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Full Length Research

Subject-oriented Information and Communication Technology (ICT) competencies among mathematics lecturers in tertiary institutions in Cross River State, Nigeria

John Egrinya Afufu[1]*, Joy Ibeh Afufu[2] and Simon Anusha Afufu[3]

[1]Department of Curriculum and Instructional Technology, University of Cross River State, Calabar, Nigeria.
[2]Bekwarra Secondary School, Abuochiche, Bekwarra-Cross River State, Nigeria.
[3]Department of Science Education, University of Calabar, Nigeria.

*Corresponding author. Email: afufujohn@gmail.com

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ABSTRACT: This study assessed ICT subject-oriented competencies among Mathematics Lecturers in Tertiary Institutions in Cross River State. Institutional type (Universities and Colleges of education) was also looked at in this study. Two research questions and one null hypothesis 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 the pedagogical ICT competencies of mathematics lecturers. The initial draft of the instrument, the purpose of the study, as well as the research questions and hypotheses, were given to experts for validation. The responses of the respondents were subjected to reliability analysis using Cronbach Alpha (∝) method to determine the internal consistency of the instrument. A reliability coefficient of 0.91 was obtained. The questionnaire was administered to mathematics lecturers and their responses were analysed using mean and standard deviation to answer research questions while the null hypothesis was tested using t-test statistics at a 0.05 level of significance. The results indicated that mathematics lectures subject oriented ICT competencies are applied to a low extent in mathematics instruction. Institutional types do not have any significant influence on the extent mathematics lecturers apply subject oriented ICT competencies in mathematics instruction. This revealed that mathematics lecturers required the needed subject oriented 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 subject oriented ICT competencies of lecturers.

Keywords: Application, mathematics instruction, mathematics lecturers, subject oriented ICT competencies, tertiary institution.

INTRODUCTION

Computer-based teacher education improves teacher competency and proficiency, enabling educators at all levels to offer students technology-supported learning opportunities and fulfil professional standards in the teaching and learning process. The proliferation of information and communication technology (ICT) has caused a paradigm shift in teacher education as well as teaching and learning, moving away from the old strategy that is centred on the teacher, text, students, and surroundings and toward a new approach. Science, technical advancement, and globalization in the current world have brought about the introduction of this new, technologically oriented approach to the educational system (Afolabi, 2014).

The following are some of the potentials that the boom of ICT presents for improving the calibre of teaching and learning, according to Archibong *et al*. (2010): Encouraging faculty and students to consider how they instruct and learn; using learning theory, research, and best practices in instruction to create online learning environments; increasing the visibility and accessibility of teaching and learning; promoting cooperation and teamwork among employees (as well as students); giving more individuals greater access to education; improving the standing and qualifications of college instructors. Thanks to its dynamic, interactive, and interesting material, ICT has unquestionably had an impact on both the quantity and quality of teaching and learning. It can also offer genuine potential for tailored education (Egomo *et al*., 2012). Technologies of information and communication may be excellent auxiliary resources for reforming and advancing education. When applied properly, various ICTs increase educational quality, increase access to education, and reinforce the value of education in the increasingly digital workplace by transforming teaching and learning into an engaging, active process that is relevant to everyday life (Ezenwafor, 2011). Recognizing the importance of ICT education, governments worldwide have implemented various strategies to aid in the acquisition of ICT education. These strategies include improving education and training programs, creating an environment that fosters ICT development, offering incentives for computerization and automation, and raising venture capital (Pelgrum and Law 2003).

The government, institutions, organizations, and individuals in Nigeria are increasingly concerned about the desire to include ICT into education. The National Universities Commission (NUC) of Nigeria has made commendable progress in this approach by installing physical ICT infrastructures in a few chosen universities (Federal Ministry of Education, 2010). All college instructors must possess computer literacy, according to a National Commission for Colleges of Education (NCCE) regulation. In order to facilitate the actualization of the primary tasks of higher education institutions, it is imperative that ICT be properly integrated into education at the tertiary levels (Afufu, 2015). But despite the admirable efforts of the Federal government and other organizations to fund the use of ICT in education, Nigeria's education system continues to fall behind in this area of technology (Owolabi *et al*., 2013). Among other things, a lack of sufficient ICT abilities and skills may have contributed to this.

