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RESEARCH ARTICLE

INFORMATION AND COMMUNICATION TECHNOLOGIES IN EDUCATION: AVAILABILITY AND UPTAKE IN YENAGOA METROPOLIS, BAYELSA STATE OF NIGERIA

***Ighedose, L. O. and Ighedose, U.A**

Planning & Statistics Unit, Federal Medical Centre Yenagoa, PMB 502, Yenagoa, Bayelsa State, Nigeria

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****Corresponding author:* *Ighedose, L. O.***

ABSTRACT

The importance of Information and Communication Technologies (ICT) has become so strong in contemporary times. A descriptive survey, the research assessed availability of ICT devices and uptake by teachers in secondary schools in Yenagoa metropolis and make recommendations.43 mathematics teachers were purposively selected for the study; data were collected by questionnaire that has a reliability co-efficient of 0.73 and structured interview. These were cross-tabulated and analyzed using descriptive statistics. Mean scores cum percentages were reported. $M = 1.5$ and $M = 3.0$ were preset as bases for rejection or non-rejection of computed mean scores for availability and uptake of a device respectively. More male respondents (77%) than female respondents (23%) and more mathematics teachers in private schools (60%) than in public schools (40%) were reported. There were more teachers with a University degree (79%) than those with lower qualification in the study. White board/markers and scientific calculators reported high availability ($M = 1.7$) and uptake ($M = 3.4$). Desk and laptop computers, mathematics game devices, audio-visual devices, as well as projector/screen ($M = 1.4$ & $M = 2.5$) reported poor availability and uptake respectively. Poor electricity supply, ICT illiteracy, over-crowded classrooms were found as challenges to uptake of ICT devices.

INTRODUCTION

Use of Information and Communication Technologies (ICT) has gained so much relevance. Although the development of ICT dates back to history of computers in the nineteenth century, lots of improvement took a quick successive turn. Early in the twentieth century, the growth of ICT took a dynamic turn. This was brought about by the expanded scope to which computers and computing were being applied. However, Woodford (2016) observed that it was in the last two decades of the twentieth century that computers were seen as great inventions. At the early stage which dates back to 500BC, computers were in the form of calculators for simple addition and subtraction and then for mathematical calculations which were later improved upon by subsequent scientists with the introduction of binary codes and later in the nineteenth century, a new branch of mathematics called the Boolean algebra (Woodford, 2016). It thus suffices that at the early stage, computers were limited to arithmetic calculations which received improvement to include word processing, data storage and retrieval. This era was hailed as it marked improvement on manual typewriters which lacked the features of data-saving and retrieval. Emphasis was on information technology as it aided the speed with which information were processed. Today, there is a hybrid concept which encompasses not only transmission of information at the speed of light, but also programme software and other features which are specially designed to aid teaching by creating and disseminating images, voice output, and illustration. The software and devices could be Internet, desktop and laptop computers, scientific calculators, palm tops, ipads, smart phones, and so on. The Internet has been acclaimed and it is defined as a means of connecting a computer to any other computer anywhere in the world via dedicated routers and servers(Online Business Dictionary, 2017). When two computers are connected over the Internet, they can send and receive all kinds of information such as text, graphics, voice output, video, and computer programs (Chukwudi In: Yoku, 2015). The Internet is seen as the computer super-high way which affords intra and international networking for worldwide sending and receiving of information by individuals, communities, business organizations, government and institutions including schools (Chukwudi In: Yoku, 2015). Experience has shown that Information Technologies got advanced with the addition of the communication variant occasioned by the desire to transmit information at much higher speed. Such method as telegraph was introduced and improved with the introduction of telefax machines that could transmit facsimile copy of the original from source to the destination intended by the sender. The transmission was made possible through the interaction of the sender's telefax device with the recipient's device.

