

Full Length Research Paper

Level of Utilization of Information and Communication Technology (ICT) Tools for Teaching and Learning Mathematics in Senior Secondary Schools in Kano Municipal Education Zone, Kano State, Nigeria

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Received 30 July 2020; Accepted 20 August, 2020

ABSTRACT: This study investigated the assessment of Teachers' and Students' level of utilization of ICT tools for teaching and learning Mathematics in Kano municipal education zone, Kano state, Nigeria. The study was of a survey carried out on Mathematics teachers in senior secondary schools in the zone. A total of 170 students and 50 Mathematics teachers were studied using a questionnaire survey. The data gathered were analyzed using simple percentages and Chi-Square statistics analyses. The findings revealed

Mathematics teachers and students utilized ICT tools for teaching and learning Mathematics. It was recommended that seminars/workshops should be organized for Mathematics teachers on how to and the benefits ICT tools utilization.

Keywords: Information and Communication Technology (ICT), Integration, Teaching Learning, Mathematics, Utilization, ICT tools

INTRODUCTION

In today's global economy and competitive environment, Information Communication Technology (ICT) is becoming a widely accepted tool for multi-faceted development in all fields. In view of the flexible services it offers, the new digital technologies offer the potential to revolutionize the traditional education system. There is the need to produce technologically literate workforce with positive disposition to technology use and reasonable competency of performing in a borderless knowledge based economy.

According to UNESCO (2002) cited in Owhotu (2006), ICT is a term used to describe the tools and the processes to access, retrieve, store, organize, manipulate, produce, present and exchange information by electronic and other automated means. These means include hardware, software and telecommunication in the form of personal computers, scanners, digital cameras, phones, faxes, modems, CD and DVD (digital view disc), players and records, digitalized video, radio and TV programs and multimedia programs.

Information and Communication Technology (ICT) is an instrument par excellence that a nation can rely upon to bring about self-reliance in an educational system. Therefore, there is the need to integrate ICT into teaching and learning.

Mathematics is one of the most important core subjects offered at the primary and secondary school levels of Nigeria educational system. It is of great usefulness to every human being and to the economic growth of any nation. As stated in the National Curriculum for secondary schools of the Federal Ministry of Education (FRN, 2013), the aims and objectives of Mathematics teaching at this level of education are; to help develop further conceptual and manipulative skills and their applications; to provide an intermediate course of study and meet the needs of potential mathematicians, engineers, scientists and other professionals, such as businessmen, administrators and architectures.

Background of the study

“Technology has been shown to positively influence student learning when students explore technology-rich tasks that simultaneously require them to use higher-order thinking skills (HOTS), such as analyzing or evaluating information or creating new representations of knowledge” (Polly, 2011). Information and communication technologies (ICT), is to convey a vast amount of information in a very short period of time. “Classes with online learning, whether completely online or blended, on average produce stronger learning outcomes than learning face-to-face alone” (Underwood, 2009). Information and Communication Technologies (ICTs) have impacted greatly on teaching, learning, research, and school management in a number of ways. They are electronic technologies used for accessing, processing, gathering, manipulating and presenting or communicating information. It encompasses software, hardware, and even the connectivity (Anderson and Baskin, 2002).

The field of education has been affected by Information and Communication Technology, and which in turn has undoubtedly affected teaching, learning and research (Yusuf, 2005). UNESCO (2011) also submitted that teachers need to use teaching methods which are appropriate for acquiring needed knowledge in particular societies. Students are not only to acquire an in-depth knowledge of their school subjects but also to understand how they can generate new knowledge, using information and communication technology (ICT) as a tool (Sanmi, 2016)

Information and Communication Technology (ICT) is a tool that comprise of electronic devices which are utilized for the information and communication needs of institutions, organizations, students and individuals.

