TEACHERS' REFLECTION OF INFORMATION AND COMMUNICATION TECHNOLOGIES IN SECONDARY SCHOOL MATHEMATICS AND SCIENCE LESSONS DELIVERY IN NIGERIA

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Abstract

This study examined teachers' reflection of information and communication technologies in secondary school Mathematics and Science lessons delivery in Kwara state, Nigeria. The study employed a descriptive survey method. The population for the study comprised all public senior secondary schools in Kwara state. Four hundred and forty-eight Mathematics and Science teachers purposively selected from public senior secondary schools in South and Centre senatorial district of Kwara state were involved. The instrument for data collection was a researcher designed questionnaire with a test-retest reliability of 0.78. The data collected were analysed using frequency count, percentage and chi-square. Findings from the study shows that teachers without ICT knowledge find it difficult to integrate ICT knowledge to classrooms instruction delivery. Teachers also agreed that insufficient and unavailability of ICT facilities within the school hinders the use of ICT in classroom learning, thereby hindering the global exposure of the students to the technological advancement. The study recommended among others that training and retraining of teachers should be carried out at regular intervals through seminars, workshops, and conferences in order to facilitate the use of technology in the act of teaching and learning in Nigerian Schools.

Keywords: Information Communication Technology, Technological advancement, Teaching and learning delivery, Secondary schools in Kwara state

Introduction

The advancement of any nation is a function of the quality of education provided to her citizen especially in the area of Sciences and technology. However, there cannot be technological advancement without adequate knowledge of Mathematics and Science. This may account for the inclusion of Mathematics as a compulsory subject in Nigerian Secondary School Curriculum and why Science courses are given the highest priority when it comes to admission policies. (NPE 2013). As the society changes, a good teacher who wants positive changes in the lives of his/her learners must be able to use different technologies and tools to enhance their teaching and students' learning. There are many technological and tools that should be integrated in to teaching and learning process but the integration of these tools and technologies has been hampered by many challenges especially in developing countries like Nigeria.

According to Hennesssy & Scanlon (2001) Information communication technologies (ICTs) are technologies used to communicate and to create, manage and distribute

information. Such technologies include computers, the internet, telephone, television, radio and audio-visual equipment. However, this definition has been expanded to include any device and application used to access, manage, integrate, evaluate, create and communicate information and knowledge. These devices include but not limited to radio, television, cellular phones, computer hardware and software, network hardware and software, satellite systems, peripherals, connections to the internet, digital technologies and others. ICTs changes the way people live, learn and work. Technology tools and their applications have the capacity to increase the quality of people's lives by improving the effectiveness of teaching and learning, the productivity of industry and government and the well-being of nations. ICT literacy include being able to install and configure common software, familiar with and making use of computer modem regularly, ability to access computer bulletin board or online services. Others include ability to send and receive messages via electronic devices, uploading and downloading computer files with ease, and printing from computer and so on. (Olakulehin, 2007).

Also, Information communication technologies (ICTs) could be referred to as information handling tools that are used to produce, store, process, distribute and exchange information. Ogunsola (2005) described ICT as an electronic based system of information transmission, reception, processing and retrieval, which has drastically changed the way we think, the way we live and the environment in which we live. The use of ICT enhance students' deeper understanding of complex topics, concepts and it aids ability to recall information and use it to solve problems outside the classroom (Hennessy, 2000; Adeyemi & Olaleye, 2011).

The successful integration of ICTs in academic system depends largely on the competence derived from ICT literacy skills acquired over the time and on the attitude of teachers towards the role of modern technologies for teaching, learning and research purposes. Thus, teachers need to be confident in using ICT effectively for their teaching and research purposes.
The use of information communication technologies (ICTs) has been perceived by researchers such as (Ogundipe (2012); Adeoye and Popoola (2011)) as one of the major ways through which a teacher can foster effective learning in the learners.
Different types of technology can be used by teachers to support and enhance students' learning. These include; video content, handheld technologies, projectors, e-mails, interactive boards, internet facilities and so on. The kind of technologies to be adopted by teachers in the teaching process should depend on the content of the lesson to be taught. According to

Marshall (2002), various technologies deliver different kinds of content and serve different purposes in the classroom. Word processing and e-mail promote communication skills; database and spreadsheet programmes enhance organizational skills; and modelling software enhances the understanding of Science and Mathematics concepts. It is necessary to consider how these electronic technologies differ and the characteristics that make them important as vehicles for education delivery (Hennesssy & Scanlon, 2001). Hence, a teacher need to think about the kind of technologies to use in the classroom and for what purposes and get himself acquainted with different technologies that can foster effective teaching.

