Assessment of Availability, Teachers' Proficiency and Challenges of ICT Integration in Teaching Secondary School Mathematics and Science in Bauchi State, Nigeria

[1]Dogo, P., [1]Tyoor, I.T., [1]Joseph, M., [2]Sulai, E. I., [3]Huseyn, G. and [3]Samaila, Y. D.
[1]Science Education Department, Faculty of Education, Federal University, Kashere, Nigeria
[2]Mathematics Unit, SBRS, Gombe State University
[3]Science Laboratory Technology Department, School of Science and Technology,
Abubakar Tatari Ali Polytechnic, Bauchi
Email: talk2peterdogo@yahoo.com'(07087284916)

Abstract
The study assesses status of integration of Information and Communication Technologies (ICT) in teaching mathematics and science at Public Senior Secondary School in Bauchi Central Educational zone of Bauchi State, Nigeria. The study was aimed to; find out types of available ICT facilities for teaching mathematics and science; establish teacher's proficiency level of integration of ICT in teaching and learning of Mathematics and Science, and establish challenges faced in the integration of ICT facilities for teaching mathematics and science, Descriptive research design was used for the study. Non Proportional and Purposeful sampling were used for choosing fifty (50) teachers who formed the sample of the study. The sample size was taken from a target population of 250 (20%) mathematics and science teachers. Two instruments were used for data collection. Included were structured and open ended questionnaires and interviews. Data were analyzed using descriptive statistics. Findings revealed high percentage of teacher's response on the availability of ICT facilities in the study schools, included were white board (74.5 %), laptops (68.6%), printers (56.9%), computer device (50.9%), smart board (50.1 %) and projectors (49.0%). Half (51.0%) of teachers reported internet service and scanning machine not functional. Few teachers (15.7%) reported computers and printers (11.7 %) not functional. Majority (44%) of mathematics and science teachers have a fair knowledge of using ICT facilities to present lesson. Result revealed teachers lack of workshop/seminar on ICT integration (88.2%), students' ratio to ICT facilities (computers) (86.3%) and lack of time for teachers (58.6%) using ICT during lesson were major challenges. The implication of the study is that effective ICT integration can only be actualized if new initiatives are taken. Thus the study recommended that Mathematics and science teachers should be engaged on professional development training with emphasis on ICT integration in the classroom situation. Stake holders in education sectors and school administrators most ensure effective functions of available ICT facilities in secondary schools.
Keywords: ICT, Integration, Schools, Teaching and Learning Mathematics and Science.

Introduction
The world is becoming a global village as a result of the revolution in Information and Communication Technology (ICT). ICT is impacting and changing all aspects of human life. This impact cannot be ignored but should be integrated in areas of studies such as Science, Technology, Engineering and Mathematics (STEM). Thus the need for teachers who are adequately prepared to teach mathematics and science curriculum cannot be over emphasized (Ngeze, 2017). This is because teachers influence learning outcomes and therefore one way a society can move

forward is to build its human capital through the use of ICT. ICT is viewed as an important tool to support and facilitate new ways of teaching and learning mathematics and science globally (Kennedy &Odell, 2014).

ICT use improves the way science and mathematics is taught and enhances students' understanding of basic concepts of science and mathematics. The use of ICT in teaching, presents a paradigm shift from a teacher centered to a learner-centered, from individual learning to collaborative learning, and from a teacher as a source of knowledge to a learner as source of knowledge. The ability to harness ICT in the design of the classrooms learning can have an impact in the engagement of students in the learning of science and mathematics, by creating more options for learners to connect technology with course content (Abubakar etal, 2020)

In Cyprus for example, a study on effective practice of ICT integration in education revealed that teachers have demonstrated their willingness to integrate ICT in their teaching practice. Such initiatives were perceived by teachers as a step toward improving their pedagogical content knowledge. The same study further revealed several factors as perceive by teachers that hinder their level of ICT integration in the classroom situation. Such factors among others includes; lack of time, ill structured design curriculum, lack of infrastructures and tools to better support teachers and learners (Charalambos, 2010),

In Kenya a study on opportunities and challenges of ICT integration for learning mathematics and science in schools revealed that, effective use of ICT in teaching motivates both teachers and students (Shela, et al 2018). The same study found that the major challenge students experienced was lack of Technical know-how from their teachers resulting into limited thinking and lack of reasoning.