Lecturers provide an explanation of how to use the technological tools in the classroom in addition to their number and quality. It is required of lecturers to be proficient in using these resources and to be ready to equip students with the benefits of technology. Teachers should have access to technology resources and capabilities so they may integrate technological concepts and skills into their lesson plans while teaching the required subject matter in schools and classrooms (United Nations Educational, Scientific and Cultural Organization (UNESCO), 2008). However, upon critical evaluation of the teaching and learning process in Nigerian tertiary institutions, it became apparent that the real obstacles were not finding relevant content to teach or developing effective teaching pedagogies, but rather gaining access to and being proficient in the use of ICT to support teaching and learning (Afufu, 2015). Teachers at Nigeria's higher education institutions frequently deal with the challenge of creating new, ICT-focused courses. It can be challenging for instructors to decide which subjects should be covered with ICT, how to organize them, and which teaching strategy would be best to deliver the material to students in a way that will maximize understanding. Since technical advancement is occurring quickly across all subject areas, this is even more challenging for instructors who are experts in their field. Therefore, in order to optimize their ability to contribute to the improvement of students' digital competence, instructors and lecturers must possess the knowledge and abilities to integrate ICT into their regular teaching activities.

According to UNESCO (2008), competency is a collection of qualities encompassing attitudes, knowledge, and abilities that allow one to successfully carry out the tasks associated with a particular job or function to the standards required in the workplace. ICT competence, according to UNESCO in Afufu (2015), is the capacity to: understand why one uses ICT and how it affects users and content; know when to apply or develop a particular skill when using an ICT resource; and have a critical and self-assured attitude toward living with the technology. Thus, to improve teaching effectiveness, teachers must possess a variety of knowledge, abilities, and attitudes related to ICT in the classroom. These competencies are known as ICT competencies in education.

UNESCO (2008) recommended three approaches to ICT competence standards for teachers: technology literacy, knowledge production, and knowledge deepening. The curriculum and assessment, pedagogy, ICT, organization and administration, policy and vision, and teachers' professional development are the six components of the educational system that are produced by these approaches. By integrating technological skills into the curriculum, instructors can employ new technology to a greater extent. This is the focus of their technology literacy in ICT competencies. The goal of teachers' expanding ICT competencies is to improve their capacity to use knowledge to benefit society and the economy. Deepening their ICT competencies, instructors can use their ICT expertise to solve complex, real-life problems. The ability of teachers to innovate and create new knowledge is what constitutes their knowledge creation ICT competencies, which are intended to provide teachers and other ICT users with the skills necessary to deploy ICT

tools at different levels. This is made possible by instructors' ability to create applications across a range of subject areas that leverage on ICT to enhance instruction and learning.

In Nigeria, there are three categories of ICT competencies: pedagogical, subject-oriented, and personal (Abolade and Yusuf 2005; Akudolu 2008; Diri, 2013; Afufu, 2015). Subject-oriented competency, according to these writers, is the understanding of ICT capabilities, operations, use, and characteristics, such as automation and speed functions, and how ICTs can enhance teaching and learning. It also includes the capacity to modify ICT for use in teaching. Proficiency in the use of subject-specific ICTs during education, including Corel Draw, ICT mathematical and statistical software, finding solutions to mathematical problems online, and managing information via ICTs. Both the development of learners' ICT skills and the use of ICT as a teaching instrument in the classroom require teachers to acquire new competencies. Subject-oriented competency includes data analysis, creating multimedia course materials, utilizing ICT in subject-based instruction, and classroom procedures.

Subject-oriented competency aims to create learning environments in a particular field of study; it is a prerequisite for a better understanding of learning mechanisms; it clarifies prior knowledge; and it serves as the foundation for tailoring lessons to the needs of individual students (Yvonne and Dieter, 2015). It is connected to knowledge of content. Subject-oriented competencies are essential to the teaching profession since lecturers must build pedagogical methods for the particular subject matter in addition to their subject-matter expertise (Karimi, 2015).