Such electronic devices include computers (software and hardware), networking, telephones, videos, multimedia and internet (Nwakundo and Nwakundo 2006). The use of information and communication technology (ICT) creates a powerful learning environment and it transforms the learning and teaching processes in which students deal with knowledge in an active, self-directed and constructive ways (Volman and Van Eck, 2001). ICT is not just regarded as a tool, which can be added to or used as a replacement of existing teaching methods, but seen as an important instrument used to support new ways of teaching and learning. It should be used to develop students’ skills for communication, problem solving and lifelong learning of Mathematics (Vogt, 2003).

When ICTs are employed in education given the right condition, they can accelerate, enrich, and deepen basic skills in reading, writing, Mathematics and the sciences, and they can motivate and engage students to learn as they become more independent and responsible for their learning. Furthermore, ICTs help to relate academics to the practices of today’s work. Information and communication technologies, especially network technologies have been found to encourage active learning, support innovative teaching, reduce the isolation of teachers, and encourage teachers and students to become active researchers and learners. They can also strengthen teaching through the provision of powerful tools to teachers. Other derivable benefits of ICT integration in education are enumerated as follows. First, ICTs can assist in reducing teachers’ workloads through its use for lesson preparation and worksheet, writing students’ report and individual education plan, collating and analyzing students’ attainment information for target setting; recording and analyzing attendance and disciplinary information, and maintaining link between the school and parent to ensure parental involvement in school activities (British Educational Communications and Technology Agency, BECTA, 2004). Second, it can be used in getting necessary instructional content of subjects, and collaboration can be ensured with teachers globally. In addition, teachers can also have up to date knowledge of a subject area.

Third, ICTs can assist in teachers’ development, for instance, the Internet. In the context of teachers’ development e-learning can be used for both initial and continuing development through courses, workshops, and other activities, formal and informal, where students and practicing teachers learn about integrating ICTs across curriculum to support learning. There are several global gateways of on-line resources to support teachers’ development. These include: ICTs in Education, developed by UNESO, Paris; Education Network of Australia, developed by Education Institute, Adelaide; Institute of Education Technologies in Education, developed by UNESCO, Moscow; and so on. These portals provide opportunities for users to ask questions,

post materials, and submit assignments (Anderson, 2004). Also, ICTs will shift focus from teacher-centered to student-centered learning, where learners are active participants in the learning process, produce and share knowledge, and participate and learn in collaboration with others. Thus, teachers become learning facilitator, collaborator, coach, mentor, knowledge navigator, and co-learner and not a dispenser of knowledge. In addition, ICT can be multi-media for instructional delivery. Instructional content can be delivered in textual, audio, visual, and audio-visual forms. Thus, equity can be ensured for all categories of learners (disabled, geographically disadvantaged, those who cannot attend regular school, etc.).

In the same vein, Information and Communication Technology (ICT) is often perceived as a catalyst for changes in teaching styles, learning approaches and access to information (Watson, 2005). The use of ICT has changed the conventional ways of learning and proposes the need to rethink education in terms of a more current context (White, 2010). Further, Casal, (2007) submitted that ICT can help by providing alternative possibilities for education. Also Guzel, (2011) concluded that the effectiveness of the use of computer through the teaching process has contributed to the teaching of Mathematics. Therefore, there is the need for the Mathematics teachers and students to familiarize and acquaint themselves with ICT tools to enhance effective teaching and learning of the subject. Teaching is becoming one of the most challenging professions due to rapid expansion of knowledge which requires modern technologies that necessitate the use of ICT. ICT has become within a short time one of the basic building blocks of a modern society. Many countries now regard the understanding of ICT and the mastering of its basic concepts as part of the core of teaching and learning process of education (UNESCO, 2002). In this study, learning refers to the process whereby learners acquire and master knowledge and skills imparted in them by the instructor through interaction with ICT tools in relation to their academic performance and application of the acquired skills and knowledge.