Olakulehin, (2007), divided the use of information and communication technologies in the education process into two broad categories: ICTs for Education and ICTs in Education. ICTs for education implies the development of information and communications technology specifically for teaching/learning purposes, while the ICTs in Education involves the adoption of general components of information and communication technologies in the teaching learning process. The use of information technology at any level of classroom interaction has yielded positive result in engaging learners' attention and at improving learners' understanding of the concept to be learnt. (Yusuf 2005; Adeoye and Popoola 2011).

Cox, Preston and Cox (1999), identified a number of factors which might influence and support teachers in using ICT in the classroom. Such factors include;

i. External variables: this represent the influences on teachers which come from outside their sphere of control, such as requirements of a national curriculum or national guidelines; the changes in society; school policies on the use of ICT; opinions of colleagues; pressure from parents and students; the influence of the local education authority.

ii. Perceived ease of use: This variable influences teacher support for ICT. There are a wide range of skills and competencies needed by the teacher in order to find ICT easy to use. For instance, regular use and access to computer outside the school can increase teacher's confidence in it usage.

iii. Perceived usefulness: However, if teachers perceive ICT to be useful to them, their teaching and their students' learning, then according to (Cox, Preston and Cox, 1999), they are more likely to have a positive attitude to the use of ICT in the classroom.

Teachers training and development has been identified by McCarney (2004) as one of the contributing factors in using ICT effectively in the classroom. According to him, teachers who favoured ICT were likely to have well-developed ICT skills and to see ICT as an important tool for learning and teaching. Equipping teachers with adequate training, skills and access to ICT facilities improves their attitude towards ICT usage in the classroom. According to Aramide (2004), teachers have inadequate training opportunities on the use of ICT in a classroom environment. Many times, teachers are just sent for training without employing needs analysis of who among them needs training, what type of training programme does he/she need. Also, other factors hindering integration of ICTs into class room teaching include: teachers' perceived usefulness of ICTs, teachers' attitude, inadequate ICT facilities, no access/limited access to ICTs (Marshall, 2002; UNESCO, 2009; Olokoba, et al., 2014.)

It has been observed that the use of ICT facilitates the achievement of educational goals by enhancing effective teaching and learning in our schools but integration of ICTs to teaching and learning in Nigeria especially at secondary school level seems to be on 'policy document paper' only without proper implementation (Aramide, 2004). The use of ICT facilities for pedagogy of instruction at the secondary school level, is still a major problem as most schools have little or no access to ICT facilities and many teachers are not technological savvy. Hence, this study examined teachers reflection use of ICTs in the teaching of Mathematics and Science in Kwara state Secondary Schools, Nigeria

Research Objectives

The main objective of the study is to examine teachers' use of information and communication technologies in secondary school Mathematics and Science lessons delivery in Kwara state Secondary Schools. Specifically, the study was set out to:

1. identify the ICTs which teachers have access to in their schools and the frequency of their access per week.
2. investigate the adequacy of the various aspects of ICTs available/usage in respondents' schools
3. assess the factors hindering teachers' readiness and confidence in using ICT for class room instruction.
4. examine teachers' perception about the perceived ease of using ICT in the class room.
5. examine teachers' perception about the perceived usefulness of ICT in teaching/learning processes.

Research Questions

The following research questions were raised to guide the study:

1) Which ICTs do teachers have access to in their schools and what is the frequency of their access per week?
2) What is the adequacy of the various aspects of ICTs availability/ access in respondents' schools?
3) What are the factors hindering teachers' readiness and confidence in using ICTs for class room instructions?
4) What are the teachers' perceptions about the perceived ease of using ICTs in the class room?
5) What are the teachers' perceptions about the perceived usefulness of ICTs in teaching /learning process?