Research has shown that instructors' proficiency with ICT applications is influenced by how much they incorporate ICT into their instruction and students' learning (Abolade and Yusuf 2005; Akudolu 2008; Diri, 2013; Omoniyi and Quadri, 2013). The competency of instructors is a particular problem when new media or subjects are introduced into the educational system (Yusuf, 2005). It is also thought that a variety of other factors, such as the institutional type (that is, universities and colleges of education), influence the level of ICT competencies among instructors in Nigerian tertiary institutions. This is why Onasanya *et al.* (2010) found that college of education lecturers' level of competence and skill acquisition in using ICT facilities and equipment is concerning; the authors also noted that university lecturers had greater ICT competencies and skills than college of education lecturers. Similarly, Ololube (2006) found that ICT utilization competencies vary among teachers, with professionally qualified teachers appearing to be more dominant with a high ICT competency rate than their non-professional counterparts. This suggests that educational background influences the level of ICT competencies possessed by lecturers. Also, other researchers like Buabeng-Andoh (2019), Ifenthaler and Schweinbenz (2013), Ottenbreit-Leftwich *et al*. (2020), Agyei and Voogt (2021), and Mumtaz and Ezziane (2022) found that many lecturers lacked the necessary skills, competencies and confidence to use ICT tools effectively in their instruction, resulting in underutilization of available technologies. It is against the backdrop that this study investigated ICT subject-oriented competencies among mathematics lecturers in tertiary institutions in Cross River State.

Statement of the problem

To meet the goals of the nation's ICT policy and enable Nigerian lecturers to become members of the community of experts in ICT-supported teaching, a number of organizations, including the Federal Government of Nigeria, the National Universities Commission (NUC), and the National Commission for Colleges of Education (NCCE), have made investments in ICT usage in education. This is predicated on the reality that information and communication technology (ICT) is being employed in mathematics education and other educational programs as tools, tutors, and tutees.

Despite these admirable efforts, in Cross River State the subject-oriented ICT competencies of lecturers in tertiary institutions in the application of ICT in the teaching and learning situation are still not known. Evidence abounds from the background of the study that the level of ICT application during instruction varies among lecturers in tertiary institutions due to some factors such as lecturers' ICT competencies and institutional type among others. Because ICT competencies among lecturers have been recognized in the literature as a prerequisite for the application of ICT in instructions, techniques to improve its application must be continuously sought. Thus, the study's central issue is: to what extent do mathematics lecturers at tertiary institutions in Cross River State use ICT to teach mathematics? What is their level of subject-oriented ICT competencies in this regard?

Purpose of the study

The purpose of this study is to assess ICT subject oriented competencies among mathematics lecturers in tertiary institutions in Cross River State. Specifically, the study seeks to determine the:

1. To what extent do mathematics lecturers apply subject oriented ICT competency in mathematics instructions in tertiary institutions in Cross River State.
2. Influence of institutional type (Universities and Colleges of Education) on the extent mathematics lecturers applies subject oriented ICT competencies in mathematics instruction in Cross River State.

Significance of the study

This study is significant from both a theoretical and practical standpoint. The results of this study may, in theory, highlight the necessity for mathematics instructors who are not yet competent in ICT to pursue training, and for those who are already trained and competent to continue developing their skills to remain relevant in the teaching and learning process of the modern day. In line with competency-based teacher education (CBTE), the goal is to give educators the information, abilities, and attitudes necessary for them to identify and resolve difficult issues in their field of expertise through the use of cognitive behaviour modification (CBM).

The study's practical implications are anticipated to benefit educators, learners, and commissions from tertiary institutions, including the Ministry of Education, the National Universities Commission (NUC) and the National Commission for Colleges of Education (NCCE). The study's findings will be very helpful to teachers since they will increase their knowledge of and exposure to the goals and objectives of Nigeria's ICT strategy. It will introduce educators to the value of ICT in the process of teaching and learning mathematics. It will highlight the necessity for math teachers who are not yet proficient in ICT to pursue training to stay current with the demands of the teaching and learning process in the twenty-first century and beyond. Additionally, the study will introduce postsecondary educators to the ICT competency abilities necessary to prepare today's workers, future educators, and clients with the skills and information needed to promote ICT use at work.

The results of this study will also benefit the students since efforts to raise teacher competency will have a positive impact on activities that promote student learning. When teachers with the necessary competencies integrate ICT into their lessons, it will encourage and drive students to pursue information on their own, even without the teacher's help. This study will give tertiary institutions—universities, polytechnics, monotechnics, and colleges of education—information about the ICT competency levels of their faculty. This information will help them decide how to help teachers become more proficient in ICT, whether by sending them to refresher courses or setting up in-service training. Second, the findings of this study will support higher education institutions in implementing and enforcing ICT-based teaching to ensure that incoming instructors meet the necessary ICT competency standards before entering the workforce.

