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# **Application of Information and Communication Technology (ICT) In Science Education: Issues and Challenges**

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By

**EFFOING E. OKON-ENOH**

*Federal College of Education,  
Obudu,  
Cross River State.*

**MOSES E. USHIE**

*Federal College of Education,  
Obudu,  
Cross River State.*

## **Abstract**

*This study examines the application of ICT and its roles in science education. It discusses the potentials of this modern technologies in scientific research and how they could be exploited to facilitate effective teaching and learning in science education. The paper also looked at the nature of science education, concept of ICT, sources of ICT in science education, ICT and the teaching/learning of science education, problems of ICT in science education and the way forward. The paper further stresses that the development of ICT pose so many challenges to science educators, researchers and librarian or information professionals in Nigeria.*

## **Introduction**

The value of information to any society at all times is hardly in doubt especially its importance in socio-economic development. ICT encompasses a broad range of tools that facilitate communication and the processing and transmission of information by electronic means, it has undergone rapid changes and transformation over the last few decades. The emergence of Information and Communication Technology (ICT) in education has transformed teaching and learning to a more viable and effective method and would likely set the standard for the future. Iloeje (2002) in Utubaku and Okon-Enoh (2009) contended that, the interactivity in education and learning techniques brought about by the new technology has created a whole new learning environment and transformed the relationship among science teachers and the learners. The result is that the ways and means of packaging and delivering information has changed. No wonder Hamid and Roach (1991) reported that the Mac Bride round table conference on new world information and communication order has

also given impetus to the agitation for unrestricted and balance flow of information ~~the world~~ countries in the world. ICTs are offering even less developed countries a widow of opportunities to leapfrog the industrialization stage and transform their economics into high value-added information economies that can compete with the advanced economies on the global market.

Information, which is an assemblage of data in a comprehensive form capable of communication, has no doubt played a leading role in the development and modernization of the human society. It abounds in various fields of human endeavour, among whom are academic in science education. Of serious concern is the need to fully exploit and effectively use this information.

Scientists need information for current awareness, retrospective searches, factual information, improving existing services, acquiring new ideas, research and to produce information (Chawed Hury, 1998). The literature indicate that information needs differ according to area of specialization. Some needs it for current awareness, while others need it for ongoing faculty research (Njongmeta and Etikhamenor, 1998).

### **Concept of Information Communication Technology**

Aina, mutual and Tiamiyu (2008) defined Information Communication Technology as comprising pieces of equipment, network infrastructures and the associated knowledge and skills for creating, manipulating, transferring and using information or knowledge. Information and Communication Technology would involve, the electricity, telephone system, the computers and the technical know how and manipulation of the various infrastructure which need to be regular. Ani (2005) contended that Information and Communication Technology is concerned with the various means of generating, processing and transferring information using basically computers and telecommunication. The World Bank (2002) described Information and Communication Technology as the creation, storage and processing of data including hardware (computer networks, servers, storage devices, desktop computer) and system software (operating systems, programming language and software application). Rahman (2002) contended that Information and Technology as the technology of creation, processing, storage, retrieval and transmission of data and information including telecommunications, satellite computer (software), the internet and global systems of mobile communication (GSM).

Ukpebor (2006) noted that Information and Communication Technology (ICT) is the acquisition, processing, storage and dissemination of vocal pictorial, textual and numerical information by a micro electronics-based combination of computing and telecommunications. Abayai (2004) contended that Information and Communication Technology are vast web of high speed, digital communication networks, delivering information, education and entertainment services to schools offices, homes and so on. Abifarina (2003) stated that Information and Communication Technology (ICT) refers to the different infrastructures used in creation, storage, processing, communication and application and the numerous services these infrastructure renders.

### **Sources of ICT in Science Education**

Source of information typically consulted by science educators (societal) includes (a) formal sources, which comprises monographs, journals, magazine, newspaper, books, proceedings, treatise, technical report, and dissertations and (b) information sources, which include workshops, discussions with colleagues, radio, television, mass media, electronic data base etc (Cutis, Weller and Dalia, 1997). It is gathered from the literature that scientists show preference for journals over other sources Shalom and Burton (1998). It was noted that scientist show a strong preference for information systems of communication, (Keddy, and Karisiddapa 1997, Cullen, 1997) moreover, academics generally have high expectation of success when they use the internet to seek information (Kires 1998, Bule 1998).

Science education remains the precursor to acquiring the scientific know-how and the gate way to scientific breakthrough and socio-economic and industrial development. America, Japan and Britain are the leading industrial nations in the world today because of their level of scientific know-how and practice. While low level science education especially in Africa is responsible for their slow rate of development. The slow rate of development in Africa calls for improvement in science education. Mohammed (2004) maintained that science education is a means of enriching an individual's knowledge, developing his full personality and preparing the person to undertake specific task which are essential to the immediate environment and beyond science education indeed has become such an indispensable knowledge in the 21<sup>st</sup> century. No wonder Mustapha (2004) contended that the importance of science in the development of any society is not in question. Infact the level of the scientific attainment of a scientific and technological know-how which in turn determines their level of the socio-economic and industrial development. It may interest the Nigerian populace to note that science education have identified alternative sources for the diversification of our economy and for the improvement of the living conditions of the entire citizens.