Methodology

This study employed a descriptive survey method. The population for the study comprised all Mathematics and Science teachers in public secondary schools in Kwara state. The sample for the study was made up of 448 Mathematics and Science teachers selected from South and Centre senatorial district of Kwara state using purposive sampling techniques. Twenty-four senior secondary schools were selected from each of the senatorial district involved in the study making a total of 48 schools The samples were purposively selected from the secondary schools with large population of students and teachers in the study area.

A researcher designed questionnaire tagged ICT Availability and Use was used to gather data. The instrument consisted of two sections. The section A requested the respondents' personal data which contained 5 items. Section B was based on the research questions where respondents were required to respond to items 1-27 by ticking as applicable. The research instrument was pilot- tested using 40 teachers from Education District I. A test-retest reliability of 0.78 was obtained. The researcher personally administered the questionnaire to the respondents, and collected the filled questionnaire back on the same day. A total of 500 copies of questionnaire were distributed but only 448 were duly filled and returned. Data collected was analysed using frequency count and percentage. Percentages was used to

analyse the research questions.

Research question 1

What is the adequacy of the various aspects of ICT facilities / access in respondents' schools?

Table 1: Adequacy level of the various aspect of ICTs availability/access

ITEM	very good	Good	Fair	poor/nonexistence	To
Computer Hardware	84 (18.75%)	106(23.66%)	22(4.91)	236(52.68%)	100%
Software	48 (10.71%)	88(19.64%)	144(32%)	168(37.5%)	100%
Computer Consumable	24(5.34%)	40 (8.93%)	112(25%)	136(60.71%)	100%
ICT technical support	28 (6.25%)	72 (16.07%)	68 (15.18%)	280(62.5%)	100%
Internet Access	28(6.25%)	25(5.58%)	45 (10.04%)	350(78.12%)	100%
Digital Projector/project	48(10.71%)	70 (15.63%)	84(18.75%)	246(54.91%)	

Table 1 revealed that 52.86%, 37.5%, 60.71%, 62.5%, 78.12% and 54.91% of the teachers indicated respectively that computer hardware / software, Computer Consumable, ICT technical support, Internet Access, Digital Projector/project cameral are not adequate or not available in their schools. The implication of the result on table1 is that, ICT facilities are grossly inadequate or not available in the various schools of the respondents since more than 50% of the respondents are of the opinion that the facilities are either not available or inadequate in their schools.

Research question 2: Which ICTs do teachers have access to in their schools and what is the frequency of their access?

Table 2: Rate of use of ICT in instruction delivery

ICT	monthly	weekly	occasionally	not at all	total
Computer	94(20.98%)	74(16.52%)	66(14.73%)	214 (47.77%)	100%
Digital camera	28 (6.25%)	26(5.80%)	44(9.82%)	350(78.13%)	100%
Software packages	74(16.51%)	66 (14.73%)	112(25%)	196(43.75%)	100%
Internet	56(12.5)	50(11.16%)	88 (19.64%)	254 (56.70%)	100%
Digital Projector	90(20.09%)	54 (16.52%)	68(15.18%)	236(52.68%)	100%

Table 2 revealed that out of 448 teachers involved in the study, only 20.98% and 16.52% of them agreed that they have access to computer for instructional delivery weekly and monthly respectively. 47.77% of them agreed that they do not have access to computers in their schools while the 14.73% of them agreed they occasionally have access to computer for instructional delivery. It was also discovered that only 5.80% and 6.25% of the teachers have weekly and monthly access to digital cameras in their schools respectively while the 9.82% have occasional and 78.93% signified they had no access to digital camera in their schools.

The table above shows that 12.5 % and 11.6% of the teachers were of the opinion that they have access to internet weekly and monthly respectively in their schools, while the

remaining 19.64% and 56.70% of the teachers said they have occasional and no access to internet respectively in their school for instructional delivery. Also, majority of the respondent 56.70% and 52.68% indicated that they had no access to internet and digital projector in their schools. Hence, teachers' access to ICTs are grossly inadequate.

