the area of study. The responses collected from the respondents were subjected to further analysis.

5.9. Method of Data Analysis

The research questions were answered using mean and standard deviations. The mean value of 2.50 was used as a bench mark for decision, while the hypotheses were tested using t-test statistic at 0.05 level of significance.

6. Results

Research Question 1

To what extent does mathematics lecturers apply personal ICT competency in mathematics instruction in tertiary institutions in Cross River State?

Table 1: Mean and Standard Deviation of Respondents on the Extent Mathematics Lecturers Apply Personal ICT Competency in Mathematics Instruction in Tertiary Institutions in Cross River State.

		N = 26		
S/N	**Item Statement**	**Mean** $(\overline{x})$	**SD**	**Dec.**
1	Using the keyboard during mathematics instruction	2.46	1.17	LE
2	Using available hardware during mathematics instruction	2.69	0.97	HE
3	Using of different instructional software packages in mathematics	2.50	1.06	HE
4	Using of different operating systems	2.58	0.98	HE
5	Accessing the internet	3.08	0.74	HE
6	Using of e-mail	3.15	1.08	HE
7	Using key ICT skills in developing and presenting information	2.65	0.97	HE
8	Participating in online discussions like facebook	2.62	1.02	HE
9	Hardware repairs	1.69	0.92	LE
10	Writing general programmes	2.08	0.79	LE
	Cluster Mean	**2.55**	**0.47**	**HE**

Table 1 shows the mean and standard deviations of respondents on the extent mathematics lecturers apply personal ICT competency in mathematics instruction in tertiary institutions in Cross River State. The result obtained show that items 2 - 8 had mean ratings of 2.69, 2.50, 2.58, 3.08, 3.15, 2.65 and 2.62 with standard deviations of 0.97, 1.06, 0.98, 0.74, 1.08, 0.97 and 1.02 respectively. These mean values are above the bench mark value of 2.50 which implies high extent. This means the mathematics lecturers apply the following personal ICT competencies in mathematics instruction to a high extent. These include: using available hardware during mathematics instruction, using of different instructional software packages in mathematics, using different operating systems, accessing the internet, using of e-mail, using key ICT skills in developing and presenting information and participating in online discussions like Facebook. However, using the keyboard during mathematics instruction, hardware repairs and writing general programmes are applied to a low extent, this is because their mean values are within the range of 1.50-2.49 which are below the bench mark value of 2.50 which implies low extent. The cluster mean rating of 2.55 with a standard deviation of 0.47 showed that mathematics lecturers apply personal ICT competencies in mathematics instruction to a high extent.

Research Question 2

To what extent does mathematics lecturers apply pedagogical ICT competency in mathematics instruction in tertiary institutions in Cross River State?

Table 2 shows the mean and standard deviations of respondents on the extent mathematics lecturers apply Pedagogical ICT competency in mathematics instruction in tertiary institutions in Cross River State. The result obtained show that items 11-20 had mean ratings of 2.27, 1.73, 2.12, 2.35, 2.19, 2.04, 2.00, 2.46, 2.27 and 1.77 with standard deviations of 0.96, 0.77, 0.86, 0.84, 0.74, 0.91, 0.98, 0.90, 0.96 and 0.95 respectively. These mean values are within the range of 1.50 – 2.49 which are below the bench mark value of 2.50 this implies low extent. This means that mathematics lecturers apply the following pedagogical ICT competencies in mathematics instruction to a low extent. These include: evaluating mathematics topics using specific mathematics software, developing mathematics websites, preparing ICT-based learning materials in mathematics, preparing schemes of work and lesson notes in mathematics using ICT, solving common ICT problems relating to instruction in mathematics, writing mathematics programmes, monitoring ICT teaching and learning mathematics, integrating ICT in mathematics, using ICT for teaching and learning mathematics and developing hardware components. The cluster mean rating of 2.11 with a standard deviation of 0.54 showed that mathematics lecturers apply pedagogical ICT competencies in mathematics instruction to a low extent.

Research Question 3

To what extent does mathematics lecturers apply subject oriented ICT competency in mathematics instruction in tertiary institutions in Cross River State?

Table 3 shows the mean and standard deviations of respondents on the extent math-

Table 2: Mean and Standard Deviation of Respondents on the Extent Mathematics Lecturers Apply Pedagogical ICT Competency in Mathematics Instruction in Tertiary Institutions in Cross River State.