Since teachers at these levels are stakeholders in the educational enterprise, the study's findings will also reveal the ICT competencies of tertiary-level educators, offering valuable insight into the future of ICT integration, acceptance, and usage in the teaching and learning of mathematics and other subjects in Nigeria at various educational levels. The findings of this study will enable policy makers and curriculum planners, to restructure the Nigerian National Policy for Information Technology to specify the ICT competency standards for teachers at all levels of education in Nigeria and formulate a school curriculum that has implications for ICT usage in classrooms at all levels of education.

Scope of the study

The study is focused on assessing mathematics lecturers' subject oriented competencies in the application of ICT in mathematics instruction in tertiary institutions in Cross River State. The universities and colleges of education in Cross River State are the tertiary institutions on which this study focuses. The content scope of this study will cover the Standard ICT Competency Framework for teachers as stipulated by UNESCO (2008). The competencies include subject-oriented competency.

Research questions

The following research questions were asked to guide the study.

1. To what extent do mathematics lecturers apply subject oriented ICT competency in mathematics instructions in tertiary institutions in Cross River State?
2. What is the influence of institutional type on the extent mathematics lecturers apply subject oriented ICT competencies in mathematics instruction in Cross River State?

Hypothesis

The following null hypothesis was formulated to guide the study and is tested at a 0.05 level of significance.

H_{01}: Institutional type (universities and colleges of education) does not have any significant influence on the extent mathematics lecturers apply subject oriented ICT competencies in mathematics instruction.

METHODOLOGY

Design of the study

This study adopted a descriptive survey research design. The design according to Nworgu (2015) 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 aim 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 intends to collect and analyzed data on the group of mathematics education lecturers in tertiary institutions in Cross River State to ascertain the extent of their subject oriented 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.

Area of the study

The study was conducted in Cross River 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 subject oriented ICT competencies in mathematics instruction in tertiary institutions is not yet known

Population of the study

The population of the study is made up of all the (26) mathematics education lecturers in the four (4) tertiary institutions in Cross River state. (Personnel Department of the various tertiary institutions in Cross River State).

Sample and sampling technique

All the twenty six (26) mathematics education lecturers of the four (4) tertiary institutions in Cross River state was used in this study. Therefore, no sampling process was carried out as the entire population constituted the sample for the study. This is because the population is manageable.

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 rephrased the items to include the term 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 as institutional type. Section B comprises a 10-item instrument structured on pedagogical competencies. It was designed on a four-point Likert scale of very high extent (VHE), high extent (HE), low extent (LE) and very low extent (VLE) to determine the extent mathematics lecturers apply subject oriented ICT competencies in mathematics instruction in tertiary institutions.

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.

Data analysis

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

RESULTS

The results of data analysis are based on data collected for the study. The presentation follows the sequence of the research questions and the null hypotheses that guided the study.

Research question one: To what extent do mathematics lecturers apply subject oriented ICT competency in mathematics instruction in tertiary institutions in Cross River State?

Table 1 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. The results 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 benchmark value of 2.50 this implies a 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 a 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 students in the learning of mathematics, promoting learner-autonomy by discouraging teacher-learner interaction and encouraging online learning more

Table 1. 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 a 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 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 students in the learning of mathematics	2.00	0.74	LE
29	Promoting learner autonomy by discouraging teacher-learner interaction	2.12	0.81	LE
30	Encouraging online learning more than face-to-face learning of mathematics	2.15	1.00	LE
	Cluster Mean	**2.06**	**0.54**	**LE**

Table 2. 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.

S/N	**Items**	**University (N = 8)**			**College of Education (N=18)**		
		$\overline{x}$	**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 a 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 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 students in the learning of 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 online learning more than face-to-face 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**

than face-to-face 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.

Research question two: 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 2 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 results 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 a 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 does not influence the extent

Table 3. t-test analysis of the extent institutional type influences mathematics lecturers' application of subject oriented ICT competencies in mathematics instruction.

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

mathematics lecturers apply subject-oriented ICT competency in mathematics instruction in tertiary institutions in Cross River State.

