INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)- BASED SCIENCE EDUCATION: VISIONS IN THE 2IST CENTURY NIGERIA

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Abstract

Information and Communication Technology (ICT) devices have permeated the universe as a way of development. ICT uses computers, telecommunications' networks and other electronic devices (programmable and nonprogrammable) to process information and perform specific tasks much more quickly than we could do by ourselves. The impact in education is observable in the increasing popularity of using e- learning and other web-based applications to enhance the traditional ' room-based ' face to face teaching and learning environment in developed countries of the world. In reality, ICT- based science education is still an unharnessed area in Nigeria. Positive steps have been taken to that effect, but, a lot of work still has to be done. This paper therefore visualizes the status of ICT- based science education in the 21st century Nigeria, highlighting the benefits, problems and prospects. The major recommendations include: provision of sufficient number of ICT devices and infrastructures for schools, followed by training of teachers-on hands on use of the devices.

Introduction

Information and Communication Technology (ICT) is a system that processes, stores, and / or transfers information by use of computers, telecommunications networks, and other programmable and non-programmable electronic (e-) devises (Afrihub 2005). That is why ICT has reduced the world to a small sphere commonly referred to as global village.

ICT is an important system for both home and social life. Since education is a life-long process for an individual, ICT also has a lot to contribute to education of a person, when properly guided. An effective use of electronic devises for teaching and learning of sciences is a very important aspect of vision ICT for science education in the 21st Century Nigeria. Both the educators/ teachers and the learners stand to benefit from the networks ranging from e- learning, internet services and to other services.

The world is pervaded by change as a way of development. Nigerians should be prepared to keep up with the change. Research studies in education indicate that the use of computer-based resources can help to improve teaching, scientific inquiry, and scientific literacy (Olele 2008). In addition, using computer skills, accessing information from the internet etc, have been reported to offer certain advantages over traditional methods (Olele 2001). This implies that the use of older educational resources such as teachers, chalkboards, charts, and other traditional expository/ lecture methods of teaching, are no longer deemed sufficient to cope with the volume and nature of information, skills, and competencies expected of science education sector in 2 I^{s1} Century Nigeria. In reality, ICT - based education is still an unharnessed area in Nigerian science education. Scholars have been researching and reporting their findings on the usefulness of the method, but, a number of obstacles still impede the meaningful adoption of the systems in Nigeria. This paper therefore visualizes the status of ICT- based science education in 21$^{s'}$ Century Nigeria highlighting the barriers, benefits and prospects.

Benefits of E- learning in Science Education

According to Jones (2003), e-Learning uses web-based technology to improve learning for students. The use of technology (ICT) employs different modes of delivery, and can cater for thousands of students in geographically different locations, learning, at different times. It also allows for inexpensive and on-going updating of content (Amah 2007). E- learning has also been interchangeably used with such terms as Digital learning, computer enhanced learning, computer-aided learning, on-line learning etc. That was why e-learning was described as a derivative of business on-line training . It was thus defined as an online training that is delivered in a synchronous (real- time

instructor led) or a synchronous (self-paced) format (Knowledge Net 2002).

Benefits of Internet in Science **Education**

Internet is the acronym for International Network. It is today the most sophisticated and modern way of interactive networking. Internet has offered global access to all kinds of information generation and sharing across the world, thus reducing the world to a global village (Addo 2001).

The internet is a network of computers through which data, images, voices, and video are sent and received through both wireless and fixed wired devices (Peterson 1995). The device is extensively used in education and research. System integration of the vast, variety of computers in the internet is obtained through (he internet protocol also known as transmission control protocol / internet protocol (TC/IP). Addo (2001) stated that the internet through the TCP/IP provides the following services to the users:

Electronic mail (e-mail): to send or receive ronic letters

File transfer protocol (FTP), to down load / upload textual files.

Remote login (login and telnet): to log on to nodes at remote site locations.

News: to maintain contacts with networked interest groups.

Bulletin board services (BBS): to receive / send short communications such as chart.

Wide area information service (WAIS); to search international data base.

Archie: to find network resources on the internet that is, indexing services.

World wide web (www).

According to Nwachukwu (2007), e-mail services have been extensively used for teaching, in such aspects as communicating with students, organizing documents, scheduling events, planning course activities, and handling students requests. The system invariably reduces course administration burden and control.

ICT and Nigerian Teachers in the 21st Century.

Teachers and educators are the implementers of curriculum content in an educational institution. It is very important that teachers are often trained and retrained to meet up with the fast changing technology. That was why it was spelt out in F.R.N. (2004), that the Nigerian philosophy of teacher education is to "provide the teacher with intellectual and professional background adequate for their assignment and to make them adaptive to any changing situations, not only in the life of their country, but in the wider world".

