
Application of Information and Communication Technology (ICT) in Nigerian Education System: Issues and Challenges as they Relate to Vocational Technical Education

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Abstract

Information and Communication Technology (ICT) refers to technologies that are used to collect, store, edit and pass on information in various forms. It covers both old and new technologies used for handling information. ICT has applications in network education programme, distance learning, teaching and learning, computer aided drafting, inventory of tools and equipment in vocational education. ICT's are useful in and relevant to all the service areas of vocational education which involve development of cognitive, affective, psychoproduative and perceptual skills needed in the Nigerian workforce. Among the issues generated by ICT is the question of effective use of ICT without strong teacher training programmes to facilitate its application. While high technology-enhanced education holds promise, its implementation poses such challenges as integration of technology across curricula, copyright issues and

dynamism of ICT which demands retraining of personnel to cope with its constantly changing nature. Despite the issues and challenges posed by ICT, it is certainly superior to the traditional method of learning but certainly more costly. The emerging importance of ICT has necessitated recommendations such as the integration into teaching and learning at all levels of Nigerian education followed by proper training and retraining of teachers in the art of ICT. Nigeria should participate in ICT research in order to make her contributions to the sustainability and success of ICT in the business of vocational education and education in general.

Introduction

We are in a new world of globalization and high-tech world of design due to changes. Whatever happens in one part of the globe is transmitted very quickly to other parts through the mass media and the internet. This is made possible by new technologies such as telecommunications, satellite, internet, e-mail, computers and electronics. New life has been brought into our educational system by the introduction of computer. The computer age has erased the old ways of keeping records. The process, acquisition, storage and dissemination of information in the educational sector have assumed a novel shape. The new technology today has made the world borderless. Distance learning notwithstanding is easy to communicate or reach anyone. A student can now be taught by an unknown person. Awotua-Efebo (2006) emphasized that the introduction of information technology (ICT) in education has made a total difference in the meaning of education. Cyber space is now the order of the day. Educators and learners can now get and disseminate information without much effort. A lot of information communication technologies, such as networked education programme, E-mail facilities, Internet etc. are emerging in the education world.

Information and Communication Technology (ICT) Defined

According to Wali (2001), Information Technology or IT comprises various kinds and sizes of computers. The computers are connected via telephones to facilitate the sharing of the data they house. The data come in many forms: texts, sounds, and pictures. This definition places much emphasis on computers as information technology.

To Laudon and Associates (1994), Information Technology and Systems include all the different means, methods and tools that humans have used throughout history to help manage information, conduct business, communicate with others and better understand the world. This definition is very elastic. It incorporates virtually every kind of device used in gathering and disseminating information.

According to Liverpool (2002), ICT is a generic term referring to technologies that are used for collecting, storing, editing and passing on information in various forms. This definition is precise. However, Butcher (2003:10) citing Gunton (1993: 150) defined ICT as electronic technologies for collecting, processing and communicating information. They can be separated into two main categories thus: those which process information, such as telecommunication systems and those which disseminate information such as telecommunication system.

Importance of ICT

From the above definition, we can see that, Information and Communication Technology (ICT) performs the following functions: collecting, storing, processing and communicating information. ICT's are technologies, equipment and methods used to handle information. These include computers, telecommunications and electronics. ICT covers both 'old' and 'new' technologies used for handling information from paper, pencils, books and cameras to computers.

Essentially, a modern information system follows the same pattern as the communication cycle or process. It is an input-output cycle. It involves taking in data (such as raw scores, name, pictures, sounds, information etc.) (input), analyzing this information using the computer to process (store, manipulate rearrange, and analyze) the data and finally displaying this processed information to users usually on computer screens, television screen, printers or even through loudspeakers (output). The information supplied as output can then be used as a basis for acting on the data that was input (feedback). ICT can play key roles in administration. Student's data, personnel administration, purchasing and supplies, advertisement, etc. can be handled with ease using ICT. ICT is particularly useful in research as it gives access to a world of resources, especially in electronic media. Robinson (1991:100) says that the use of new information technology can serve three main functions namely:

1. Deliver all or part of the learning content to learners,
2. Supplement and extend content provided in a different form (e.g. print); and
3. Provide a two-way channel of communication for feedback or for exchange between tutors and students with their peers for feedback or for learning problem-solving, advice, debate and support.