		N = 26		
S/N	**Item Statement**	**Mean($\overline{x}$)**	**SD**	**Dec.**
11	Evaluating mathematics topics using specific mathematics software	2.27	0.96	LE
12	Developing mathematics websites	1.73	0.77	LE
13	Preparing ICT-based learning materials in mathematics	2.12	0.86	LE
14	Preparing schemes of work and lesson notes in mathematics using ICT	2.35	0.84	LE
15	Solving common ICT problems relating to instruction in mathematics	2.19	0.74	LE
16	Writing mathematics programmes	2.04	0.91	LE
17	Monitoring ICT teaching and learning mathematics	2.00	0.98	LE
18	Integrating ICT in mathematics	2.46	0.90	LE
19	Using ICT for teaching and learning mathematics	2.27	0.96	LE
20	Developing hardware components	1.77	0.95	LE
	Cluster Mean	**2.11**	**0.54**	**LE**

ematics lecturers apply subject oriented ICT competency in mathematics instruction in tertiary institutions in Cross River State. The result obtained show that items 21-30 had mean ratings of 2.23, 1.88, 2.19, 1.85, 2.12, 2.15, 1.96, 2.00, 2.12 and 2.15 with standard deviations of 0.76, 0.76, 0.98, 0.83, 0.76, 0.78, 0.95, 0.74, 0.81 and 1.00 respectively. These mean values are within the range of 1.50–2.49 which are below the bench mark value of 2.50 this implies low extent. This means the mathematics lecturers apply the following subject oriented ICT competencies in mathematics instruction to a low extent. These include: Using ICT as a didactic tool in mathematics education, employing digital devices during mathematics instruction, implementing cooperative learning strategies in mathematics using ICT, establishing virtual learning environment in mathematics education, encouraging ICT-based collaborative learning in mathematics education, using specific mathematics software to give assignments to only the intelligent students, working effectively with ICT in developing learners ICT capability in mathematics, using ICT to involve parents in their children's learning in mathematics, promoting learner-autonomy by discouraging teacher-learner interaction and encouraging on line learning more than fact-to-fact learning of mathematics. The cluster mean of 2.06 with a standard deviation of 0.54 showed that mathematics lecturers apply subject oriented ICT competencies in mathematics instruction to a low extent.

Table 3: Mean and Standard Deviation of Respondents on the Extent Mathematics Lecturers Apply Subject oriented ICT Competency in Mathematics Instruction in Tertiary Institutions in Cross River State.

		N = 26		
S/N	**Item Statement**	**Mean $(\overline{x})$**	**SD**	**Dec.**
21	Using ICT as a didactic tool in mathematics education	2.23	0.76	LE
22	Employing digital devices during mathematics instruction	1.88	0.76	LE
23	Implementing cooperative learning strategies in mathematics using ICT	2.19	0.98	LE
24	Establishing virtual learning environment in mathematics education	1.85	0.83	LE
25	Encouraging ICT-based collaborative learning in mathematics education	2.12	0.76	LE
26	Using specific mathematics software to give assignments to only the intelligent students	2.15	0.78	LE
27	Working effectively with ICT in developing learners ICT capability in mathematics	1.96	0.95	LE
28	Using ICT to involve parents in their children's learning in mathematics	2.00	0.74	LE
29	Promoting learner-autonomy by discouraging teacher-learner interaction	2.12	0.81	LE
30	Encouraging on line learning more than fact-to-fact learning of mathematics	2.15	1.00	LE
	Cluster Mean	**2.06**	**0.54**	**LE**

Research Question 4

What is the influence of institutional type on the extent mathematics lecturers apply personal ICT competency in mathematics instruction in Cross River State?

Table 4 shows the mean and standard deviations of respondents on the extent mathematics lecturers apply personal ICT competency in mathematics instruction in tertiary institutions in Cross River State based on institutional type. The result obtained show that the university mathematics lecturers access the internet and use e-mail to a very high extent. The result also showed that university mathematics lecturers use items 1, 4, 7 and 8 to a high extent while they use items 2, 3, 9 and 10 to a low extent. On the other hand, the colleges of education mathematics lecturers use items 2-8 to a high extent and use items 1, 9 and 10 to a low extent. However, the cluster mean of 2.60 with a standard

Table 4: Mean and Standard Deviation of Respondents on the Extent Mathematics Lecturers Apply Personal ICT Competency in Mathematics Instruction in Cross River State Based on Institutional Type.

