CHALLENGES ASSOCIATED WITH SCIENCE TEACHERS' UTILIZATION OF INFORMATION AND COMMUNICATION TECHNOLOGY IN NIGERIAN SENIOR SCHOOLS

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Abstract

The current trend for Science, Technology and Mathematics (STM) education worldwide is to explore the opportunities which Information and Communication Technology (ICT) create for both teachers and students in educational settings. In this regard, this paper examined the challenges associated with science and mathematics teachers' utilization of ICT in Nigerian senior schools. It was widely established in the literature that utilization of ICT offers many means of improving teaching and learning in the classroom. From the extensive literature reviewed, this paper found that major challenges associated with science and mathematics teachers' utilization of ICT are: poor infrastructures, lack of qualified ICT expert, lack of teacher competence, attitude of teachers, inadequate ICT tools and poor ICT policy implementation strategies among others. Based on the challenges, it was concluded that science and mathematics teachers were not fully equipped for ICT integrated teaching. It was also suggested that adequate ICT tools should be provided and science and mathematics teachers' should regularly update their knowledge and competencies through training and re-training, workshops and conferences on ICT utilization.

Keywords: Challenges, Science teachers, ICT, Utilization, Senior Schools

Introduction

Science teaching in senior schools is an active process which utilizes various instructional resources such as books, abacus, laboratory equipment, charts, specimens and ICT tools among others. This is with a view to inculcating skills and attitude in the learners so as to enable them utilizes scientific processes adequately. The essence of science teaching is to give knowledge and adequate information about the physical world. In this case, each schoolchild need to understand some facts about the natural phenomena, laws and properties of matter, application of scientific knowledge and the scientific principle that a child may come across in his life (Abimbola, 2013). The use of mathematics in everyday life can be found in utilitarian aspects of mathematics in preparing children for useful living. It is important to state that Science and mathematics teaching in senior schools requires sound background knowledge in both theory and practical aspects by science and mathematics teachers. Therefore, science and mathematics teachers are crucial enablers in matters relating to progress in Science, Technology and Mathematics (STM) education (Marafa, 2017).

The origin of the educational utilization of ICT was derived from previous terms such as Information Technology (IT) and New Technologies (Nwana, 2010). ICT can be generally

described as those technological tools that are used for accessing, gathering and manipulating information. The technologies could include hardware computers, software applications and the Internet (Anderson & Glen, 2003). Yusuf (2007) remarked that ICT has affected every aspects of human activity and have potential to play in STM education. In this regard, utilization of ICT tools in teaching and learning STM has the capability to motivate students to learn as they become more independent and responsible for their learning (Suleiman, 2012; Yusuf, 2007).

It is also vital to note the benefits of ICT can only be enjoyed by confident users. That is, science teachers need to be ICT compliant. In a bid to achieve this, Nigeria as a nation has since recognised the potential benefit of ICT in her educational system. This dates back to the 1988 National policy on Computer Education which indicated the intention of the Federal Government of Nigeria (FGN) to integrate ICT into the senior school curriculum. The implementation of the policy was commenced with assembling of ICT tools and training of teachers in Federal Government Colleges and some of the Nigerian Armed Forces Secondary Schools (Owojori, 2000; Yusuf, 2007). Senior school education is an important level of educational structure in Nigeria. It is the level of education which links between basic and higher education.

According to FRN (2004), the broad goals of senior school education are to prepare individual for useful living within the society and higher education. Senior school education therefore provides a comprehensive programme for the youths which equip them with basic skills in academic as well as prepares them for coping with the problems of life. FRN (2001) re-emphasized the need for the integration of ICT in Nigerian educational system. However, the specific objectives of National Policy on ICT in education FRN (2010) are to facilitate the teaching and learning process, promote problem solving, critical thinking and innovative skills, enhance the various teaching/learning strategies required to meet the needs of the population, foster research and development and enhance universal access to information among others.