Research hypothesis (H_{01}): Institutional type (universities and colleges of education) does not have any significant influence on the extent mathematics lecturers apply subject oriented ICT competencies in mathematics instruction

The result in Table 3 showed the t-test analysis of the extent institutional type influences 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 the 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 obtained. 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. The 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 subject oriented ICT competency in mathematics instruction in Cross River State. Hence, institutional type (universities and colleges of education) does not have any significant influence on the extent mathematics lecturers apply subject-oriented ICT competencies in mathematics instruction.

Summary of findings

From the data analysis and the interpretation of the results, the following findings emerged.

1. Mathematics lecturers in tertiary institutions in Cross River State apply subject oriented ICT competencies in mathematics instruction to a low extent.
2. Institutional type (universities and colleges of education) does not have any significant influence ($p>0.05$) on the extent mathematics lecturers apply subject oriented ICT competencies in mathematics instruction in Cross River State.

DISCUSSION

Research question one looked into how much subject-oriented ICT competency is used by mathematics lecturers

in colleges and universities to teach mathematics. The results showed that subject-oriented ICT competencies are not often applied by mathematics lecturers when teaching mathematics. This indicates a lack of competency on the part of mathematics lecturers in using ICT as a didactic tool in mathematics education, using digital devices during instruction, implementing cooperative learning strategies in mathematics using ICT, creating a virtual learning environment in mathematics education, encouraging ICT-based collaborative learning in mathematics education, assigning assignments to only the brightest students using specialized software, effectively using ICT to develop learners' ICT capability, involving parents in their children's mathematics education using ICT, and promoting learner autonomy by discouraging teacher-learner interaction and favouring online learning over factual knowledge of mathematics. This is consistent with the findings of Diri (2013) who found that subject-oriented ICT expertise is lacking in mathematics teachers. The results of this study also supported the findings of Rautopuro *et al.* (2006) who opined that technology use is more common than ICT integration into educational practice to improve teaching and learning. To improve student performance, math lecturers must progress in their use of ICT in the teaching and learning process.

The study also looked into how different types of institutions affect how much subject oriented ICT competencies are used in mathematics instruction by lecturers in tertiary institutions. The results indicate that the type of institution (college of education and university) does not influence how much subject oriented ICT competencies is used by mathematics lecturers at tertiary institutions. This suggests that subject oriented ICT competencies are used to the same extent in mathematics instruction by mathematics lecturers at universities and education colleges. Subject oriented ICT competencies are used sparingly in mathematics instruction in both universities and education colleges. These results contradict the findings of Onasanya *et al*. (2010) who claimed that ICT competencies and skills were higher among university lecturers than among college of education professors. It is concerning, therefore, that mathematics lecturers at universities and colleges of education lack sufficient expertise when it comes to using ICT to teach arithmetic. To enhance the ICT proficiency of lecturers, it is imperative to organize workshops, seminars, and in-service training programs. These initiatives will provide opportunities for lecturers to acquire new skills, stay updated with the latest technological advancements, and effectively integrate ICT into their teaching methodologies. By investing in professional development activities, educational institutions can ensure that lecturers are equipped with the necessary knowledge and expertise to effectively utilize ICT tools in their academic roles.

Conclusion

From the findings of this study, it could be seen that the use of subject-oriented ICT competencies in mathematics instruction is rather low among mathematics lecturers in Cross River State tertiary institutions. Therefore, the competencies of mathematics lecturers in the use of ICT in mathematics instruction must be improved. This is evident from the study's findings, which showed that lecturers' mean scores were assessed as having poor levels of competency in subject-oriented competencies. The majority of these ICT tools are utilized by mathematics lecturers, but they are not always applied wisely in mathematics lessons since mathematics lecturers are still learning how to use ICT effectively.

The study revealed also that institutional type (universities and colleges of education) does not have any significant influence on the extent mathematics lecturers apply ICT competencies in mathematics instruction in Cross River State. This suggests that to increase their competencies in using ICT in mathematics instruction, mathematics lecturers at universities and educational institutions should be exposed to ICT through workshops, seminars, and in-service training. For ICT to be integrated into mathematics instruction and other educational programs, all teacher preparation courses must incorporate components aimed at enhancing the ICT competencies of both educators and students. It is recommended that lecturers be assisted in acquiring ICT competencies and developing an interest in integrating ICT into their lectures through in-service training activities.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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