		University (N = 8)			**College of Education (N=18)**		
S/N	**Items**	$\overline{x}$	**SD**	**Dec.**	$\overline{x}$	**SD**	**Dec.**
1	Using the keyboard during mathematics instruction	2.50	0.92	HE	2.44	1.29	LE
2	Using available hardware during mathematics instruction	2.25	0.70	LE	2.89	1.02	HE
3	Using of different instructional software packages in mathematics	2.13	0.64	LE	2.67	1.18	HE
4	Using of different operating systems	2.63	0.91	HE	2.56	1.04	HE
5	Accessing the internet	3.63	0.51	VHE	2.83	0.70	HE
6	Using of e-mail	3.63	0.74	VHE	2.94	1.16	HE
7	Using key ICT skills in developing and presenting information	3.00	0.92	HE	2.50	0.98	HE
8	Participating in online discussions like facebook	2.88	1.12	HE	2.50	0.98	HE
9	Hardware repairs	1.63	1.06	LE	1.72	0.89	LE
10	Writing general programmes	1.75	0.70	LE	2.22	0.80	LE
	Cluster Mean	**2.60**	**0.44**	**HE**	**2.52**	**0.49**	**HE**

deviation of 0.44 for university mathematics lecturers and the cluster mean of 2.52 with standard deviation of 0.49 for college of education mathematics lecturers showed that mathematics lecturers in tertiary institutions in Cross River State apply personal ICT competencies in mathematics instruction to a high extent. Therefore, institutional type has no influence on the extent mathematics lecturers apply personal ICT competency in mathematics instruction in tertiary institutions in Cross River State.

Research Question 5

What is the influence of institutional type on the extent mathematics lecturers apply Pedagogical ICT competency in mathematics instruction in Cross River State?

Table 5 shows the mean and standard deviations of respondents on the extent mathematics lecturers apply pedagogical ICT competency in mathematics instruction in tertiary institutions in Cross River State based on institutional type. The result obtained show

Table 5: Mean and Standard Deviation of Respondents on the Extent Mathematics Lecturers Apply Pedagogical ICT Competency in Mathematics Instruction in Cross River State Based on Institutional Type.

		University (N = 8)			**College of Education (N=18)**		
S/N	**Items**	$\overline{x}$	**SD**	**Dec.**	$\overline{x}$	**SD**	**Dec.**
11	Evaluating mathematics topics using specific mathematics software	2.38	0.91	LE	2.22	1.00	LE
12	Developing mathematics websites	1.63	0.74	LE	1.78	0.80	LE
13	Preparing ICT-based learning materials in mathematics	2.00	0.92	LE	2.17	0.85	LE
14	Preparing schemes of work and lesson notes in mathematics using ICT	2.00	0.75	LE	2.50	0.85	HE
15	Solving common ICT problems relating to instruction in mathematics	2.00	0.92	LE	2.28	0.66	LE
16	Writing mathematics programmes	1.88	0.83	LE	2.11	0.96	LE
17	Monitoring ICT teaching and learning mathematics	1.88	0.83	LE	2.06	1.05	LE
18	Integrating ICT in mathematics	2.38	0.91	LE	2.50	0.92	HE
19	Using ICT for teaching and learning mathematics	2.38	1.06	LE	2.22	0.94	LE
20	Developing hardware components	1.25	0.46	LE	2.00	1.02	LE
	Cluster Mean	**1.97**	**0.48**	**LE**	**2.18**	**0.56**	**LE**

that the university mathematics lecturers apply items 11-20 to a low extent. On the other hand, the colleges of education mathematics lecturers use items 14 and 18 to a high extent and apply items 11-13, 15-17, 19 and 20 to a low extent. However, the cluster mean of 1.97 with a standard deviation of 0.48 for university mathematics lecturers and the cluster mean 2.18 with standard deviation of 0.56 for college of education mathematics lecturers show that mathematics lecturers in tertiary institutions in Cross River State apply pedagogical ICT competencies in mathematics instruction to a low extent. Therefore, institutional type has no influence on the extent mathematics lecturers apply

pedagogical ICT competency in mathematics instruction in tertiary institutions in Cross River State.

Research Question 6

What is the influence of institutional type on the extent mathematics lecturers apply Subject oriented ICT competency in mathematics instruction in Cross River State?

Table 6 shows the mean and standard deviations of respondents on the extent mathematics lecturers apply subject oriented ICT competency in mathematics instruction in tertiary institutions in Cross River State based on institutional type. The result obtained show that both the university mathematics lecturers and college of education mathematics lecturers apply items 21-30 to a low extent. Similarly, the cluster mean of 1.93 with a standard deviation of 0.53 for university mathematics lecturers and the cluster mean of 2.12 with standard deviation of 0.53 for college of education mathematics lecturers show that the mathematics lecturers in tertiary institutions in Cross River State apply subject oriented ICT competencies in mathematics instruction to a low extent. Therefore, institutional type has no influence on the extent mathematics lecturers apply subject-oriented ICT competency in mathematics instruction in tertiary institutions in Cross River State.