In Tanzania, a similar study on ICT integration in teaching and learning in secondary schools found that, the number of computers and other ICT facilities did not tally with number of learners (Ngeze, 2017). Thus the successes behind the integration of ICT in learning depend adequately on teachers' preparation and readiness.

In Nigeria, the policy for integration of ICT in the classroom situation has already been adopted and applied by mathematics and science teachers (Avbarefe, 2021). This has been due to the role of ICT in the modern world (Adanma, 2014). A policy for admission into tertiary institutions in Nigeria require candidates possess ICT skills, hence the need for teachers to integrate ICT in teaching and learning in the classroom (Abubakar, 2014). Despite the demand needed in the usage of ICT in classroom practice, mathematics and science teachers in Nigeria still face so many challenges. Ihechukwu (2016) on a study on impediment to integration of ICT in teaching and learning of mathematics found that series of factors hinder the full integration of ICT in secondary schools. Factors identified were, lack of teachers competent and confidence, negative attitudes among teachers and inadequate ICT personnel,

Ihechukwu (2016) further opines that, lack of ICT knowledge by teachers make them feel anxious about using ICT in the classroom situation and thus lack of confidence to use in their teaching. The great success behind the integration of ICT in teaching of mathematics and science in secondary school is teachers' high proficiency level of ICT and the effective usage of ICT in the Nigerian secondary school classroom.

Statement of the Problem

At classroom teacher's knowledge of ICT can accelerate and improve their mythology in teaching mathematics and science. The integration of ICT in teaching and learning science and mathematics at secondary school level poses a lot of challenges to teachers. Major challenges are teachers' proficiency level, usage level and competency toward ICT integration (Shela, et al, 2018). In Nigeria, few (35.1%) secondary school teachers possess high level of awareness of country educational policy on ICT integration in classroom teaching (Adebowale & Dare, 2012). Abubakar etal (2020) in a study on assessment of teachers' utilization of power point usage for Mathematics Instructions in Senior Secondary Schools in Sokoto revealed that Majority of the respondents disagreed that they know how to

integrate PowerPoint in Mathematics instruction. Evidence to this view was also observed on a study on teacher's readiness for integration of ICT in teaching of biology in secondary schools in Bauchi state. Findings revealed that majority (56%) of teachers do not used use ICT integration in their lessons (Barde, 2017). Lack of use of ICT facilities by mathematics and science teachers during instruction may be connected to reasons such as lack of availability of ICT facilities, lack of teacher's proficiency of ICT integration and challenges faced by teachers, these call the study.

Objectives of the study

The study was guided by the followings;
1. To find out level of available of ICT facilities in teaching mathematics and science at senior secondary schools of Central Educational Zone, Bauchi State
2. To find out proficiency level of ICT integration among teachers in teaching mathematics and science at senior secondary schools in Central Educational Zone, Bauchi State.
3. To find out challenges based on frequencies for integration of ICT in teaching mathematics and science.

Research question

1. What is the level of availability ICT integration for teaching mathematics and science subjects in senior secondary school in Central Educational of Zone of Bauchi State?
2. What is teachers' proficiency level of ICT integration in teaching of mathematics and science at senior secondary schools in Central Educational Zone of Bauchi State?
3. What are challenges based on frequencies face by teachers in integration of ICT in teaching and learning of mathematics and science in Central Educational Zone of Bauchi State?

Methodology

The study employs descriptive survey as a research design. The design seeks to explain, describe and discuss some attributes on variables under study. The target population for the study was 250 mathematics and science teachers at senior secondary school levels from the study schools (MoE, 2018). Purposeful sampling was used to select 50 mathematics and science teachers from the study public secondary schools within the Central Educational of Bauchi State.