ICT in Education

The most striking innovation in the field of education is the integration of ICT in teaching, learning and research. In this era of utilization of ICT, educators must be imaginative, innovative, flexible and willing to renew their vision of teaching/learning process if they are to fully realize the potential of ICT. Numerous research findings have proven the benefits of ICT in education which undoubtedly affects teaching, learning and research. It is gratifying to state that the current trend for education worldwide is to explore the advantage which ICT creates in the teaching/learning enterprise. ICT tools have the capability to motivate students to learn as they become more independent and responsible for their learning (Yusuf, 2007). The benefits of ICT in educational settings can only be enjoyed by confident users. That is, teachers and students who are ICT compliant.

Science Teaching

Science teaching is a process that utilizes various instructional resources such as books, laboratory equipment/apparatus, specimens, chemical/reagents and ICT tools to develop skills and attitudes in the learners so as to enable them utilizes scientific processes adequately. The objective of science teaching is to give knowledge and information about the physical universe. To live as an efficient member of a modern society, each schoolchild need to know some facts

about the natural phenomena, laws and properties of matter, application of knowledge of science and the scientific principles that a child may come across in his life (Aladejana, 2007). Science teaching in senior schools requires sound background knowledge in both theory and practical aspects by science teachers. Therefore, science teachers are crucial enablers in matters relating to progress in science education.

Utilization of ICT in Teaching Science

The issue of utilization of ICT for science teaching has become progressively vital due to the global environment of the 21st century. The use of ICT in science teaching gives a three dimensional real picture which resemble living organisms or an object in all respects. ICT allows slide shows projection to make science lesson explanation more attractive with many components as videos, diagrams, animated gifs, photographs and links to aid navigation (Oyelekan & Olorundare, 2012). When ICT tools are used in science teaching, instructions can be seen clearly by students during practical activities and the use of interactive white board give them opportunity to interact. ICT tools could be employed to explain the morphological features, physiological sections of plants and animals, floral diagram, dissection of animals. Endangered and rare species could also be known to students without difficulty. ICT tools are used extensively for designing chemical equations. The chemical structure of compound and properties may be stored as databases and used for instructional purposes.

The often perceived difficult and abstract concepts in chemistry such as radioactivity, mole and stoichiometry, electrochemistry, thermodynamics, chemical kinetics, inorganic and organic chemistry among others can be programmed into computer software that teachers and students could utilize to make their teaching and learning better (Oyelekan, 2008). In the same vein, using ICT either as a tool in practical activities or as a substitute for the laboratory based elements of an investigation can aid theoretical understanding of physics (Marafa, 2017). Despite the thirst by some of the science teachers to utilize ICT tools for instructional purposes, they are confronted with enormous challenges that might have impeded their readiness to utilize these technological tools for instructional purposes. Challenges are experiences that confront one's sense of intelligence. They are mysteries which are to be lived or worked with. Hence, the purpose of this paper is to discuss challenges associated with science teachers' utilization of ICT in senior schools. Specifically, this paper discusses various challenges associated with teachers' utilization of ICT with a view to making recommendations. Olorundare (2011) noted that there are obvious problems/challenges that are set to hinder the successful implementation of such ICT policy at the classroom level. The challenges militating against the effective use of ICT in teaching and learning sciences are of multifarious dimensions. Some of these challenges are highlighted as follows:

Poor Infrastructure: A formidable challenge to the use of ICT is infrastructural deficiencies. Necessary infrastructures such as electricity and telecommunication facilities for the smooth operation of ICT tools are either lacking or grossly operated at epileptic level. Aduwa-Ogiegbaen and Iyamu (2005) reported that ICT tools were made to function with other infrastructure such as electricity under controlled conditions. For the past twenty years, the entire country has been having difficulty providing stable and reliable electricity supply to every part of the 36 states and the FCT, Abuja.

Lack of Qualified Information and Communication Technology Experts: Nigeria does not only lack information infrastructure, it also lacked the human skills and knowledge to fully integrate ICT into senior school education. The need for locally trained skilled ICT specialist to install, maintain and support these new innovations cannot be overemphasized. There is acute shortage of trained personnel in application software, operating system, network administration and local technicians to service and repair ICT tools. Those who are designated to use ICT tools in Nigeria do not receive adequate training, at worst, do not receive any training at all (Okebukola, 1997; Goshit, 2006; Evoh, 2007).