Research Hypothesis 1

Institutional type (Universities and Colleges of Education) do not have any significant influence on the extent mathematics lecturers apply personal ICT competencies in mathematics instruction.

The result in Table 7 showed the t-test analysis of the extent institutional type influence mathematics lecturers' application of personal ICT Competencies in mathematics instruction. The result shows that only item 5 showed significant difference because the probability value is less than 0.05 set as level of significance, while there was no significant difference on items 1-4 and 6-10 because the probability values are greater than 0.05. The cluster t-value of 0.35 with a degree of freedom of 24 and a probability value of 0.73 was obtained. Since the probability value of 0.73 is greater than 0.05, this means that the result is not significant. Therefore, the null hypothesis which stated that Institutional type do not have any significant influence on the extent mathematics lecturers apply personal ICT competencies in mathematics instruction is not rejected. Inference drawn therefore is that mathematics lecturers from both universities and colleges of education share the same view on the extent of the application of personal ICT competency in mathematics instruction in Cross River State. Hence, Institutional type (Universities and Colleges of education) do not have any significant influence on the extent mathematics lecturers apply personal ICT competencies in mathematics instruction.

Research Hypothesis 2

Institutional type (Universities and Colleges of Education) do not have any significant influence on the extent mathematics lecturers apply Pedagogical ICT competencies in mathematics instruction.

Table 6: Mean and Standard Deviation of Respondents on the Extent Mathematics Lecturers Apply Subject Oriented ICT Competency in Mathematics Instruction in Cross River State Based on Institutional Type.

		University (N = 8)			**College of Education (N=18)**		
S/N	**Items**	$\overline{x}$	**SD**	**Dec.**	$\overline{x}$	**SD**	**Dec.**
21	Using ICT as a didactic tool in mathematics education	2.00	0.75	LE	2.33	0.76	LE
22	Employing digital devices during mathematics instruction	1.63	0.51	LE	2.00	0.84	LE
23	Implementing cooperative learning strategies in mathematics using ICT	2.38	1.18	LE	2.11	0.90	LE
24	Establishing virtual learning environment in mathematics education	1.63	0.51	LE	1.94	0.93	LE
25	Encouraging ICT-based collaborative learning in mathematics education	2.25	0.88	LE	2.06	0.72	LE
26	Using specific mathematics software to give assignments to only the intelligent students	2.13	0.99	LE	2.17	0.70	LE
27	Working effectively with ICT in developing learners ICT capability in mathematics	2.00	0.92	LE	1.94	0.99	LE
28	Using ICT to involve parents in their children's learning in mathematics	1.63	0.74	LE	2.17	0.70	LE
29	Promoting learner-autonomy by discouraging teacher-learner interaction	1.88	0.83	LE	2.22	0.80	LE
30	Encouraging on line learning more than fact-to-fact learning of mathematics	1.88	0.99	LE	2.28	1.01	LE
	Cluster Mean	**1.93**	**0.57**	**LE**	**2.12**	**0.53**	**LE**

The result in Table 8 showed the t-test analysis of the extent institutional type influence mathematics lecturers' application of pedagogical ICT Competencies in mathematics

Table 7: t-test Analysis of the Extent Institutional Type Influence Mathematics Lecturers Application of Personal ICT Competencies in Mathematics Instruction.

S/N	**Items**	**Institution**	**Mean**	**SD**	**t-cal**	**df**	**Sig.**	**Dec.**
1	Using the keyboard during mathematics instruction	UNI COE	2.50 2.44	0.92 1.29	0.11	24	0.91	NS
2	Using available hardware during mathematics instruction	UNI COE	2.25 2.89	0.70 1.02	-1.60	24	0.12	NS
3	Using of different instructional software packages in mathematics	UNI COE	2.13 2.67	0.64 1.18	-1.20	24	0.24	NS
4	Using of different operating systems	UNI COE	2.63 2.56	0.91 1.04	0.16	24	0.87	NS
5	Accessing the internet	UNI COE	3.63 2.83	0.51 0.70	2.83	24	0.01	S
6	Using of e-mail	UNI COE	3.63 2.94	0.74 1.16	1.52	24	0.14	NS
7	Using key ICT skills in developing and presenting information	UNI COE	3.00 2.50	0.92 0.98	1.22	24	0.23	NS
8	Participating in online discussions like Facebook	UNI COE	2.88 2.50	1.12 0.98	0.86	24	0.39	NS
9	Hardware repairs	UNI COE	1.63 1.72	1.06 0.89	-0.24	24	0.81	NS
10	Writing general programmes	UNI COE	1.75 2.22	0.70 0.80	-1.42	24	0.16	NS
	Cluster Mean	**UNI** **COE**	**2.60** **2.52**	**0.44** **0.49**	**0.36**	**24**	**0.73**	**NS**