The schools selected were five boarding secondary schools within the same educational zone. Included were Government Girls College, Kafin Madaki (A). Government Girls College (B), Bauchi, Federal Government Girls Collage, Bauchi (C), General Hassan Usman Kasina Unity College (D) and Government Science Secondary School Dass (D). The selection of sample schools was based on school type (existing boarding schools), reasonable number of mathematics and science teachers as well as some kind of ICT infrastructure.

Sample Size

In each School there were ten (10) of qualified mathematics and science teachers. Teachers who were having their first degrees in areas mentioned above were selected and participated in the study. Thus the sample number of mathematics and science teachers used for the study was 50.

Data Collection

For the purpose of this study, researchers developed two research instruments, included were Mathematics and Science Teacher Questionnaires (MSTQ), Interviewed schedule. The instruments were pilot tested in Government Science College Dass, a school located in Bauchi Southern Educational Zone of the state, different from the study schools. Ten qualified mathematics and science teachers found at Senior Secondary in the school level were pilot tested.

The research instruments were validated by an ICT teacher and two lectures from the Department of Science Education, Federal University, Kashere, Gombe State. Thus a Chronbach Alpha coefficient was used to measure the reliability and the consistency of the research instrument (MSTQ) in three sections. Included were the reliability coefficient for items on availability of ICT

facilities (α = 0.76), the reliability coefficient for items on teachers' proficiency level (α = 0.72) and the reliability coefficient for items on challenges face by teachers in integration of ICT (α = 0.74).

Interviews

Interviews were conducted for four principals and eight Heads of department that were involved in the study, making a total of 12 teachers. Interview responses were meant to provide in-depth knowledge about data collected through the questionnaire. However, their opinion regarding technology integration in teaching, availability of ICT facilities in schools and challenges faced by teachers' use of technology in teaching in their school investigated.

Data Analysis

Data analyses were guided by both research objectives and the research questions. Data from the research instrument were coded and keyed into Statistical Package for Social Science (SPSS) computer package. Data were grouped and analysed into similar themes in line with research questions. Quantitative data were analysed using simple descriptive statistics (frequencies, percentages).

Results

Research question one: What ICT facilities are available and functional in teaching of mathematics and science subjects in senior secondary school in Central Educational of Zone of Bauchi? The research question was set in order to test the first objective in the study. Responses obtained from mathematics and science teachers were scored and obtained based on frequency count and percentages. Table 1 presented the result

Table 1: Percentage response of teachers on availability of ICT facilities for teaching mathematics and science

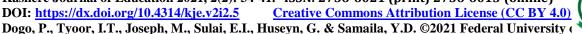| Items	Available		Not Available		Functional		Not Functional	
	F	%	F	%	F	%	F	%
Computer	30	58.9	8	15.7	5	9.7	8	15.7
Printer	29	56.9	6	11.7	6	11.7	10	9.6
Internet service	19	37.5	4	7.8	2	3.9	26	51.0
Laptop	25	49.0	10	19.6	10	19.6	6	11.7
Projector	35	68.6	2	3.9	2	3.9	12	23.5
Photocopying machine	8	15.7	25	49.0	4	7.8	14	27.5
Scanning machine	4	7.8	18	35.3	3	5.9	26	51.0
Smart Board	26	50.1	8	15.7	3	37.5	14	27.4
White Board	38	74.5	2	3.9	10	19.6	1	2.0

Source: (Field Survey, 2018)

Table1 indicated a significant and reasonable percentage of teachers reported on the availability of ICT facilities in the study schools. Included were white board (74.5 %), laptops (68.6%), printers (56.9%), computer device (50.9%), smart board (50.1 %) and projectors (49.0%) respectively. Further result indicated that, some ICT facilities found in the existing schools were not functional. More than half (51.0%) of teachers reported that internet service and scanning machine were not functional. Few teachers (15.7%) reported computers and printers (11.7 %) respectively

were not functional. Based on findings therefore most of the study schools have ICT facilities for integration in teaching of mathematics and science in secondary schools Bauchi central educational despite lack of internet service in most of the existing schools. Thus the need to improve internet service for effective integration of ICT facilities in mathematics and science classroom situation.