Statement of the Problem

The importance of Mathematics as a compulsory subject at the senior secondary school level cannot be overemphasized. Despite the importance of Mathematics to the development of the nation, the achievements of students have remained consistently poor over the years (Eze, 2003; Betiku, 2003; Aprerbo, 2003). The use of ICT tools has captured the attention of the education community to enhance teaching and learning of Mathematics, and also has the capability not only of engaging students in instructional activities to increase

their learning, but of helping them to solve complex problems in Mathematics to enhance their cognitive skills (Jonassen and Reeves, 1996). Numerous teaching strategies have been developed by experts to respond to the problem of students' poor performance in Mathematics. One of such strategies is the use of ICT (Adeyemo, 2010), which have now detracted from teaching and learning due to so many reasons such as insufficient and limited access to computer hardware and computer software, sufficient time in the school timetable to involve students in using ICT for learning Mathematics, lack of opportunities for teachers on ICT training and teachers' lack of knowledge in integrating ICT into teaching and learning to enhance performance and innovation in curriculum development.

However, Gao et al., (2011) suggested that, the integration of ICT into teaching Mathematics depends on individual teacher's confidence and competence. Research findings have indicated that lack of teachers' confidence prevents teachers from using ICT in their teaching (Peeraer and Van Petegem, 2011). In the same vein, Snoeyink and Ertmer (2002) argued that; lack of computers, lack of quality software, lack of time, technical problems, teachers' attitudes towards computers, poor funding, lack of teacher confidence, resistance to change, poor administrative support, lack of computer skill, poor fit of curriculum, scheduling difficulties, poor training opportunities, and lack of vision as to how to integrate ICT into classroom instruction. Straub (2009) reported that for the use of ICT tools in teaching and learning to remain sustained, personal factors such as teacher's skills, knowledge, competencies, readiness characteristics of the love for innovations and the influences of individual's context should never be ignored as part of the planning process. Straub (2009) that ICT is very good if fully integrated in Mathematics class; and it can improve students' academic achievements in Mathematics. Furthermore, it has been proved that new technologies have lots of benefits on the students. Based on these various importance of ICT tools in teaching and learning of Mathematics, hence, the study assessed teachers' and students' level of utilization of ICT tools for teaching and learning Mathematics in Kano municipal education zone, Nigeria.

Purpose of the study

The main purpose of the study is to assess teachers' and students' level of utilization of ICT tools for teaching and learning Mathematics in Kano municipal education zone, Nigeria. Specifically, the study examined the level of:

- (i) Mathematics teachers' utilization of the ICT tools.
- (ii) Students' utilization of the ICT tools.
- (iii) Competency of Mathematics teachers' utilization of

ICT tools.

(vi) Competency students' utilization of ICT tools. As well as the influence of

(v) Mathematics teachers' gender on the utilization of ICT tools.

(vi) Students' gender on the utilization of ICT tools.

Research questions

The following questions were raised for the study and answered:

(i) What is the level of Mathematics teachers' utilization of ICT tools?

(ii) What is the level of students' utilization of ICT tools?

(iii) What is the level of competency of Mathematics teachers' utilization of ICT tools?

(iv) What is the level of competency of students' utilization of ICT tools?

(v) Does the gender of Mathematics teachers influence their level of utilization of ICT tools?

Hypotheses

Based on the research questions raised and answered the following hypotheses were formulated and tested in the study:

Ho₁: There is no significant difference in the level of utilization of ICT tools by male and female Mathematics students in Kano municipal education zone, Nigeria.

Ho₂: There is no significant difference in the level of utilization of ICT tools by male and female Mathematics teachers in Kano municipal education zone, Nigeria.

Conceptual Framework/Literature Review

This work is anchored, in parts, around Nada, (2015) model. This model hinges on the evaluation of instructional materials where the evaluator(s) follow the ADDIE phases which are Analysis, Design, Development, Implementation and Evaluation. Briefly, these phases stand for:

(a) Analysis-The researcher here is interested in basically the following: analysis of the learners, prepare an instructional analysis, create instructional goals and analysis learning objectives.