instruction. The result shows that there was no significant difference on items 11-20 because all the probability values are greater than 0.05 set as level of significance. The cluster t-value of -0.90 with a degree of freedom of 24 and a probability value of 0.37 was obtain. Since the probability value of 0.37 is greater than 0.05, this means that the result is not significant. Therefore, the null hypothesis which stated that Institutional type do not have any significant influence on the extent mathematics lecturers apply pedagogical ICT competencies in mathematics instruction is not rejected. Inference drawn therefore is that mathematics lecturers from both universities and colleges of education did not differ in their opinion on the extent of the application of pedagogical ICT competency in mathematics instruction in Cross River State. Hence, Institutional type (Universities and Colleges of education) do not have any significant influence on the extent mathematics lecturers apply pedagogical ICT competencies in mathematics instruction.

Table 8: *t*-test Analysis of the Extent Institutional Type Influence Mathematics Lecturers Application of Pedagogical ICT Competencies in Mathematics Instruction.

S/N	**Items**	**Institution**	**Mean**	**SD**	**t-cal**	**Df**	**Sig.**	**Dec.**
11	Evaluating mathematics topics using specific mathematics software	UNI COE	2.38 2.22	0.91 1.00	0.36	24	0.72	NS
12	Developing mathematics websites	UNI COE	1.63 1.78	0.74 0.80	-0.45	24	0.65	NS
13	Preparing ICT-based learning materials in mathematics	UNI COE	2.00 2.17	0.92 0.85	-0.44	24	0.65	NS
14	Preparing schemes of work and lesson notes in mathematics using ICT	UNI COE	2.00 2.50	0.75 0.85	-1.42	24	0.17	NS
15	Solving common ICT problems relating to instruction in mathematics	UNI COE	2.00 2.28	0.92 0.66	-0.87	24	0.39	NS
16	Writing mathematics programmes	UNI COE	1.88 2.11	0.83 0.96	-0.69	24	0.55	NS
17	Monitoring ICT teaching and learning mathematics	UNI COE	1.88 2.06	0.83 1.05	-0.43	24	0.67	NS
18	Integrating ICT in mathematics	UNI COE	2.38 2.50	0.91 0.92	-0.32	24	0.75	NS
19	Using ICT for teaching and learning mathematics	UNI COE	2.38 2.22	1.06 0.94	0.36	24	0.72	NS
20	Developing hardware components	UNI COE	1.25 2.00	0.46 1.02	-1.96	24	0.06	NS
	Cluster Mean	**UNI** **COE**	**1.97** **2.18**	**0.48** **0.56**	**-0.90**	**24**	**0.37**	**NS**

Research Hypothesis 3

Institutional type (Universities and Colleges of Education) do not have any significant influence on the extent mathematics lecturers apply subject oriented ICT competencies in mathematics instruction.

The result in Table 9 showed the t-test analysis of the extent institutional type influence mathematics lecturers' application of subject oriented ICT Competencies in mathematics instruction. The result shows that there was no significant difference on items 21-30 because all the probability values are greater than 0.05 set as level of significance. The cluster t-value of -0.79 with a degree of freedom of 24 and a probability value of 0.44 was obtain. Since the probability value of 0.44 is greater than 0.05, this means that the result is not significant. Therefore, the null hypothesis which stated that Institutional type do not have any significant influence on the extent mathematics lecturers apply subject oriented ICT competencies in mathematics instruction is not rejected. Inference drawn therefore is that mathematics lecturers from both universities and colleges of education

Table 9: t-test Analysis of the Extent Institutional Type Influence Mathematics Lecturers Application of Subject Oriented ICT Competencies in Mathematics Instruction.