As ICT devices, computers are very important as they can be used to aid effective teaching through features like the Visual Display Unit (VDU), the Central Processing Unit (CPU) which comprises Arithmetic and Logic Units and the various input and output devices. This helps for ease of complex calculations. Like the desk or laptop computers, scientific calculator is a special ICT device that comes with features to calculate Mean, Averages, Co-Signs, Square Roots, Errors Margins and other mathematical calculus in addition to carrying out basic additions, divisions, subtractions and multiplications. Thus, it is a special calculator with advanced mathematical functions and it is programmable and has trigonometric, logarithmic, and exponential functions (Online Oxford Living Dictionary). Students and teachers have found scientific calculators very useful as they are now a veritable instrument for processing a large amount of equations and mathematical problems to enhance students' understanding of mathematics. Scientific calculators have also been observed to be a graphing calculator which solves scientific problem, draw graph, perform addition, division, subtraction, and multiplication besides using it to handle exponents, logarithms, and trig functions (Sujoy, 2016; Brauer, 2016).

The introduction of projector has provided a gradual replacement for traditional chalkboard that the teacher struggles with daily by writing, cleaning and re-writing on it. A projector provides the students the opportunity to request the teacher to repeat a slide to enable them ask questions or take down notes; this opportunity is not so with the traditional chalkboard where information written on it is often wiped…projectors have advantages such as better use of teaching time, presentation enhancement, easy note-taking and teaching versatility (Whitetaker, 2001).

Audio-visual device is any device which can aid teaching; it takes different forms and has the capacity to capture audio and visuals, that is, image or video inputs and generate a signal which can be accessed by other devices; the devices may only record input in a storage device such as cameras, microphones, scanners, et cetera (Hindocha, 2016).

Having reviewed types of ICT devices being used by teachers, it suggests that ICT devices are important in improving students' understanding. The devices also have promises of enhancing a teacher's efficiency and make him or her more effective in delivery of educational materials to students. However, it is yet unclear to what extent ICT devices are available in education in Yenagoa metropolis, the State Capital of Bayelsa State of Nigeria and their uptake by teachers.

Objective of the study: To assess availability of ICT devices and uptake by mathematics teachers in secondary schools in Yenagoa metropolis, Bayelsa State of Nigeria and make recommendations based on research outcomes.

MATERIALS AND METHODS

Study design: The research is a descriptive survey. It described availability of ICT devices in education and uptake by mathematics teachers in secondary schools in Yenagoa metropolis, Nigeria. It engaged systematic collection of data through questionnaire.

Study population/setting: The study population was 43 mathematics teachers drawn from selected public and private secondary schools. The setting was limited to Yenagoa metropolis which is the Capital of Bayelsa State. Bayelsa State is one of the six South-South States of Nigeria. The State has common boundaries with Rivers and Delta State and is one of the foremost oil producing areas of the Niger Delta Area of the country.

Study instrument: The instrument for data collection was a self-designed questionnaire and structured interview. The questionnaire had an introductory part, demographic details, and the part that addressed the research questions. The questionnaire dwelt on availability of ICT devices in education and uptake by mathematics teachers in secondary schools. The questionnaire had the ranking options of 'Yes/No', 'Strongly agreed ', 'Agreed', 'Disagreed' and 'Strongly disagreed'.

Reliability of the Instrument: The instrument was first pre-tested using the test, re-test method. The questionnaire was first administered and then re-administered to the same set of respondents. The scores of both tests were correlated using the Pearson Product Moment Correlation Coefficient and 0.73 was reported. The pretest questionnaire was administered at Epie National High School, Yenagoa.

Procedure for data collection: Purposive technique was used in selecting the teachers for the study due to the low level of number of mathematics teachers' population. All teachers that were not mathematics teachers were excluded.

Data analysis: The data collated was analysed using MS Excel. Descriptive Statistics like percentages for the demographic characteristics, and arithmetic mean scores were calculated and reported on the research questions. A preset benchmark of M = 2.0 or M = 3.0 was used as the standard for rejection or non-rejection of a parameter given the observed range.

Ethical consideration: The consent of participating teachers were sought and received. This ensured credibility of data collected and their identities were kept confidential for every piece of information or data that they supplied during the course of the research.

Table 1. Demographic Male mathematics teacher respondents (77%) were more than female mathematics teacher respondents (23%) while private schools had more mathematics teachers (60%) than public schools (40%). Respondents (79%) had a minimum qualification of first degree while 21% had NCE and a qualification below it as their highest qualification in the study Table 2.