(b) Design-The researcher evolves and focuses on designing assessment for topic, selecting a form of the course as well as coming up with own instructional strategy.

(c) Development-the instructional designer integrate the

engineering with the educational settings

(d) Implementation- in this phase plans are put into action. This where the instructors are trained, learners are prepared, learning environment is organized

(e) Evaluation- Here all the phase are assessed to ensure that meets the needs of the learners.

This study emphasized the need to assess whether or not ICT tools are effectively utilized in our Senior Secondary Schools. This seems to fit into the "evaluation phase" of the ADDIE model. Onasanya et al. (2011) in their study of teacher's awareness and extent of utilization of information communication technologies for effective science and health education in Oyo state, Nigeria. Their findings show that the level of their utilization of ICT resources for teaching science and health education was found to be very low and there exists a significant difference between the male and female science teachers in their level of utilization of ICTs, with the male out-performing their female counterparts with higher mean scores. This implies that there is low utilization of ICTs resources for teaching science and health education in Oyo state, Nigeria. Bala (2019) in research thesis titled; the Impact of Information and Communication Technology in Education: a case study of Federal College of Education Kano, Nigeria. This study therefore sought to find out teachers' and students' level of utilization of ICT tools for teaching and learning Mathematics in Kano municipal education zone, Kano state Nigeria

METHODOLOGY

This study used a survey research method to investigate the level of utilization of ICT tools. Prior to the work, two research assistants were briefed on how to distribute and collect the questionnaires. The research instrument used has twenty-six (26) questions and based on Likert four point scales apart from Section A which contains four (4) questions relating to basic information on the respondents.

Research design

The study was of the survey type. In a survey research, information is obtained from the respondents and is used to describe the population. This is a survey research because information was obtained from respondents to describe them with regards to their level of utilization of ICT tools for teaching and learning Mathematics.

Population

The population for the study comprised of all senior secondary schools' Mathematics teachers and students

in Kano municipal education zone, the target population consisted of four hundred and fifty seven (457) Mathematics teachers and ninety seven thousands five hundred and twenty four (97,524) students in senior secondary schools in the zone.(source: Record and planning office – Kano municipal education zone.)

Sample

A total number of fifty (50) Mathematics teachers and one hundred and seventy (170) senior secondary school students were randomly selected from senior secondary schools in Kano municipal education zone.

Sampling technique

Purposive random sampling technique was used in selecting the research samples from the population, so that no member has more chance of being selected than any other member of the population.

Research instrument

The instrument used for the study was researchers-designed questionnaire namely (The questionnaire to assess the Level of Utilization of Information and Communication Technology (ICT) Tools for Teaching and Learning Mathematics in Senior Secondary Schools in Kano Municipal Education Zone, Kano State, Nigeria). In This study, questionnaire was administered on the Mathematics teachers and students.

Validity

The instrument used for data collection was researchers-designed questionnaire and was validated by three (3) Mathematics educators, two (2) ICT experts and an English language expert all from the Kano municipal education zone, Kano state Nigeria.

Reliability

Test re-test method was used to determine the reliability of the instrument. A reliability coefficient of 0.78 was obtained using Pearson Product Moment Correlation (PPMC) at 0.05 level of significance.

Data analysis technique

The data collected from the questionnaire's responses were tabulated in form of tables' analysed using

percentage. Percentages were used because they are a useful statistic for describing information about people, events or situations. Percentages are particularly useful in describing the characteristics of two or more groups of people or objects where the numbers of people or objects in the groups are different. Statistical means were also used to calculate questions 1 to 4 and chi-square was to test the null hypotheses in questions 5 and 6.