S/N	**Items**	**Institution**	**Mean**	**SD**	**t-cal**	**Df**	**Sig.**	**Dec.**
21	Using ICT as a didactic tool in mathematics education	UNI COE	2.00 2.33	0.75 0.76	-1.03	24	0.32	NS
22	Employing digital devices during mathematics instruction	UNI COE	1.63 2.00	0.51 0.84	-1.16	24	0.26	NS
23	Implementing cooperative learning strategies in mathematics using ICT	UNI COE	2.38 2.11	1.18 0.90	0.63	24	0.54	NS
24	Establishing virtual learning environment in mathematics education	UNI COE	1.63 1.94	0.51 0.93	-0.89	24	0.37	NS
25	Encouraging ICT-based collaborative learning in mathematics education	UNI COE	2.25 2.06	0.88 0.72	0.59	24	0.56	NS
26	Using specific mathematics software to give assignments to only the intelligent students	UNI COE	2.13 2.17	0.99 0.70	-0.12	24	0.90	NS
27	Working effectively with ICT in developing learners ICT capability in mathematics	UNI COE	2.00 1.94	0.92 0.99	0.13	24	0.98	NS
28	Using ICT to involve parents in their children's learning in mathematics	UNI COE	1.63 2.17	0.74 0.70	-1.78	24	0.09	NS
29	Promoting learner-autonomy by discouraging teacher-learner interaction	UNI COE	1.88 2.22	0.83 0.80	-1.00	24	0.33	NS
30	Encouraging on line learning more than fact-to-fact learning of mathematics	UNI COE	1.88 2.28	0.99 1.01	-0.94	24	0.35	NS
	Cluster Mean	**UNI** **COE**	**1.93** **2.12**	**0.57** **0.53**	**-0.79**	**24**	**0.44**	**NS**

did not differ in their opinion on the extent of the application of subject oriented ICT competency in mathematics instruction in Cross River State. Hence, Institutional type (Universities and Colleges of education) do not have any significant influence on the extent mathematics lecturers apply subject-oriented ICT competencies in mathematics instruction.

7. Discussion

Research question one sought to find out the extent mathematics lecturers apply personal ICT competency in mathematics instruction in tertiary institutions. The findings indicated that the mathematics lecturers in tertiary institutions in Cross River State apply personal ICT competencies in mathematics instruction to a high extent. These include: the use of available hardware during mathematics instruction, using of different instructional software packages in mathematics, using different operating systems, accessing the internet, using of e-mail, using key ICT skills in developing and presenting information and participating in online discussions like Facebook. However, the use of keyboard during mathematics instruction, hardware repairs and writing general programmes are applied to a low extent. This implies that mathematics lecturers have a high level of personal ICT competency. This is in disagreement with the findings of Diri (2013) who reported that mathematics teachers lacked the necessary personal ICT competency needed for classroom usage. Personal ICT competency facilitates mathematics instructions when properly and fully applied in mathematics instruction.

Research question two sought to find out the extent mathematics lecturers apply pedagogical ICT competency in mathematics instruction in tertiary institutions. The findings indicate that mathematics lecturers in tertiary institutions in Cross River State apply pedagogical ICT competencies in mathematics instruction to a low extent. These include: evaluating mathematics topics using specific mathematics software, developing mathematics websites, preparing ICT-based learning materials in mathematics, preparing schemes of work and lesson notes in mathematics using ICT, solving common ICT problems relating to instruction in mathematics, writing mathematics programmes, monitoring ICT teaching and learning mathematics, integrating ICT in mathematics, using ICT for teaching and learning mathematics and developing hardware components. This implies that mathematics lecturers have a low level of pedagogical ICT competency. This is in agreement with the findings of Diri (2013) who reported that mathematics teachers are not adequately competent in their pedagogical ICT competency. This finding of this study is not consistent with the expectations in UNESCO (2002b) which advocate teachers' instructional practices and the knowledge of the curriculum. It requires that lecturers should be able to develop applications within their disciplines to make effective use of ICTs to support and extent teaching and learning. The finding also is in disagreement with Jegede, Dibu-Ojerinde and Ilori (2007) they observed that as teachers' perceived computers to be useful in their pedagogical enterprise, the interests become aroused which in turn help their computer skills.

Research question three sought to investigate the extent mathematics lecturers apply subject oriented ICT competency in mathematics instruction in tertiary institutions. The findings revealed that mathematics lecturers apply subject oriented ICT competencies in mathematics instruction to a low extent. This means that mathematics lecturers' competency in using ICT as a didactic tool in mathematics education, employing digital devices during mathematics instruction, implementing cooperative learning strategies in mathematics using ICT, establishing virtual learning environment in mathematics education, encouraging ICT-based collaborative learning in mathematics education, using specific

mathematics software to give assignments to only the intelligent students, working effectively with ICT in developing learners ICT capability in mathematics, using ICT to involve parents in their children's learning in mathematics, promoting learner-autonomy by discouraging teacher-learner interaction and encouraging on line learning more than fact-to-fact learning of mathematics is limited. This implies that mathematics lecturers have a low level of subject-oriented ICT competency. This is in agreement with the findings of Diri (2013) who reported that mathematics teachers are inadequately competent in subject-oriented ICT competency This finding of this study also agreed with Rautopuro,Pontinen and Kekkonen (2006) who attested that technologies are more frequently used rather than the integration of ICT into educational practice to enhance the teaching and learning process. Mathematics lecturers need to advance in the integration of ICT in the teaching and learning process to enhance students' performance.