Table 2. Availability of ICT devices in education: Scientific Calculator (91%, M = 2.0) is the commonest available ICT device for teaching mathematics. This was followed by White Board Marker (79%, M = 1.8). Smart Phone reported 65% (M = 1.7) while Internet for Mathematical Solutions had 63% (M = 1.6). As shown, availability of Smart Phone nonetheless recorded a slightly higher mean than that reported against the Internet. Availability of ICT Laboratory had 51% (M = 1.5). On the other hand, availability of devices such as Desktop and Laptop Computers, Mathematics Game Device, Audio-Visual Devices, and Projector/Screen fell below the cut-off mean score of 1.5 Table 3.

Uptake of ICT devices by mathematics teachers: Majority of respondents (86%, M = 3.3) affirmed or agreed that they regularly use Scientific Calculator to teach mathematics. Second to this was the use of White Board/Markers (82%, M = 3.4). Use of Smart Phone (58%, M = 2.6) also reported acceptance.

It is observed that the use of White Board/Markers reported the highest acceptance with a Mean Score of 3.4 as against a Mean Score of 3.3 for Scientific Calculator. The use of other devices such as Desktop and Laptop Computers, Mathematics Game Device, Audio-Visual Devices, and Projector/Screen fell below the cut-off mean score of 2.5 in the study.

Table 1. Demographic Variables (N = 43)

	N (%)	N (%)	TOTAL
Sex	33(77)	10(23)	43
	Public (%)	Private (%)	TOTAL
Type of School	17(40)	26(60)	43
	JSS 1 – 3(%)	SSS 1 – 3(%)	TOTAL
Teahcers' Class	17(40)	26(60)	43
	NCE and below (%)	B.ED/SC & above (%)	TOTAL
Highest Qualification	9(21)	34(79)	43

Source: Field Survey

Table 2. Availability of ICT devices in education (N = 43)

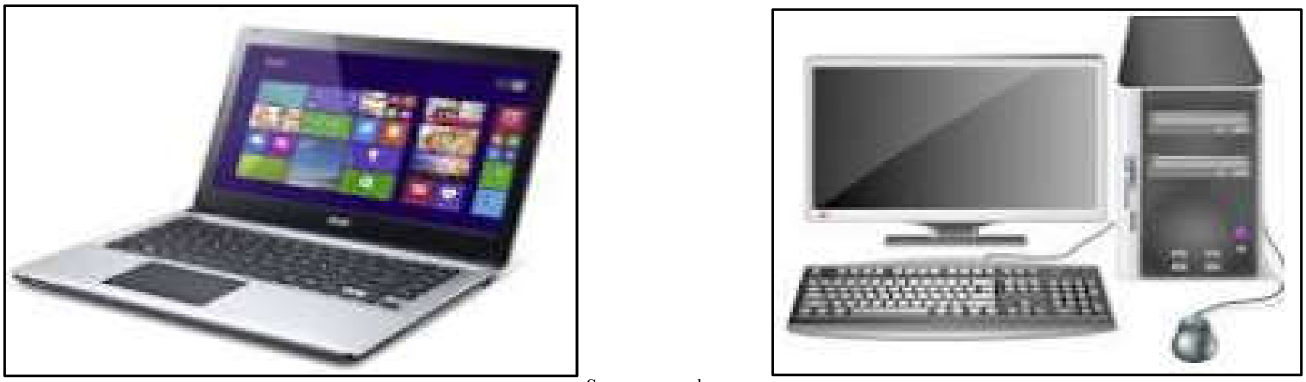
Categories	Yes (%)	No (%)	fx(Mean Score)	Ranked Decision
Desktop computer	14(33)	29(67)	1.3	Rejected
Laptop computer	19(44)	24(56)	1.4	Rejected
Internet for mathematical solutions	27(63)	16(37)	1.6	Accepted
Projector/Screen for Maths Info. Display	13(30)	30(70)	1.3	Rejected
Scientific Calculator	39(91)	4(9)	2.0	Accepted
Mathematics Gaming Devices	16(37)	27(63)	1.4	Rejected
Smart Phone	28(65)	15(35)	1.7	Accepted
Audio-Visual Device like Video Recorder	15(35)	28(65)	1.4	Rejected
White Board and Markers	34(79)	9(21)	1.8	Accepted
ICT Laboratory	22(51)	21(49)	1.5	Accepted