Lack of Teacher Competence: Most senior school mathematics and science teachers lack the skills to fully utilize technology in curriculum implementation. Hence, the traditional chalk and duster approach still dominates in senior school science and mathematics pedagogy. Information transfer using ICT tools is minimal or non-existence in many schools in Nigeria (Anao, 2003). Senior schools science and mathematics teachers need to be trained on educational technologies and the integration of ICT into teaching - learning process. According to Carlso and Firpo (2001), teachers need effective tools, techniques and assistance that can help them develop ICT based projects and activities specially designed to raise level of teaching in required subjects and improve students learning.

Attitudes of Science Teachers towards Information and Communication Technology Utilization: The challenges toward effective utilization of ICT as a tool for teaching and learning is not only infrastructure and capacity building related, but also attitudinal. Most of the studies on the challenges of the use of ICT in teaching have shown that teacher's attitudes and resistance to change were significant challenges. Empirica (2006) stated that teachers who are not using new technology such as computer in classroom are still of the opinion that the use of ICT has no benefits. There is uncertainty so far, of the nature of attitudes of both teachers and students. Research findings have shown that when users feel frustrated or insecure with the use of ICT tools, they will not be enthusiastic in its integration into school work (Olorundare, 2011).

Non-Availability/Inadequate Information and Communication Technology Tools: Lack of modern ICT tools such as computers especially in Nigerian senior schools pose enormous challenge on the utilization of ICT for teaching and learning sciences and mathematics in secondary schools, where the ICT tools are available, they may not be adequate for instructional purposes. Research findings have indicated that insufficient numbers of computers and peripheral devices inhibit deployment of ICT by teachers (Ndrika & Kanu, 2012). Okwudishu (2005) discovered that unavailability of some ICT components in the schools hampers teacher's use of ICT tools. This problem may be due to underfunding.

Lack of Relevant Science Instructional Software Packages: There is no doubt that the ultimate power of technology is the content and communication. Though, software developers and publishers in the developed countries have been trying for long to develop software packages and multimedia that have universal application (Aduwa-Ogiegbaeu & Iyamu, 2005). Due to the differences in education standards and requirements, these products do not integrate into curriculum across countries. Instructional software that is appropriate and culturally suitable to the Nigerian education system is in short supply. There is a great discrepancy between relevant software supply and demand in developing countries like Nigeria (Rasaki, 2012).

Insufficient Time for Information and Communication Technology Utilization in Schools: Time imposes a serious challenge to the use of ICT in senior schools. This is due to the tight schedule of lessons which does not give science and mathematics teachers ample opportunity to

utilize available ICT tools in the schools. Hamza and Mohammed (2012) reported that most common challenge was the lack of time the teachers have to plan technology lessons, explore the different Internet sites or look at various aspects of instructional software packages. BECTA (2004) indicated that lack of time exist for teachers in many aspects of their work as it affects their ability to completes task with some of the participant teachers specifically stating which aspects of ICT require more time. These include the time to locate internet advice, prepare lessons, explore and practice using the technology, deal with technical problems and receive adequate training.

High Cost of Information and Communication Technology Tools: The price of computer hardware and software continues to drops in most developed countries, but in developing countries such as Nigeria, the cost of ICT tools is several times more expensive. Nigeria has over 6000 public secondary schools. Majority are short of books, paper and pencils. Many of the schools lack adequate infrastructure such as classrooms and only few are equipped with television or radio. Apart from the basic computers themselves, other cost associated with peripherals such as printers, monitors, paper, modem, extra disk drivers, photocopier are beyond the reach of many senior schools in Nigeria. Many schools cannot afford the exorbitant internet connection fees. High cost of ICT component has been reported as one of the factors which influence provision and use of ICT services (Hamza & Mohammed, 2012).