Research question 3

What are the factors hindering teachers' readiness and confidence in using ICT for class room instructions?

Table 3: Factors hindering teachers' readiness and confidence in using ICT

Item	strongly agree	Agree	Strongly disagree	Disagree	total
Teachers lack expertise with ICT	190(42.4%)	114(25.45%)	86(19.2%)	58(12.95%)	100%
Lack of confident in using ICT	124 (27.68%)	158(35.27%)	56(12.5%)	100(22.32%)	100%
Insufficient Knowledge Of appropriate Software	234(52.23%)	106 (23.66%)	42(9.38%)	66(14.73%)	100%
Erratic power supply	292(65.18%)	108 (24.11%)	20(4.46%)	28(6.25%)	100%
Rigid school time table	246 (54.91 %)	60(13.40%)	32 (7.14%)	110(24.55)	100%

Table 3 revealed that 67.85% , 69.64% and75.89% of the sampled teachers agreed respectively that lack of expertise, lack of confidence in using ICT and insufficient knowledge about ICT hindering teachers 'readiness and confidence in using ICT for class room instructions. In addition, it also indicated that 89.29% and 68.31 of the respondents agreed that erratic power supply and rigid school time table affect teacher usage of ICT

Research question 4

What are the teachers' perceptions about the perceived ease of using ICT in the class room?

Table 4. Teachers' perception about the perceived ease of using ICT

Hindrances	strongly agree	Agree	Strongly disagree	Disagree	total
High cost of computer and internet	210(46.89%)	118(26.34%)	46(10.27%)	74 (16.56%)	100%
Workload of teachers	70(15.63)	98(21.88%)	56(12.5%)	448 (50%)	100%
Insufficient time	66(14.17%)	106 (23.66%)	42(9.38%)	240(53.57%)	100%
It is time consuming	252(56.25%)	90 (20.09%)	74(16.52%)	32(7.14%)	100%
It is an additional burden	38(8.48)	66(14.73)	242 (54.02)	102(22.77)	100%

From table 4, it is observed that out of 448 sampled teachers, 62.5% and 62.95% of them respectively were of the opinion that the Workload of teachers and timing will not hinder them not to integrate technologies into teaching and learning process or hinder their use of ICT for instruction delivery. Rather, 73.23% of the sampled teachers agreed that high cost of purchase of computer and internet services is an impediment to teachers' usage ICT for class room instruction delivery

Research question 5

What are the teachers' perceptions about the perceived usefulness of ICT in teaching /learning process?

Table 5: Teachers' perception about the perceived ease of using ICT

Uses of ICT	strongly agree	Agree	Strongly disagree	Disagree	total
Make learning easy and permanent	228(50.81%)	86(19.20%)	46(10.27)	88(19.64%)	100%
Makes teaching interesting	152 (33.93%)	134(29.91%)	88(19.64%)	74(16.52%)	100%.
Improve students' performance	228(50.89%)	106 (23.66%)	42(9.38%)	72(16.07%)	100%
It broaden students Students' knowledge	290(64.73%)	86 (19.20%)	24(5.36%)	48(10.71%)	100%
It makes difficult concept easy	32(7.14)	60(13.39)	246(54.92)	110(24.55)	100%

Table 5 revealed that out of 448 teachers sampled for the study, 70.09% and 63.89% agreed respectively that ICT makes learning easy, permanent and makes teaching interesting. While 74.55% and 83.93% of the respondents also agreed respectively that ICT improves students' performance and broaden students' knowledge. On the other hand, majority of the sampled teacher (79.47%) do not agreed that ICT makes difficult concept easy for students to understand.