DISCUSSION

The demographic information revealed that 170 senior secondary school students participated in the study that comprised of 91 female and 79 male students. The female students participated more in the study with 91 representing 53.5% while their male counterpart was 79 representing 46.5%. Fifty (50) Mathematics teachers participated in the study comprised of 26 (52.0%) female and 24 (48.0%) male teachers. Out of 50 teachers involved in this study, 31(62%) were qualified which constitute majority of the respondents while 19 (38%) fell in the category of not qualified and the (Table 1) also indicates that most of the teachers were either less experienced or moderately experienced with 42% (21) and 32% (16) Mathematics teachers respectively, while the highly experienced Mathematics teachers constitute 26% (13) respectively.

Research Question 1: What is the level of Mathematics teachers' utilization of ICT tools?

Table 2 shows the distribution of the Mathematics teachers' responses and their mean levels of utilization ICT tools. The result indicate that a substantial proportion of Mathematics teachers frequently utilized ICT tools for teaching Mathematics as by 20 (40%) of the respondents and mean of 1.86. Also, it was revealed that 16(32%) of Mathematics teachers rarely utilized ICT tools with responses and the mean of 1.87 and most of Mathematics teachers do not utilized ICT tools for teaching Mathematics as the frequency for these responses was 14(28%) with the of 1.88. this is in line with the findings of Onasanya et al. (2011).

Research Question 2: What is the level of students' utilization of ICT tools?

Table 2 also shows that students rarely utilized ICT tools for learning Mathematics as indicated by 58(34.1%) of the respondents and mean of 2.01. Also, it was revealed that 57(33.5%) students frequently utilized ICT tools with the mean 2.03 and some of the students do not utilized ICT tools for learning Mathematics as these responses

Table 1: Demography of teachers and students based on gender, experience and qualification.

	Gender	Respondents	Percentage (%)
Teacher's Gender	Male	24	48.0
	Female	26	52.0
Student's Gender	Male	79	46.5
	Female	91	53.5

Table 2: Distribution of the Mathematics teachers 'and students' responses and their mean levels of utilization ICT tools.

Utilization	No. of teachers	Percentage (%)	Mean	No. of Students	Percentage (%)	Mean
Frequently Used	20	40.0	1.86	57	33.5	2.03
Rarely Used	14	28.0	1.88	58	34.1	2.01
Not Used	16	32.0	1.87	55	32.4	2.05
Total	50	100.0	5.61	170	100.0	6.09

Table 3: Distribution of the Mathematics teachers' and students' responses and their mean levels of competency in using ICT tools.

Level of Competency	No. of teachers	Percentage (%)	Mean	No. of Students	Percentage (%)	Mean
Highly Skilled	13	26.0	1.82	54	31.8	1.98
Skilled	16	32.0	1.81	57	33.5	1.96
Not Skilled	21	42.0	1.80	59	34.7	1.94
Total	50	100.0	5.43	170	100.0	5.88

had lowest frequency of 55(32.4%) respondents with the highest mean of 2.05. this also agreed with the findings of Onasanya et al. (2011).

Mathematics with mean of 1.82. this agree with the findings of Bala (2019)

Research Question 3: What is the level of competency of Mathematics teachers' utilization of ICT tools?

Table 3 shows that 21(42%) of Mathematics teachers were Not Skilled in the use of Information and Communication Technology (ICT) tools for teaching Mathematics. Also, it was revealed that 16(32%) of Mathematics teachers were skilled in the use of ICT tools with the mean of 1.81 and 13(26%) of the teachers were Highly Skilled in utilization of ICT tools for teaching

Research Question 4: What is the level of competency of students' utilization of ICT tools?

Table 3 also shows that 54(31.8%) of the students were Not Skilled in the use of Information and Communication Technology (ICT) tools for learning Mathematics as indicated by their responses. Also, it was revealed that 57(33.5%) of the students were Skilled in the use of ICT tools with the mean of 1.96 and 59(34.7%) of Mathematics teachers were Highly Skilled in ICT tools utilization with mean of 1.98. This also agree with the findings of Bala (2019).

Table 4. Chi-square analysis of students' and teachers' levels of utilization of ICT Tools based on Gender.

