

# IMPORTANCE OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) TO SCIENCE EDUCATION IN NIGERIAN EDUCATIONAL SYSTEM: JOURNEY SO FAR

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## **Abstract**

The purpose of this paper was to identify the importance of information and communication technologies in science education. It began by clarifying some basic concepts, and went further to look at the status and need for information and communication technology in education. It also enumerated the potential of each technology and identified five levels of technology used in education. The paper further examined the relevance of information and communication technologies to science education and how they have been used. Recommendations were made based on the research findings. Finally, conclusion was drawn based on how information and communication technology gadgets facilitates teaching/learning.

## **Information and Communication Technology (ICT)**

This is an umbrella term that includes any communication device encompassing radio, television, cellular phones, computer and network hardware and software satellite system as well as the various services associated with them which include video conferring and distance learning. ICT can be defined as computer based tools and techniques for gathering and using information. It encompasses the hardware and software, the network and several other devices (video, audio, photographic camera, etc.) that can convert information in processing technologies such as computer and internet, as well as fixed-

line telecommunication networks. ICT is an electrical application of computing, communication, telecommunication and satellite technology (Yusuf, 2000).

ICT in education according to Olurankinse (2007) is the means of learning through electrical and electronic hardware as well as electronic computing software. She also maintained that ICT includes learning through the internet, web and global systems of mobile communication.

ICT in education is the wholesome integration of modern telecommunication, particularly the internet into the education system. It has lots of advantages and if fully integrated, will help in solving some problems in the educational system of Nigeria. The advantages include:-

- i. With ICT in schools, education is made more productive by making instructions more powerful, more scientific and real.
- ii. It can be used as an instructional tool to explore, investigate, solve problems, interact, reflect, reason and learn concepts in the classroom.
- iii. It provides a common ground for all professionals to contribute towards effective and productive learning/teaching environment.
- iv. It permits alternative types of educational patterns for facilitating learning especially as it can be adopted and adapted to serve all types of educational instructions and interest.
- v. Finally, it gives room for independent and individual study

### **Science Education**

Knowledge of science entails knowledge of scientific facts, laws, theories – the products of science, it also entails knowledge of the processes of science. But what is science education? According to Ogunniyi (1986), people confuse science and science education, while science like other subjects has well defined disciplines such as: Biology, Chemistry, Physics and Geology, Science education cuts across many fields of human endeavour such as: the natural sciences mentioned above, sociology, philosophy, psychology, history, art, language among others.

Science education is not science per se but education in science. While science has very rich content, science education as a reflective subject is relatively sparse in content. Science education has no real language of its own – that is language with vocabulary rules, sentence structure rules, rules for deriving meanings from sentences, operational definitions or theory of knowledge upon which the discipline is built.

### **Goals and Objectives of Science Education**

The goal of science education at school level in the past decade appeared to be that of making students acquire the knowledge of science in order to pass external examinations such as the General Certificate in Education (GCE) and or West African School Certificate (WASC). The results of these examinations were used in selecting candidates for admission into universities and other higher institutions of learning. In addition, learners were also expected to acquire an understanding of nature and as well appreciate science as a field of disciplined inquiry. Thus, these two goals were hardly given any emphasis.

In the recent past, another goal, the development of scientific attitude was added. The concept “scientific attitude” implies

behaviours that demonstrate accuracy, honesty, open-mindedness, objectivity, non-bias, skepticism and possession of a critical questioning, and rational mind (Gauld, 1973, 1982). According to the Education Policies Commission (USA), possession of a scientific attitude, aside from being the mark of a scientifically – minded person, is also the mark of rational one, and would naturally seem to represent pre-dispositions appropriate for solving problems in everyday life. This is perceived as beneficial for the individual and society alike.

Although, possession of these attitudes is good for scientific work, to claim that these attitudes are reflective of all scientists may be misleading. The true successful scientist may not necessarily be of superior intelligence, but may sometimes be illogical, passionate, selfish, ambitious and secretive. (Mahoney, 1976).

Current goals of science education include developing scientific literacy which requires making learners to understand the impact of science on them as individuals and society. A person who has acquired scientific literacy among others will be able to:

- vi. Recognize that scientific concepts (e.g., velocity, force, energy, and photosynthesis) are invented or created by acts of human intelligence and imagination and not tangible objects accidentally discovered, like a fossil, a new plant, or a particular mineral.
- vii. Comprehend the distinction between observation and inference, and to discriminate between the two processes in the scientific context under consideration.
- viii. Distinguish between the occasional role of accidental discovery in scientific investigation and the deliberate strategy of forming and testing hypotheses.
- ix. Understand, through scientific examples, the sense in which scientific concepts

- and theories are mutable and provisional rather than final and unalterable, and to perceive the way in which such structures are continually refined and sharpened by processes of successive approximation.
- x. Comprehend the limitations inherent in scientific inquiry and be aware of the kinds of questions that are neither asked nor answered.
- xi. Be aware of at least, a few specific instances of interaction between science and society on moral, ethical, and sociological planes.