Basic ICT Facilities

Laudon and Associates (1994) categorized the different kinds of information communication technologies (ICT) into five basic types namely:

- a. Sensing Technologies
- b. Communication Technologies
- c. Analysis Technologies
- d. Display Technologies
- e. Storage Technologies

Sensing Technologies are devices used to gather information from the environment and translate same into a form that can be understood by the computer. Data collection devices, sensors, scanners, computer keyboards, computer mouse or track balls, electronic pens and touch screens are some examples of sensing technologies.

Communication technologies are concerned with typing together and communicating information between the various kinds of technologies. Fax (facsimile) video, cellular telephones, telecommunication networks computer networks are some examples of communication technologies. A group of devices linked together is called a network. Networked computers can share data, programmes and printers within a building or campus. However, larger geographical areas need a wide area network

(WAN). This network uses telephone lines, microwaves and satellite. It is noteworthy that the internet is probably the most famous and largest wide area network. Internet connects thousands of smaller networks and millions of users around the world. With a personal computer, a telephone line and modem, one can get internet access in one form or the other (Laudon and Associates, 1994 and Liverpool, 2002). Analyzing Technologies embrace the computer hardware and software. Computers take in information from sensing and communication devices and then store and process the information. Laudon and Associates classify on the basis of size the computers of concern into:

- a. **Small:** desktop, laptop, and note book, handheld or palm top computers
- b. **Medium:** workstations and minicomputers
- c. **Large:** mainframe and super computers

Display technologies are essentially output devices which make processed data available to human users through sight or sound. Display screens, printers, audio output devices e.g. loudspeakers are examples of display technologies.

Storage technologies, as their names suggest, store large quantities of information in an easily accessible form. Examples of storage technologies are magnetic tape, diskettes and hard disc, magnetic disc, optical disc (CD-ROMS, read only memory, VCD's video compact discs, WORM's etc.)

An optical disc is a thin, circular disc which can store information. In fact, it can store much more information than a magnetic disc of the same size.

Areas of ICT Application

A lot of information and communication technologies (ICT) are applied in the education world amongst which those are listed below:

Network Education Programme: In this method, the teacher uses instructional media. It involves interactions and communication from one computer system to another. The learner is totally separated from the teacher. Information and communication technology are immensely involved. This method facilitates studying in distance education and it is always convenient for the learner. Babalola (2007) observed that, open and distance learning is an easy means of achieving the global objectives of providing education for all by the year 2015. A learner starts learning at a convenient time. Several tools are involved for the transmission of information in a virtual study. These tools are electronic mail and the World Wide Web, Internet relay chat.

Provide Opportunities for Distance Education: The use of Network Education has created new opportunities for those Nigerians who would have stopped their education half way. The emergence of Network Education makes it possible for Nigerians to register and study in the universities abroad. This era of network education has posed a very big challenge to the old archaic style of teaching and learning.

Information Communication Technologies and Vocational Education and Training

Information and Communication Technologies (ICT) have an important role to play in technical and vocational education and training. This role or its use falls into four principal categories as identified by Chomienne (1990). These categories are:

1. Technical assistance for teaching
2. Teaching Tool
3. A work tool for students
4. Systems control tool or workshop or laboratory tools

The categories of ICT's role or use are relevant in all the service areas of vocational education. These service areas include agricultural education, business and office education, technical education, nursing education, industrial education, and distributive education. Computer is now a new member in the family of vocational education. Training in vocational education consists in cognitive learning and psychoproduative or manipulative learning. Vocational guidance and affective learning are elements in the total training. Information communication technologies are crucially important in all aspects of a given service area of vocational education and training. For the purpose of this paper, attention is focused on the application of ICT to vocational-technical education service areas. ICT's are needed in vocational-technical education with respect to:

1. Teaching
2. Inventory of tools and equipment
3. Maintenance and servicing equipment
4. Processing students' performance scores in an examination or projects
5. ICT's are also employed to support the educational system in such areas as administration of vocational technical education, communication and curriculum development in vocational education (Honey, McMillan & Carrigg, 1999).

ICT's in Teaching and Learning

Teaching is an activity that results in learning which influences individual's behaviour in an observable manner. Traditional teaching has been in practice until the advent of technological changes. Among the changes are the Information Communication Technologies which appear to immensely enhance educational practice (Spencer, Dygdon and Novak, 1995). Teaching and learning have been improved by the application by the application of ICT's in their various aspects. Lecture delivery in vocational and technical education has been facilitated by the use of short circuit TV, overhead projectors, slide and tape technique, tape recorders and computer aided design system. The foregoing information technology tools give speed to teaching efforts as opposed to the traditional chalkboard approach to presentation of information. Vocational and technical education is a workshop-based education. The intent of instruction is principally to assist learners develop psychoproduative skills needed in the seven or eight service areas of vocational-technical education (Evans, 1971) and in the world of work.