Lack of Accessibility of Information and Communication Technology Tools: Accessibility to ICT tools is another serious challenge to the use of ICT in teaching and learning. Several studies have indicated that lack of access to ICT tools, including home access, is another complex challenge that discourages teacher from integrating new technologies into education and particularly into science education (Nwagbo & Uguanyi, 2012). According to Aladejana (2007), many local government headquarters in Nigeria do not have functional telephone system. This situation is even worse in villages. Many of them also are not linked with digital telephone which makes infusion of ICT into our educational programme easy. Salau (2003) indicated that over 75% of senior schools in Nigeria are without adequate ICT tools including the Internet connectivity.

Lack of Effective Training: Training of science and mathematics teachers is a necessary condition for the effective utilization of ICT in teaching and learning. Where such training is lacking, it tends to impose a serious challenge to effective use of ICT in teaching and learning. In most of the secondary schools in Nigeria, training of teachers in the use of ICT has not been taken as a paramount issue (Nwagbo & Ugwanyi, 2012). The issue of training is certainly complex. This is because it involves the considerations of several components to ensure the effectiveness of the training (BECTA, 2004). These components are time for training, pedagogical training, skills training and an ICT use in initial teacher training. Goshit (2005) affirmed that lack of training in digital literacy, lack of pedagogical and didactic training on how to use ICT in the classroom and lack of training concerning the use of technologies in science and mathematics specific areas are factors inhibiting the proper integration of ICT into the instructional process.

Poor Information and Communication Technology Policy Implementation: FRN (1988) policy introduced computer education to the senior schools. The only way this policy was implemented was the distribution of computers to Federal Government Colleges and Armed Forces Secondary Schools (Yusuf, 2007, Owojiri, 2000). Some of the computers were never put into use. In addition, no effort was made to distribute computers to state and private owned

senior schools. Similarly, concerted effort has not been made to provide ICT tools nationwide and trained personnel. Thus, most of the schools do not yet offer ICT training programmes for their teachers (Goshit, 2006).

High Level of Poverty: High level of poverty among Nigerians hinders possession of modern ICT tools like computers, Internet services, television and so on by teachers, students, schools, parents among others (Hamza & Mohammed, 2012). High level of poverty is still prevalent in African societies (Olorundare, 2011). Financial status of an individual or school is the bane of any educational development. Without adequate funding, curriculum innovation will prove abortive or remain a mere mirage. Development and subsequent operation of ICT require financial investment by schools and individuals (Idowu, Esere & Omotosho, 2011). Poor economic situations in the country and its effects on middle level manpower are a major challenge towards the implementation of ICT in Nigerian secondary schools. Even an average middle income earner cannot afford basic ICT gadgets/tools such as, i-pads, i-phones, laptop computers and so on.

Conclusion

The current demand of the 21st century in the understanding of science and mathematics necessitates the possession of the well-built capacities by science and mathematics teachers. This implies that science teaching in senior schools demand that teachers should utilize ICT tools in their classrooms as science is activity oriented. In this regard, science teachers have to be fully equipped with sound ICT background so as to meet the required competencies of the ever changing global environment. Despite the immense benefit of ICT in the educational setting, many Nigerian senior schools were found to have little or no available ICT tools and other relevant instructional resources. It is one thing for the ICT tools to be available in a school; it is another thing for those tools to be adequate for instructional purposes. Besides, availability of ICT tools without being put into use has no positive contributively factor. It was concluded that science teachers in our senior schools were not fully equipped for ICT integrated teaching. This is due to enormous challenges associated with utilization of ICT for instructional purposes.

Suggestions

It is recommended that:

1. ICT should be made compulsory in teacher training institutions so as to help teacher trainees gain experience in dealing with ICT and new pedagogical approach.
2. Training and re-training in advanced ICT skills for serving science and mathematics teachers should be made compulsory by the government.
3. Federal Ministry of Education should make ICT competence part of the requirements for employment of senior school teachers.
4. Technical support need to be provided to senior schools by the government for maintenance of ICT gadgets in schools.
5. Senior schools should endeavour to provide science and mathematics teachers with necessary ICT resources including Internet access, hardware computers and software applications.

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