According to Perick (1993), there are many ways to define science literacy: From a narrow definition where literacy is the ability to recognize formulae and give correct definition, to a more liberal definition which includes understanding of concepts and some degree of understanding about the nature of science and its historical and social dimensions. According to him, there is no one correct definition of science literacy; it is a matter of different conceptions proving their worth for the promotion of particular ends.

Rollrick (1998) defines scientific literacy as comprising the knowledge and skills needed to empower students to control their lives at an individual and a societal level, she states that a common misconception of science for all is that it is inferno and therefore not suitable for able students. However, she emphasized that, able students and especially those who will become scientists and technologists need to understand societal issues.

Rutherford and Ahlgren (1990) defined scientific literacy as encompassing mathematics and technology as well as the natural and social sciences. According to Rutherford and Ahlgren (1990) a scientifically literate person is one who is aware that science, mathematics and

technology are interdependent human enterprises with strengths and limitations; understands key concepts and principles of science, is familiar with the natural world and recognizes both its diversity and unity; and uses scientific knowledge and scientific ways of thinking for individual and social purposes.

### **The Status of Information and Communication Technology in Nigerian Educational System**

The use of ICT in education in any nation depends on the computer technological awareness in that country. According to Akindolu (2002), the first time computer appeared in Nigeria was in 1963 when it was used to process the national census data. Some companies started the use of computer from that time. However, it is very obvious that the use of ICT in education is yet to be embraced by Nigerian educational institutions (Aleburu, 2005). Many reasons are

responsible for this. The new innovation of ICT in teaching and learning process in most schools is still a dream yet to be realized. ICT has not been integrated into the curriculum and incorporated into the mainstream of instructional programmes. Another reason is the non-availability of ICT facilities in our institutions. For instance, apart from computer science department that are equipped with few computers, available for the use of their students, most of the other students and lecturers outside the department do not have access to computers. Similarly, Aduwa-Ogiegbean and Iyamu (2005) reported that Nigerian schools are without internet facilities.

The implication of this is that students and teachers will not be able to come together for lectures, tutorials and one-to-one interactions across geographical locations. The traditional world of paper is

still the order of the day. Students will not be exposed to enriching teaching and learning materials on the internet. Another reason is inadequate training of teachers. Most teachers in our schools have not been trained on the use of ICT facilities. Few of them may be trained only to appreciate the use of which will be inadequate for them to apply in teaching and learning process.

### **Importance of ICTs in Teaching/Learning Process**

The ICTs have brought a revolution in the field of business, industry, insurance, banking, agriculture, medicine, transport and telecommunication service organization and various other fields affecting our day - to - day activities (Mangal & Mangal 2009).

ICTs have fundamentally changed the way we think, communicate and do most of the things. The field of education is no exception. Here, their use has a tremendous potentiality of serving its cause and helping the persons connected with the processes and product of education in many ways especially in teacher education. The would be teachers get sufficient help from ICT in their learning process. They are expected to get their required opportunities and training, for receiving and using information for their self-improvement.

ICT may help the-would-be teachers or student teachers to satisfy their urges or curiosity, inventiveness, construction and so on. They get acquainted with relevant sources of information, the ways and means of extracting required information, methods of information processing.

Most of what the trainee teachers acquire in terms of knowledge, understanding, skills, interests, attitude and appreciation is received through the process of

information and communication controlled by ICT. ICT supported education can promote the acquisition of the knowledge and skills that will empower students in Nigeria for lifelong learning. Computers and internet technologies enable new ways of learning which include active learning, collaborative learning, creative learning, integrative learning and evaluative learning. ICTs allow a shift from a teacher-centred pedagogy and enable learners to explore and discover rather than merely listen and remember. Gaible (2009) reiterated this fact by stating that ICT ensures that students have adequate literacy, numeracy and other basic skills.

### **Importance of ICT to Science Education**

The potential of each technology varies according to how it is used. Haddad and Drexler (2002) identify at least five levels of technology used in education: presentation, demonstration, drill and practice, interaction and collaboration. Print, audio/video cassettes, radio/TV broadcasts, computers or the internet may be used for presentation and demonstration. Drill and practice may also be performed using the whole range of technologies. However, networked computers and the internet have the best potential of enabling interactive and collaborative learning, their full potential as educational tools will remain unrealized if they are used merely for presentation and demonstration.

Haddad (2002) observes that ICTs enhance the quality of education by increasing learner motivation and engagement (through videos, television and multimedia computer software that combine text, sound and colorful, moving images), facilitating the acquisition of basic skills (through drill and practice, e.g. sesame street) and enhancing teacher training (e.g. web-based courses through the internet, satellite-based one-way

video-and two-way audio conferencing by telephone, e-mail and fax).