Decision key: Mean Score ≥ 1.5 (Accepted); Mean Score < 1.5 (Rejected)

Table 3. Uptake of ICT devices by mathematics teachers (N = 43)

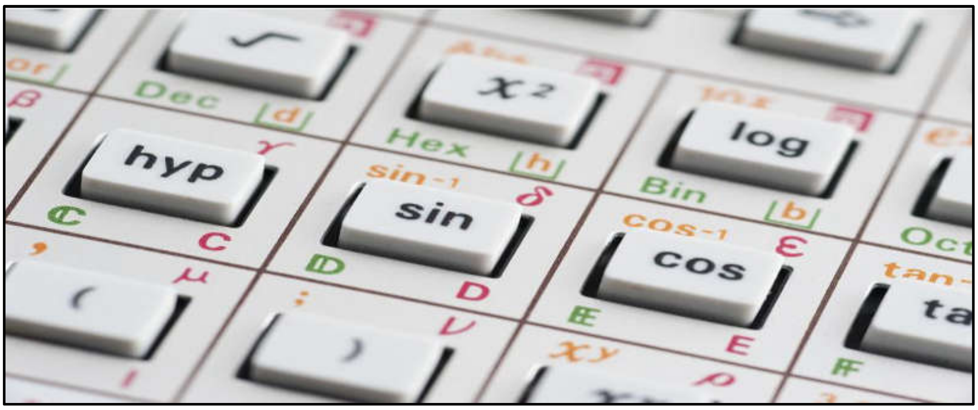
Categories	SA(%)	A(%)	D(%)	SD(%)	fx (Mean Score)	Ranked Decision
Desktop computer	7(16)	7(16)	11(26)	18(42)	2.1	Rejected
Laptop computer	10(23)	7(16)	8(19)	18(42)	2.2	Rejected
Projector/Screen for Maths Info. Display	7(16)	7(16)	10(24)	19(44)	2.1	Rejected
Scientific Calculator	25(58)	12(28)	2(5)	4(9)	3.3	Accepted
Mathematical Game Devices	10(23)	7(16)	8(19)	18(42)	2.2	Rejected
Smart Phone	13(30)	12(28)	4(9)	14(33)	2.6	Accepted
Audio-Visual Device like Video Recorder	9(21)	5(12)	10(23)	19(44)	2.1	Rejected
White Board and Markers	32(75)	3(7)	1(2)	7(16)	3.4	Accepted

Decision key: Mean Score ≥ 2.5 (Accepted); Mean Score < 2.5 (Rejected)



Sources: google.com.ng

Fig. 1. Picture of a Laptop (left) and Desktop (right) Computers



Source: http://www.freeimages.co.uk/galleries/workplace/office2/slides/calculator_trig_functions.htm

Fig. 2. Keypad of a Scientific Calculator

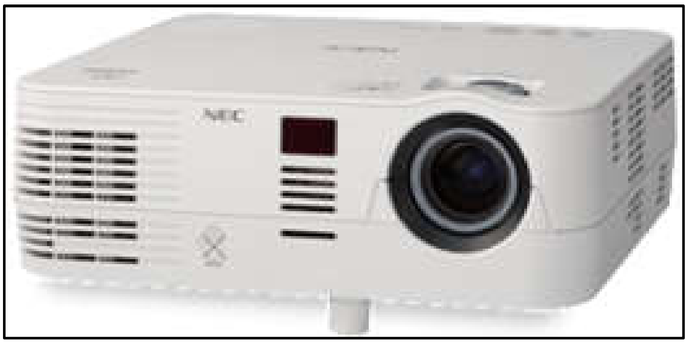


Fig. 3. Picture of a Projector

DISCUSSION

The study revealed more males than females in mathematics teaching profession. It suggests mathematics as male-dominated subject. Mathematics teachers with a University degree were found to have almost tripled the number of those with NCE and holders of lower qualifications as mathematics teachers. This seems to be a plus on the presumption that highly educated mathematics teachers means better handling of the subject.