### **Information and Communication Technology and the Teaching of Science Education**

Ojo (2005) maintains that the success of any teaching and learning process depend on the effectiveness of communication. Information and Communication Technology can play the role of a patient teacher . It consistently works at the learner pace, assisting him to acquire sets of information, skills, facts etc. According to Asiriwa (2003) a teacher conveys his thoughts, state his facts poses problems and evaluates his student by means of communication.

The teacher can take advantage of the dynamism of ICT to demonstrate sound difficult concepts, theories and principles. This will give meaning to his classroom instruction and thus enhance his teaching and makes his class presentation an exciting one. Some In programme instruction software are capable of feeding back very

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accurate information to teachers about the individual progress of all students in the class. In this setting, the computer reinforces the correct answers to the numerous question posed.

Today, the development in Information and Communication Technology has brought about evolution of Information and Communication Technology, which is ever growing and continuously affecting every aspects of human endeavour be it education, economy, politics etc (Abifarina, 2003). Thus, the teacher using ICT in his class will be able to present a well planned set of lessons and the students will experience this lesson in an exciting environment. Ojo (2005) noted that the misconception that the computer will replace the teacher and thus render him redundant does not arise, all the computer does is to reinforce and enhance the teachers lessons. ICT can help students to become independent learners capable of developing critical thinking and problems solving strategies, collaborative works and enquiry. It allows for information searchers, computer modeling, team-work, brain-storming and revision. Teachers can use computer to make learning experiences more effective and to offer students access to a variety of learning tools, expert opinions and alternative view points.

### **Problems of ICT in Science Education**

In spite of the numerous benefits derived from the current wave of innovation, which has transformed the contours of information service in science education world wide the development posses some challenges to scientists, librarians library administrators etc.

### **Challenges to Scientists**

The recent integration of Information and Communication Technologies in research, teaching particularly science education has been the topic of much debate. As science educational system around the world are under increased pressured to use the new Information and Communication Technologies (ICT) to teach students knowledge and skills they need in the 21<sup>st</sup> century, education institutions are faced with the challenges of preparing a new generation of teachers to effectively use the new learning tools in their field of specialization (UNESCO, 2002). Nigeria as a nation, however, came late and has progressed slowly in the use of ICT in all sector of the nation's existence especially in teacher education. This is as a result of chronic limitations brought about by economic disadvantages and stringent government policies. These factors have direct consequences on the nation educational development. The catalogue of the nation's ICT problems are: slow access to basic ICT equipment, low internet connectivity and lack of computers, and inadequacy of audiovisual materials and equipment including films, slides, transparencies, projectors, globes, charts maps, instructional television etc (Ololube, 2006).

The problem include lack of relevant sources, unskilled or inadequate number of CD-Rom workstations and databases and lack of skills for using these technologies (Star, 1994, Chisenga, 1997, Majid, 2001).

### **Challenges of Infrastructural Facilities**

Another challenge is the problem of poor infrastructural facilities in majority of our research centres as compared to what obtains in industrialized economies and even in many Asian as well as Latin American countries.

According to Oketunji (2000) some of the major problems associated with ICT application in science education in developing countries which calls for caution includes:

- general inadequacy in the level of relevant infrastructure especially telecommunication facilities and power supply;
- a rather exploitative local computer information technology market and unsatisfactory after-sales, maintenance and support;
- inadequate pool of relevant technical staff and problems of recruitment and retention;
- the poor ICT skills and competencies possessed by both library personnel and the users;
- the database conversion problems;
- frequent changes in technology;
- funding problems;
- the observed user resistance and failure to adapt to the use of digitized information;
- the conservative disposition of library staff and their resistance to the introduction and use of ICT in library operations and services.

### **The Way Forward**

It is right that the country should upgrade most of its ICT systems to the level where they can serve us well in the new millennium. There is a need to enhance our information and data services. This is a key requirement for the development of sectors of our economy. For example if the country had a national data base for agriculture and other national projects, it means that each time a new project in those areas are being planned and/or implemented, the government, managers and staff of the project would not have to start right from scratch on the new project, especially with regard to cost estimates, time scheduler and resource requirements.

As we have already pointed out, ICT has emerged as a key to economic development in every country as we move into the new century. Infact, people like Alvin (1990) believe that it is a technology that is easier to master and that could be used to leapfrog specific development stages, rather than starting from scratch with the basic mechanical, electronic, electrical, chemical and civil engineering components of technology.

Problems of scarcity of resources like funds, infrastructure, equipment, laboratories, textbooks and others should be addressed urgently.

Encouraging the use of visuals and audio-visuals in the teaching process, at all levels of Nigeria educational system through ICT implementation.

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### **Conclusion**

Communication becomes the bedrock for which teaching processes can be motivated and captivating. A technology that is transforming the world of communication and learning is offered by ICT. In spite of the numerous benefits that can be derived from ICT, this paper has noted that its development poses so many challenges to science educators, researchers and librarians in Nigeria. In order to avert or at least minimize the problems of fully embracing the ICT revolution in Nigeria libraries, there is need for librarians as well as science educators to evolve strategies that will be effective and relevant to the challenges.

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