In the foreseeable future, ICT-based learning, for instance e-learning, will be a fact of life for learners and will replace a big fraction of traditional school's long learning currently practiced. Again, future teachers/ educators need not be anchored to classrooms since they could make proper use .of various forms of computer enhanced learning. Infact, the conventional positioning of teachers at the front of a class with students seated at desks gazing at the teacher will be minimized depending on the particular needs of the students or teachers. In line with the above, Jones (2003) was of the view that in future, teachers will make even more use of ICT for professional activities. The activities include lesson planning, preparing of teaching materials, recording student's assessment, other administrative tasks as well as their own professional development and continuing education.

The modern society is battling with changes brought about by ICT since different types of information are obtainable from the Internet and World Wide Web.

Teacher Preparation to Live up to the Vision of ICT - Based Science Education in Nigeria

Nigerian science educators and teachers need to acquire basic computer and internet literacy. The computer literacy will equip the teacher with the basic skills necessary to operate and survive in the prevailing information and communication technology revolution (Agbo 2008). On the other hand, the internet literacy equips the teacher with the skills needed to surf the net, navigate the web and use the internet for survival in the ever changing world. Different types of the information can be obtained from the internet and World Wide Web (www), These could be either constructive or destructive. In education sector, it is the responsibility of the educator / teacher to sift the good and erudite information for the learners.

Only an educator / teacher who is computer/ internet literate can manipulate this situation. Infant, the educator should have a clear vision of expected outcome of use of ICT by the learners. The

aims and objectives of the lesson should be clear to the educator/ teacher. This means that the educator should have a vision in which ICT support learning or help the students to achieve the aims of the lesson, rather than one where the use of ICT forces learning to adapt itself to the usage (Agbo, 2008). All information on the website may not be valid for every learner. That was why Abah (2002) expressed the view that the teacher is a person who instructs learners and gives learning in an educational institution. The so called "Encarta syndrome" will steer its ugly face if the educator does not properly plan for the use of ICT for knowledge [Ofsted (2004) in Agbo 2008], This term refers to the Microsoft multimedia encyclopedia which contains many information. If the learners usage is not properly guided by the educator/ teacher, the individual may end up printing out a non valid information about a given topic.

Infact, FRN (2004) stated that one of the " philosophy of teachers' education is to provide teacher with intellectual and professional background adequate for their assignment and to make them adaptive to any changing situation, not only in the life of their country, but in the wider world". Therefore, making science educators and teachers computer/ internet literate will help them step into the gigantic task of guiding learning experiences in science education at any time. That was why Agbo (2008) stated that 'mature use of the internet by the teacher is not just a question of being able to search efficiently to locate information. He added that helping students to develop ' media literacy is an important aspect of it since this is an essential facet of education for citizenship.

In line with this opinion, Bello (2006) citing Gusen (2005) stated that:

Some teachers, however, must have seen computers in different places and for different purposes such as computerization of salary pay roll. Processing documents, results computation, and using ICT scratch card to access JAMB, SSCE and NECO results placed on the organization's website".

A teacher not only needs the ability to incorporate ICT into activities in his subject but also the ability to assess the degree of ICT capability reached by each student in the course of the learning experience. The latter ability esquires a much higher level of skill of the teacher. This emphasizes the teacher's / educator's role in the teaching -- learning process. Learners cannot use ICT without guidance despite the fact that ICT can transform activities in such a way that they facilitate the use of different interactive learning styles. That was why British Film institute (2000) in Agbo (2008) pointed out that together teacher and ICT can achieve much more than they can separately. This is because a learner who is not an abnormally gifted individual, needs to be taught as well as learn. Students learn by interaction with teachers, or fellow students and with materials in science classes as the case may be (Nwachukwu, 2005). Computer programmes offer both visual aids and audio impacts to the learners. Its huge influence on the processes and products of science teaching/ education will continue to increase in geometric progression throughout the foreseeable future.

Problems and Prospects of ICT in Nigerian Science Education

Today, people talk of the electronic age; the net age the computer age, or information age etc. Nigeria needs to embrace this powerful technology since our primary means of reaching others in far and near place are mediated by ICT. Even though problems abound, there are also prospects.

Problems of ICT

The problems militating against the use of ICT include the following: finance, infrastructure, qualified personnel, lack of relevant software and limited access to internet.

Financial constraints - A lot of money is required for establishment of ICT. The facilities and accessories are very expensive to purchase and maintain.

Weak Infrastructure- Nigerian electricity supply is epileptic. Hence, it is not conducive for functioning of electronic devices.

Inadequate Communication Facilities - Most Nigerians have no access to telephone. The connection fees for telecommunication facilities is rather high for the populace.

Lack of Qualified Personnel - there are insufficient professionals to handle ICT based learning. There is acute shortage of trained personnel in application software, operating systems, network administration and local technicians to service and repair ICT facilities. Again, the spare parts for the facilities are lacking.

Lack of Relevant software - The existing software are based on foreign cultures. Softwares appropriate and culturally suitable to the Nigerian education system are in short supplies. This is because, there is a great discrepancy between relevant software supply and demand in developing counties like Nigeria. That was why Salome (1989) observed that there are clear indications from many countries that the supply of relevant and appropriate software is a major obstacle to wider application of the computer.