More mathematics teachers were reported in private schools than in government-owned schools, suggesting a strong association with non-employment of teachers in the public school system in the recent past and possibly a reflection of scarcity of mathematics teachers in the study setting.

Study showed that scientific calculator was the commonest available ICT device and also the commonest in use. This could be due to the ease with which the device can be acquired and the central role it plays in mathematical calculations generally. The finding is supported by Woodford (2016) that calculators are of great importance to mathematical calculations with the introduction of binary codes and their simplicity of use. The study demonstrated high level of evidence on availability of ICT devices such as white board/markers, smart phones, and the Internet and ICT laboratory as well as their uses for teaching mathematics.

However, devices like laptops, desktop computers, projectors and mathematical game devices were in short supplies. There is therefore a linkage between low economic status of many teachers and their inability to afford these devices where the school authorities cannot provide. The implication is resulting to traditional mathematical tools to impact knowledge to the students. This finding has a firm root in Teach Thought Staff (2017) that found huge cost involvement in ICT acquisition and teachers' inability to harness time and resources as sources of disadvantages to the use of ICT devices in teaching.

Out of all the ICT devices enlisted in the study, white board/markers, scientific calculators and smart phones, etc were regularly used by teachers more than mathematical game devices, laptop and desktop computers, projectors and audio-visual devices as earlier reported. Widespread use of some ICT devices does not appear to be encouraged since greater majority of respondents laid emphasis on the use of white board markers and scientific calculators and de-emphasized the use of projectors, computers, mathematical game devices and the Internet which further justified the finding as reported by Teach Thought Staff (2017).

This study linked lack of training for teachers on ICT use and so, low literacy level among teachers in the use of ICT devices as an inhibitor to teachers' uptake of the devices for teaching mathematics. Other challenges identified were problem of over-crowded classrooms, inadequate ICT instructional materials, students' laziness from over-dependence on ICT, as well as ignorance and poor awareness on the benefits of ICT in teaching mathematics. This casts doubt on the relevance of universal applicability of a previous finding by Borba, Clarkson and Gadanidis (2012) which stated that evidence exists to support that the introduction of technologies into teaching has opened new approaches to teaching.

Educational implications of this research

The implication of this research to education is far-reaching. This is because the research has brought to the fore the level of availability of ICT devices, the extent to which these devices are being used and the effects they could possibly have on students. It also gives insight into what is obtainable in the developed countries of the world and how much the developing countries with inference from a State capital in Nigeria are lagging behind. Where some types of ICT devices were found to be in common use, it was discovered that certain basic requirements like electricity supply, ICT literacy level among teachers, and provision of certain basic devices were inadequate.

Thus, the implication of not remedying the observed lapses will reduce the quality of mathematics education to students and also reduce their versatility in an ICT environment. As it stands, the use of ICT devices in secondary schools in the study seems to come with mixed perception. However, there seems to be emerging trend towards improvement as time progresses.

Conclusion

This study reaffirms the important role of ICT devices in education. As found in literature review, the developed countries have gone many miles ahead and it is only advisable that the developing countries like Nigeria as represented in the study setting, brace up to ensure students are not disadvantaged. However, some inroads can be pin-pointed since ICT devices such as white board/markers and scientific calculators ($M = 1.7$ & $M = 3.4$) reported high availability and uptake respectively while desk and laptop computers, mathematics game devices, audio-visual devices, as well as projector/screen ($M = 1.4$ & $M = 2.5$) reported poor availability and uptake respectively.

Recommendation

- Government should attach more importance to the role of ICT devices in teaching, invest more in ICT equipment and train teachers and students through seminars and short courses.
- Since ICT is largely power-dependent, electricity supply to schools should be improved upon and boosted by provision of solar energy and inverters.
- The number of students in a class should be reduced to a manageable level to fall within the limit that teachers can manage through ICT devices.
- There should be early introduction of students to the use of ICT in learning mathematics from Junior Secondary School I.

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