### **Prints (Books)**

Book (print) is the most common medium encountered in school learning. Prints include – books, newspaper, journals, magazines, pamphlets, handouts etc.

### **Radio and TV Broadcast**

Radio and television have been used widely as educational tools since the 1920s and 1950s respectively. There are three general approaches to these:

**Direct class teaching:-** Where broadcast programming substitutes for teachers on a temporary basis. It consists of ready-made 20-30 minute direct teaching and learning exercises to the classroom on a daily basis. The radio lessons, are developed around specific learning objectives at particular levels of maths, science, health and languages in national curricula.

**Schools broadcasting:-** Where broadcast programming provides complementary teaching and learning resources not otherwise available. It serves merely as an enrichment of traditional classroom instruction.

**General educational programming:-** consists of a broad range of programme types – News programs, documentary programs, quiz shows, educational cartoons etc. In a sense any radio or TV programming with informational and educational value can be considered under this type e.g. sesame street, National Geographic and Discovery, etc.

### **Audio/Video Cassettes**

Radio can be used in various ways to stimulates learning among learners at various levels. Here, learners have the

opportunity to construct mental pictures of events and this broaden their imagination. It helps to re-enforce the information the student might have gathered from the teacher in the class.

Video tapes such as VCD, VHS or any video medium. The technology of these media makes both their verbal and visual symbol systems transient rather than stable. This media combines the effect of both seeing and learning in the teaching and learning and has a unique importance of recreating the past and bringing the distance place and events to the classroom.

### **Teleconferencing**

Teleconferencing refers to “interactive electronic communication among people located at two or more different places”. There are four types of teleconferencing based on the nature and extent of interactivity and the sophistication of the technology (1) audio conferencing (2) audio-graphic conferencing (3) video conferencing and (4) web-based conferencing.

**Audio conferencing:** Involves the live (real-time) exchange of voice messages over a telephone network.

**Audio-graphic conferencing:** When low-bandwidth text and still images such as graphs, diagrams or pictures are exchanged along with voice messages.

**Video conferencing:** Allows the exchange not just of voice and graphics but also of moving images. Video conferencing use either a satellite link or television network (broadcast/cable).

**Web-based conferencing:** Involves the transmission of text and graphic, audio and visual media via the internet. It requires the use of a computer with a browser and

communication can be both synchronous and asynchronous.

### **Internet and Computer Usage**

With the advent of the internet age, all aspects of society have been influenced including education. Computers and internets are used in all levels of education excluding perhaps pre-school and grade school, but with more computer –like educational toys such as leapfrog. Self learning, in addition to books, video and other materials, etc. self-directed learners often use computers. Computers are use as training tool for repetitive tasks e.g. in the fields of reading, grammar or simple arithmetic i.e. in solving equations. Teachers use computers to administer assignments, use online resources in their daily lessons.

### **Tele Collaboration**

The organized use of web resources and collaboration tools for curriculum appropriate purposes is called Tele collaboration.

Judi Harris (1998) defines Tele collaboration as “an educational endeavour that involves people in different locations using internet tools and resources to work together. Much educational tele-collaboration is curriculum based, teacher designed, and teacher-coordinated. Most use e-mail to help participants communicate with each other. Many telecollaborative activities and projects have websites to support them. Web-based collaboration tools, such as e-mail, list serves, message boards, real-time chat, and web-based conferencing, connect learners to other learners, teachers, educators, scholars and researchers, scientists and artists, industry leaders and politicians – in short to any individual with access to the internet who can enrich the learning process.

### **Conclusion**

Information and Communication Technology, saves time as it is used in our educational system to reach more of our respective large populations of students in our various institutions of learning.

Information and Communication Technology e.g. teleconferencing is used in both formal and non-formal learning contexts to facilitate teacher – learner and learner – learner discussions, as well as to access experts and other resource persons remotely.

Lastly, ICT gadgets like T.V., video, radio etc. when used in the classroom facilitates the understanding of difficult concepts especially in science and science related courses. Internet provides up-to date information and also serves as an aid to communication and to the storage and retrieval of information.

### **Recommendation**

Due to the relevance of information and communication Technology, it is recommended that:

1. ICT should be taken as compulsory course in all teacher training institutions since it improves the quality of classroom teaching and also act as a regular, structured aid to poorly trained classroom teachers in under resourced schools.
2. Interactive Radio Instruction (IRI) projects should be fully embraced by the governments, as these projects have a positive impact on learning outcomes and on educational equity.
3. University owned stations should be encouraged/created where courses can be aired (broadcasts stations).

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- xii. Policy makers should also look at the ubiquity of different types of ICTs in the country in general and in the educational system at all levels. *Parameters and Prospects* (pp.9). Washington D.C.: Academy for Educational Development and Paris: UNESCO.
5. Government should look at the challenges of integrating ICT in education i.e. infrastructure, availability of electricity and telephony, capacity building, language and content as well as financing the cost of ICT use.

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