The study also investigated the influence of institutional type on the extent mathematics lecturers apply personal, pedagogical and Subject oriented ICT competency in mathematics instruction in tertiary institutions. From the findings, it shows that institutional type (university and college of education) has no influence on the extent mathematics lecturers apply personal, pedagogical and Subject oriented ICT competency in mathematics instruction in tertiary institutions. This implies that mathematics lecturers from both universities and colleges of education apply personal, pedagogical and subject oriented ICT competencies to the same extent in mathematics instruction. Universities and colleges of education apply personal ICT competency to a high extent in mathematic instructions while pedagogical and subject oriented ICT competencies are applied in low extent in mathematics instruction in both the universities and colleges of education. This implies that mathematics lecturers from both universities and colleges of education have the same levels of personal, pedagogical and subject oriented ICT competencies. These findings are in disagreement with the views of Onasanya, Shehu, Oduwaiye and Shehu (2010) that university lecturers possessed more ICT competencies and skills than lecturers in the college of education. However, the level of competencies of mathematics lecturers in the application of ICT in mathematics instructions in both the Universities and Colleges of education is worrisome. This means that in-service training, workshops and seminars should be organized to improve the ICT competency of lecturers.

8. Conclusion

The findings of this study gave rise to the following conclusions: Mathematic lecturers in tertiary institutions in Cross River State apply personal ICT competencies in mathematics instruction to a high extent; Mathematics lecturers in tertiary institutions in Cross River State apply pedagogical ICT competencies in mathematics instruction to a low extent; and Mathematics lecturers in tertiary institutions in Cross River State apply subject oriented ICT competencies in mathematics instruction to a low extent. Therefore, there is an urgent need for the improvement of mathematics lectures' competencies in the application of ICT in mathematics instruction. This is obvious because it was noted from the findings of the study that lecturers' mean scores were rated low levels of competencies

in pedagogical and subject-oriented competencies but high in personal ICT competencies. Most of these ICT gadgets are used by mathematics lecturers but not judiciously used in mathematics instructions due to fact that mathematics lectures are not yet well competent in ICT application in instructions.

The study revealed also that institutional type (Universities and Colleges of education) do not have any significant influence on the extent mathematics lecturers apply ICT competencies in mathematics instruction in Cross River State. This implies that mathematics lecturers in the universities and colleges of education should be expose to ICT in-service training, workshop and seminars to improve their competencies in the application of ICT in mathematics instructions. Every teacher preparation course must include elements for developing ICT competencies of both teachers and learners which will promote the integration of ICT in mathematics education and other educational programmes. Lecturers should be facilitated through in-service educational activities to develop ICT competencies and become interested in ICT integration in instructions.

References

[1] Abimbade, A. (1998), Information technology. The current strategy for effective science and technology instruction. Bichi. *Journal of Education*, 21:33–39.

[2] Abolade, O. A. & Yusuf, O. M. (2005), Information and communication technologies (ICTs) and the Nigerian teacher education programme. *African Journal of Educational Studies*, 3, 1–19.

[3] Afolabi, S.S. (2014), Globalization, information communication technology and mathematics education: Implications for pedagogy in tertiary institutions, *Abacus, the Journal of the Mathematical Association of Nigeria*, 39, 355–362.

[4] Agogo, P. (2004), Students' information Hand book 2004–2006. International Public Relations Unit, Provost's Office, C.O.E, Oju.

[5] Akudolu, L. (2008), Quest for teacher needed competencies for instructional use of ICT: Views from European Union (EU). *Nigerian Journal of Teachers Education*, Vol. 4(1), pp. 1–14.

[6] Diri, E.A. (2013), Mathematics teachers' competencies in the use of information and communication technology (ICT) in classroom instruction in Yenagoa education zone, *Unpublished M.Ed Thesis*, University of Nigeria, Nsukka.

[7] Egomo, J.E., Enyi, B.I., & Tah, M.M. (2012), Availability and utilization of ICT tools for effective instructional delivery in tertiary institutions in Cross River state, Nigeria. *Global Advanced Research Journal of Educational Research and Review*, 1, 190–195.

[8] Ezenwafor, J. I. (2011), Adequacy of exposure to information and communication technology by graduating business education students of tertiary institutions in Anambra State. Being a Paper Presented at the *23rd National and 2nd International conference of Association of Business Educators of Nigeria* held at the University of Lagos on the 11th – 15th October, 2011.