Discussion of the findings

The findings of this study revealed that most teachers are not technological savvy and therefore, they lack the expertise to teach using of ICTs needed to help students partake better in learning activities. This finding is in line with that of Aramide (2004) & McCarney (2004). Results of this study also revealed that most teachers have either limited access or no access to computers, internet, digital camera, printers, and other computer facilities in their schools. This is because, more than 50% of the respondents indicated there are inadequate or no ICTs facilities in their schools. This finding is in agreement with that of (Marshall, 2002; UNESCO, 2009; Olokoba *et. al*, 2014)

The finding also revealed that most of the respondents (79.47%) do not agree that ICTs is capable of making difficulty concept easy for the learners. This finding is contrary to those of Marshall, (2002) & Okeh and Opone (2007). Also, it was revealed from the findings of the study that insufficient and unavailability of ICT facilities within the school, teachers' perceived usefulness of ICT, erratic power supply hinders teachers' readiness to use of ICT in classrooms thereby hindering the global exposure of the students to the fast moving technology. This finding is in line with that of Marshall, (2002) & Clement,(2000) who affirmed that inadequate supply of facilities needed for ICT operation hindered it effective use whether at homes, work place or school system.

Conclusion

This study was set out to investigate teachers; reflection on the use of ICTs in teaching of Mathematics and Science in Kwara state secondary schools. Based on the findings of this study, it was discovered that the major barriers hindering integration of ICTs in to the teaching of Mathematics and Science in kwara state Secondary Schools include inadequate on the job training for teachers, teachers lack of confidence in the use of ICT, lack of competence and lack of access to resources as well as inadequate provision of ICT facilities. Since effective training, confidence, competence and accessibility have been found to be critical components for technology integration in schools, ICT resources including software and hardware, effective professional development, sufficient time and technical support need to be provided for teachers in order for them to be able to meet up with their expectations of being able to use ICT for effective classroom interaction.

Recommendations

In view of the findings obtained from the study and the conclusions reached, the following recommendations were made:

- Priority should be given to Training and retraining of teachers at regular intervals through seminars, workshops, conference, etc. Providing training courses in dealing with the new devices, modern technologies and new pedagogical approaches.
- Adequate man power and seasoned teachers to facilitate the pedagogies of ICT usage should be made available in in our schools.
- Computer laboratory (ICT rooms) should be provided by the school's boards with adequate educational facilities, media resources and well-equipped classrooms should be provided by the government as well.

References

Adeoye, M.O; Popola, S.O. (2011). Teaching Effectiveness, Availability Accessibility and use of Library and Information Resources among Teaching Staff of School of Nursing in Osun and Oyo State, Nigeria Library Philosophy and practices.

Adeyemi, T.O. and Olaleye, F.O. (2010). Information communication and technology (ICT) for the effective management of secondary school for sustainable development in Ekiti state, Nigeria *American-Eurasian Journal of Science Research* 5 (2): 106-113.

Aramide, K.A. (2004). The use of Information and Commutation Technology (ICT) by Academics in Nigeria Tertiary Institution (Masters Thesis), Africa Regional Centre for Information Science. University of Ibadan, Nigeria

Clements, D. H. (2000). From exercise and tasks to problems and projects- unique contributions of computers to innovative Mathematics education. *The Journal of Mathematics Behavior, 19*(1), 9–47.

Cox, M., Preston, C. & Cox, K (1999) what factors support or prevent teachers from using ICT in their class rooms? Papers presented at the British Educational Research Association Annual Conference, University of Sussex at Brighton September 2-5. http://www.leeds.ac.uk/educol/documents/00001304.htm

Federal Republic of Nigeria (2013), National Policy on Education. Lagos: Nigeria Education Research and Development Council.

Hennessy, S. (2000). Graphing investigations using portable (palmtop) technology. *Journal of Computer Assisted Learning, 16*, 243–258.

Hennessy, S. F .P. & Scanlon, E. (2001). The role of the graphic calculator in mediating graphing activity. *International Journal of Mathematics for Education in Science and Technology, 32*(2), 267–290.

Marshall, J.M. (2002).Learning with technology: Evidence that technology can, and does support learning .San Diego: State University.

McCarney, J. (2004).Effective use of staff development in ICT. *European Journal of Education* 27, (1), 61 – 72.

Ogunsola, L.A. (2005). Information communication technologies and the effects of globalization: Twenty-first century "digital slavery" for developing countries- Myth or Reality? *Electronic Journal of Academic and Special Librarianship* 6 (1- 2) 1-10.