Question 2: What is the proficiency level of ICT integration in teaching mathematics and science among teachers at Senior Secondary

school in Educational Central zone of Bauchi State? The research question was set in order to test the second objective in the study. Mathematics and science teachers were required to rate their responses based on

knowledge levels as; Excellent, Good, Fair and poor. Responses were based on Frequency count, percentages were obtained, computed and recorded. Table 3 present the result.

Table2: Knowledge levels of ICT Integration possessed by Mathematics and Science Teachers

Statement	Excellent		Good		Fair		Poor	
	F	%	F	%	F	%	F	%
Given effective lesson using power point	10	20	15	29	22	44	4	07
Finding useful information from internet	9	18	15	30	10	20	17	32
Sustaining leaner's interest using Computers	9	18	17	33	10	19	15	30
Use of graphic software during lesson	5	05	15	30	18	35	13	25
Communicate my lesson using email	15	30	10	20	18	35	8	15
Access to ICT facilities for my lesson	5	10	11	21	12	24	23	45

Source: (Field Survey, 2018)

Table 3 indicated that majority (44%) of mathematics and science teachers have a fair knowledge of using power point for effective lesson presentation with few (7%) of the same teachers who have no knowledge of using power point for effective lesson presentation. Further result indicated that majority (32%) of teachers has no capability of sustaining learners interest using computers during lesson, however a good number of the same teachers has indicated good (33%) knowledge of using computer to sustain learners interest during lesson. On use of graphic software during lesson majority (35%) of teachers have a fair knowledge, with good number of teacher having good knowledge of using graphics software during lesson. Teachers who could not have the excellent knowledge were few (5%). Further result indicated that majority (45%) have poor knowledge of ICT due to their in ability to have access to ICT facilities, with

few (10%) who have excellent knowledge as a result of their ability to access ICT facilities.

The findings here revealed that most teachers from the study schools do not have excellent knowledge for effective integration of ICT in teaching and learning of mathematics and science at secondary school level, therefore teacher's proficiency of ICT integration is very low. Teachers need to acquire ICT skills as a way of improving their pedagogical content knowledge.

Question 3: What are challenges face by teachers on integration of ICT facilities in teaching and learning of mathematics and sciences? The research question three was set to test objective three.

Teachers were required to provide their responses based on items constructed. Their responses were rated as often, sometimes and never based on frequency count and percentages. Table 3 below presented the result.

Table3: Percentage responses of teachers on challenges of ICT integration in classroom (n = 51)

Statement	Often		Sometimes		Never	
	F	%	F	%	F	%
Teachers lack of ICT skills and knowledge	26	51.0	20	39.2	5	9.8
Lack of time for ICT during lesson	30	58.8	6	11.8	15	28.4
Insufficient infrastructure for ICT integration	41	80.3	7	13.7	3	5.9
Inconsistency in power supply	36	70.6	5	9.8	10	19.6
Lack of workshop/seminar on ICT integration	45	88.2	5	9.8	1	2.0
High level of students' ratio to ICT facilities	44	86.3	5	9.8	2	3.9
Lack of functional ICT facilities in schools.	38	74.5	14	27.5	9	17.6

Source: (Field Survey, 2018)

Table 3 indicated major challenges as often experience by mathematics and science teachers to include lack of workshop/ seminars on ICT integration (88.2%) compare to few (2.0%) who responded never as a challenge. Also high level of students' ratio to ICT facilities (86.3%) was often considered as a major challenge since few (5.7%) responded never as a challenge. Result also indicated insufficient infrastructure for ICT integration (80.3%) as often experience by both mathematics and science teachers since few (5.9%) never responded as a challenge.

Findings on inconsistency in power supply was often as reported by more than half (70.6 %) of teachers since few (19.6%) of the same teachers responded never. Similar challenges were observed as lack of time for ICT during lesson (58.8%) and teachers lack of ICT skills and knowledge (51.0%). Thus findings on challenges face by mathematics and science teachers from the study schools were highly observed as lack of workshops/seminars on ICT integration in classroom situation. Inconsistency in power supply was also a major challenge for effective integration of ICT facilities.