[9] Federal Ministry of Education (2010), *National policy on information and communication technologies (ICT) in education*. Abuja: FME.

[10] Fuglested, B.A. (2011), Teaching and teacher's competence with ICT in mathematics community of inquiry. *Unpublished master's thesis*. Agder University College, Norway.

[11] Jegede, P.O., Dibu–Ojerinde, O.O. & llori M.O. (2007), Relationship between ICT competence and attitude among some Nigerian tertiary Institution lecturers. *Educational Research and Review*, 2, 172–175.

[12] Jones, A. (2004), *A review of the research literature on barriers to the uptake of ICT by teachers*. UK: Becta.

[13] Kamath, K. V. D. (2009), Internship in Pre-service teacher education in V. venkatish & P. M. Visvar dyalayam (eds) *Teacher Education New.* Delhi: A. P. A. Publishing Corporation.

[14] McCarney, J. (2004), Effective use of staff development in ICT. *European Journal of Education*, 27, 61–72.

[15] Nworgu, B. G. (2006a), The indispensability of ICT in educational research. *Information and Communication Technology in the Service of Education*, 1–10.

[16] Nworgu, B.G. (2006b), *Educational research. Basic issues and methodology* (second and enlarged edition). Nsukka: University trust publishers.

[17] Olaniyan, M. E. (2015), The Challenges and Prospects of Teaching and Learning Dramatic Arts in Tertiary Institutions in Nigeria, *African Research and Review. An International Multidisciplinary Journal, Ethiopia*, 9, 113–124.

[18] Olaofe, I.A. (2005), *Nigerian educational emancipation:* Road map from crisis to resurgence Faculty of Education Seminar Series. No. 1: Ahmadu Bello University, Zaria.

[19] Ololube, N. P. (2006), The impact of professional and non professional teachers ICT competencies in secondary schools in Nigeria. *Journal of Information and Technology Impact.*, 6(2), 101–118.

[20] Oluwaronbi, O. (2012), *1CT and education in Nigeria*. A Seminar paper Presented at the Department of Education Technology, Obafemi Awolowo University, Ife.

[21] Onasanya, S.A. Shehu, R.A., Oduwaiye, R.O. and Shelu L.A. (2010), Higher institutions lecturers' attitude towards integration of ICT into teaching and research in Nigeria, *Research Journal of information technology*, 2:1–10.

[22] Osunde, A.U. and Omoruyi, F.E.O. (2004), An evaluation of the national teachers institutes manpower training programme for teaching personnel in mid-Western Nigeria. *International Education Journal*, 5:405–409.

[23] Owolabi T.O., Oyewole, B. K. & Oke, J.O. (2013), Teacher education, information and communication technology: Prospects and challenges of e–teaching profession in Nigeria. *American Journal of Humanities and Social Sciences*, 1, 87–91.

[24] Peters, R. S. (2003), *The philosophy of education*. London: Oxford University Press.

[25] Rautopuro, J., Pontinen, S. & Kukkonen, J. (2006), Towards the information society – the case of Finnish teacher education. *Informatics in Education*, 5, 285–300.

[26] Scriven, M. (2011), The methodology of evaluation. In R. Tyler, Gagne and M. Scriven (eds), *Perpectives on curriculum evaluation*, Chicago: Rand, McNally and Co.

[27] Tayo, O. & Adedayo, T.Q. (2003), Perceived competence of Nigerian secondary schools teachers in the use of information and communication technology (ICT), *Journal of Education and Practice*, 4(10), 157–164.

[28] Ugwuanya, T.O. (2012), Information Communication and Technology (ICT) in Teacher Education: A veritable tool for sustainable development in Nigeria. *Global Voice of Educators*, 1(1), 1–5.

[29] UNESCO (2004), *Computer proficiency for teachers*, Ministerial advisory council on the quality of teaching. Retrieved April 8, 2006. from http://www.det.nsw.edu.au/reviews/macqt/comppro.htm.

[30] UNESCO (2008), *UNESCO competency standards for teachers* from http://unesdoc.unesco.org/images/0015/00/562/15620E.pdf

[31] Williams, M.K., Foudger, T.S., & Wetzel, K. (2009), Preparing Pre-service teachers for 21^{st} century classrooms: Transforming attitudes and behaviours about innovative technology, *Journal of Technology and Teacher Education*, 17, 393–418.

[32] Yusuf, M.O. (2005), Information and communication technology and education: Analyzing the Nigerian national policy for information technology, *International Education Journal*, 6, 316–321.