Problems of producing software adapted to local needs include both the cost of production, and skilled personnel for fabrication of the gadgets.

Limited Access to the Internet - There are very few owners of cyber cafes that provide Internet services to people. Such owners are often in 'partnership with foreign information and communication companies. The services rendered are either poor or expensive and reliable, hence limited access.

Finally, it should be noted that in order to maximize the benefit of ICT in our education sector, a number of constructions are essential in addition to purchase of computers. The provision of computer is the first step. This should be followed by providing wireless local area networks (WLAN) that enable connection to remote servers without the constraint of cables. Classrooms and offices should be networked together for maximum information interchange. Laptops with efficient batteries should be provided to enable the WLAN technology to operate anywhere in the school. Current web-based applications which will enable the preparation and delivery of on —line materials should be acquired in addition. With these set in place, workshops and in —service training of teachers should be done using these equipments.

Prospects of ICT

The prospects of ICT in science teaching and learning are enormous. Members of this golden age have no choice than to use these electronic devices if they are to remain relevant to themselves and to society. Hence any nation which is not sufficiently equipped, be it intellectually, socially, or educationally, to join the ICT bandwagon, can hardly survive. Below are some major prospective areas of services of computers to teachers and learners in Nigeria.

The Electronic/Digital /Virtual Library

The modern electronic library, otherwise called the digital, virtual, or library without walls used interchangeably, refers to the vast collection of information to which people gain access over the internet, cable television or some other type of electronic connection (Batubo and Digitmie 2008: 552).

This library consists of materials and services in electronic format rather than the print. It can be located in a building or in space (virtual). Jt used mainly computers and computer networks linking up many separate libraries. Through it, information can be accessed by users anytime, anywhere regardless of distance. That was why Aina (2004:329) stated that virtual Library assists users in developing countries to access needed information. Again, he said that virtual libraries evolved as a result of electronic library and the World Wide Web (www) of the internet, and have been greatly promoted by digital libraries. Access to scholarly information enhances teaching and learning since current information updates and upgrades knowledge of the teacher.

In addition, the problem of searching through the library card catalog or periodical indexes can be made easier by typing few words pertinent to the topic under study into a computer. By so doing, the computer will avail the Nigeria teachers and students with improved techniques of research and teaching.

Teaching Methods and Learning Styles

Computers can enhance the efficiency and effectiveness of teaching-learning processes. Science departments are increasingly getting involved with computers. Computers being machines do exactly what you tell them to do. That is why it is possible to use carefully prepared computer programmes in computer assisted instruction (CAI), or computer based instruction (CBI), or to effect individualized

learning. Computers can also enhance problems solving skills of the learners by focusing on the thinking skills especially in computational sciences. Finally, teachers will cease to be anchored to the classrooms as they make appropriate use of various forms of computer-enhanced learning. Similarly, the use of power point slides in presentation of lecturers saves time, energy, enhances video coverage of the topic, and makes the lecture exciting and lively, **Current Information**

ICT offers the opportunity for school science programmes to provide students with up-to-date information, with tools for the simulation and modeling of science processes and principles (Okolo 2005). In addition, recent developments in multimedia computers present opportunities for strongly motivational and engaging learning situations which could enable learners understand and carry out scientific investigations.

Dissemination of Information

Information can easily flow from one school to another, or to and fro other educational sectors through ICT facilities such as internet, e-mail etc.

Recommendations

In line with the fact that nature abhors vacuum, the first step in solving the problem of ICT in science education is that the government should flood the schools with ICT devices and infrastructures. Thereafter, workshops and inservice training should be organized for retraining of practicing teachers and educators using the provided devices practically. The training could be in batches for effectiveness. The trained teachers and educators can then go back to the schools to put into practice, what they have learnt. The journey of a mile starts with a step. Therefore, the use of ICT- based learning will gradually replace the current conventional practices in the science classrooms when needed.

Conclusion

In Nigeria, computer can only be spotted in few primary and secondary schools. This situation is a big hindrance to a nation in assuming a good position in the ranks of global ICT world. Computer and internet are utilized for teaching and learning different subjects in developed countries. According to Olele (2008), application of computer and internet technology in education is a primary concern for education all over the world. Again, research in education has revealed that the use of computer , based resources enhances the teaching, scientific enquiry and scientific literacy. Using computer skills, application programmes, accessing information from the internet, or CD- ROMs, interactive video disc instruction, computer Assisted instruction (CAI), computer. Based instruction (CBI), computer Based learning (CBL), e-learning etc, offer certain advantages over traditional methods. They make learning easier, faster, exciting, and interesting to the learners

The above facilities are generally lacking in the nation's science classrooms. Somehow, changes have been made in the educational curriculum and polices to accommodate the learning of ICT. However, the changes have remained largely marginal due to the lack of corresponding infrastructural provision and qualified teachers./educators. This is because teachers remain the implementers of educational curriculum content since effective learning often depends on the competence and will of the teacher. The following recommendations are therefore made.

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