On interview responses for findings on availability of ICT facilities (table 1), the principal from one of the study schools revealed that ICT facilities exist in his school were computers, laptop, smart board and white board and yet lack internet service connection. Most of the HOD'S from the four schools confirmed that computer labs were mostly used by the IT experts to train students to acquire basic skills in computing and were not used for any other subject instruction. However, six out of twelve teachers pointed further that, the facility was available to all interested teachers (mainly after school) and not during school hour.

Despite availably of ICT facilities for teachers in the existing schools, interview responses from all heads of department (Mathematics and Science) indicated that most teachers only possess basic skills of ICT operation and computing without the basic skills of ICT integration in their subject areas. This is the reason why most science and mathematics teachers have a fair knowledge of ICT integration in the classroom situation as revealed in table 2 of our findings.

On challenges faced on ICT integration (Table 3) faced by teachers, one among the heads of department reputed that most of teachers who attained workshops/ seminars do not focus on the use of ICT as an instruction in class. He (HOD) further reported that most training have concentrated on how to help teachers get information on the internet and basic skills of operation and computing. According to him (HOD), the training programmed was not consistent and not timely. Thus the training is usually for newly employed teachers especially at the commencement of the academic calendar.

Discussions
The study assessed the status of integration of ICT facilities in teaching mathematics and science subjects at senior secondary school level in Bauchi State. Findings on availability of ICT facilities for teaching mathematics and science teachers indicated that, most ICT facilities in the existing schools were available , those found were white board (74.5 %), laptops (68.6%), printers (56.9%), computer device (50.9%), smart board (50.1 %) and projectors (49.0%) The finding is supported by Ngeze, (2017) in Tanzania who reported that, with the increase or provisions of ICT facilities in our secondary schools, teachers can be train and thus ICT integration in classroom would increase.

Findings on proficiency level of ICT by mathematics and science teachers in the study schools indicated few (20%) teachers have excellent knowledge of using power point during lesson compare to majority (44%) of them who have a fair knowledge. Similar result indicated few (5%) of teachers can use graphic software during lesson compare to majority (35.0%) of teachers who have fair knowledge of using graphic software. Findings also revealed that few teachers (30.0%) have a fair knowledge to communicate their lesson using email. The implication here is that most teachers lack the knowledge of using ICT facilities can hinder them from integrating of

ICT facilities in the classroom. This finding is supported by Ihechukwu (2016) who opines that lack ICT knowledge by teachers make them feel anxious and even frustrated about - using ICT in the classroom situation. The implication here is that teachers lack of knowledge affect the status of ICT integration. Further findings on challenges faced by teachers on integration of ICT in school revealed, challenges often faced by teacher include lack of workshop/ seminar (88.2%), high level of student's ratio (88.2%) and lack of time during lesson (58.8%). Similar result indicated inconsistency in power supply (70.6%) and Lack of functional ICT (74.5%). The study agreed with Charalambos (2010) in Cyprus in a study on effective practice of ICT integration in education revealed that, lack of infrastructures and tools to better support teachers and learners can hinder the effective integration of ICT in schools.

Conclusion
The outcome of this study revealed that the state of integration of ICT in teaching mathematics and science subjects in Bauchi state have not been fully conceptualize and integrated, since teacher's knowledge of ICT integration is very low and most of the training of teachers do not focus on their area of specialization but only aimed acquiring basic and computing skills. In consistence I power supply for ICT utilization was reported to often and thus slow down the ICT integration in classroom situation.

Recommendation
Based on the conclusion above, therefore it is recommended that;
1. The use of available ICT facilities should be emphasized by teachers of mathematics and science in the Nigerian secondary schools.
2. There is a need for special ICT laboratory facilities for mathematics and science
3. Teachers should be encouraged to be trained and attend seminar/ workshop on ICT skills acquisition.

4. Urgent step must be taken as the new approach remains best and new way of improving teacher pedagogy and enhancement of student's problem solving abilities in mathematics and science.

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