Gender	Frequently Used	Rarely Used	Not Used	Total	χ^2	df	Sig. value	Remark
	Students'							
	Observed	(Expected)						
Male	25(22.3)	24(20.4)	30(36.2)	79	3.304	2	0.402	NS
Female	23(25.7)	20(23.6)	48(41.8)	81				
Teachers'								
Male	4(6.2)	14(11.5)	6(6.2)	24	2.149	2	0.447	NS
Female	9(6.8)	10(12.5)	7(6.8)	26				

Research Question 5: What is the influence of Mathematics students' gender on the utilization of ICT tools?

To answer Question 5, a Chi-square test was carried out to test the null hypothesis that "there is no significant difference in the level of utilization of ICT tools by male and female Mathematics students in Kano municipal education zone, Nigeria. The results of the test are presented in (Table 4). The results indicated that there is no significant difference in the level of utilization of ICT tools by male and female Mathematics students, because the p-value (0.401) is greater than 0.05 level of significance. Therefore, the hypothesis was not rejected. This therefore means that gender does not have influence on the students' level of utilization of Information and Communication Technology tools for learning Mathematics. This disagreed with Onasanya et al. (2011). To answer Question 6, a Chi-square test was carried out to test the null hypothesis that "there is no significant difference in the level of utilization of ICT tools by male and female Mathematics teachers in Kano municipal education zone, Nigeria". The results of the test are presented in (Table 4). The results indicated that there was no significant difference in the level of utilization of ICT tool by Mathematics teachers based on gender. This is because the p-value (0.447) is greater than 0.05 level of significance. Therefore, the hypothesis was not rejected. This therefore means that gender does not influence Mathematics teachers' level of utilization of Information and Communication Technology tools for teaching Mathematics. This disagreed with Onasanya et al. (2011).

Discussion

The purpose of this study was to ascertain the level of utilization of information and communication technology (ICT) tools for teaching and learning Mathematics in senior secondary schools. It was found that 68% of the teachers and 67.6% of the students used in this study agreed that they use I.C.T. tools in teaching /learning of

Mathematics in senior secondary schools. This is in line with the calls for the use of I c t tools in the teaching of the subject by many mathematicians/Mathematics educators globally, such as, Onasanya et al. The finding is also in line with the assertion of Hennessey, Ruthven and Brindley (2005) that teacher's commitment to use technology is closely related to "recognizing the educational value and believing in the transformative potential of the technology (p.185)". Using ICT tools is definitely essential in Mathematics teaching-learning process. However, the level of Mathematics teachers' competence is vital. In research, it was revealed that 42% and 59% of the teachers and students respectively used in the study are not competent in handling ICT tools which is also in line the argument of the likes of Bala (2019). Results also showed that gender does not significantly affect the level of utilization of ICT tools in the Mathematics teaching-learning process in line with the likes of Onasanya et al. (2011).

Conclusion

It was encouraging to find that ICT tools are available in the schools used for this research. Equally important is the fact that ICT tools are available in the schools used. However, it is disheartening to see a fair percentage of the respondents are very competent in using the ICT tools. This serves as a barrier for effective use ICT tools. Thus, the need to train and retrain teachers and students on effect use of ICT tools in our senior secondary schools.

Recommendations

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

- The educational resource centers should join hand with state Ministries of Education to create awareness about ICT tools and their usefulness to both teachers and students. Also, both parties should organize workshops and seminars for in-service teachers irrespective of their

gender, experience and qualification on the application of ICT tools for effective delivery of instructions.

(b) Teachers should communicate and utilize some ICT tools effectively with their students to extricate fear that may show up amongst them.

(c) The government should properly encourage the teachers by providing them ICT tools, monetary and non-monetary benefits to enable them put in more effort and increase their efficacy in teaching Mathematics with the technology.

(d) Urgent training and retraining of both the teachers and students on how to use the available ICT tools.

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