Topical contents demanding the development of psychoproductive skills in Agricultural Education are agricultural production, agricultural mechanics and ornamental agriculture. In Home Economics, such topics as clothing management, production and service, home furnishing, equipment and services demand technical skills development. Skills development in Health Occupations are needed in nursing, environmental health and medical laboratory technology. Topics of interest in Trade and Industrial Education are appliance repair, automotive services, welding, building technology, refrigeration, drafting or technical drawing, electrical/electronic technology and aircraft maintenance (not yet included in the Nigerian vocational education curriculum). Typing, stenographic and secretarial occupations, filing, accounting, data processing are topics in Business and Office Education demanding the development of psychoproductive skills. In Technical Education, topics of concern include automobile technology, woodwork technology, metalwork technology, industrial safety and industrial electronics (FRN, 2004; Evans, 1971 and Thompson, 1973).

The development of psychoproductive skills in the foregoing instructional contents in vocational education calls for demonstration. Demonstration involves showing and telling learners what to do in the process of skills development or acquisition. ICT's are quite liberal in offering useful techniques in skills practice. Audio visual techniques are employed to record both information and live presentations of the skills demonstrated for the learners. This approach makes it easy for the learners to replay the audio-visual machine for the purpose of reinforcing their learning.

ICT's make distance learning possible. This approach is very useful in teaching information. When skills practices are involved, technical information disseminated by e-learning technique should be backed by a nearby laboratory for actualizing the practices observed on the screen.

Other aspects or forms of ICT's are video camera which is used to record for replay all live skills demonstrations in vocational technical education. Digital micrometer is replacing the manually adjustable type. The latter is not so easy to use in measuring diameters of round stock in vocational education. Numerical control machine has been around and used for many decades. It is very useful in the machine shop in which metal parts are machined according to the required specification. The machine operates under the command of a computer which carries tape containing instructions. After operation is executed by the machine, it gives an indication of completed operation, then the machine instructor or student replaces the tool with another one for a different operation. In automobile technology, computers are employed to diagnose engine problems for solution.

Simulation and Vocational Technical Education

A simulator is a device which is similar to but not identical with the real equipment in operation. Simulators are usually designed to provide instruction on selected and critical skills which are required on the actual equipment (Miller and Rose, 1975). Of the two classes of simulation, interactive simulation (and physical simulation) often referred to as a **human in the loop simulation**, is a simulation in which physical simulations include human operators such as in a flight simulator or driving simulator. Simulators, a high-tech training approach are of immense value in

vocational education and training. They have a lot to offer to the classroom of the future in vocational education (Hertel, 2002, Aldrich, 2003 and Aldrich, 2004 and Chomienne, 1990).

Information Communication Technology (ICT) and Computer-Aided Drafting (CAD)

We are living in the high-tech world of design due to changes. While the technologies change, one thing has remained unchanged and that is that the designer or the human has to make the decisions. ICT and CAD are tools used greatly to design, to solve problems and cannot do the thinking for humans. CAD is greatly applicable in vocational-technical education, engineering and science. Designing and drawing with CAD system is faster and has almost replaced the traditional drawing method (Spencer, Dygdon and Novak, 1995).

ICT and Inventory of Tools and Equipment in Vocational and Technical Education

ICT can be used effectively for inventory of tools and equipment in vocational education laboratories. Proper tool and equipment inventory ensures security of same. Retrieval of inventory items is easy and can be used to check the presence or absence of items of concern. Service and maintenance schedules of given tools and equipment can also be stored and retrieved when desired. ICT's are multifaceted and therefore, can be employed to serve the needs of vocational education in its various dimensions and levels. The nature of vocational education as a workshop-based/industry-oriented education easily lends itself to the applicability of information and communication technologies.

Preparation of students' result after examinations can be a tedious job especially where large class sizes are involved. When ICT's are employed, the task is accomplished at a very fast rate. Storage and retrieval of information on students' performance can be obtained in a matter of seconds. The ICT's in their various forms have really replaced the old ways of recording and retrieval of data. ICT's are also employed to support the education system in such areas as administration, communication and curriculum development in vocational education (Honey, Gulp and Carrigg, 1999).

Information and Communication Technologies: Issues and Challenges

Information and communication technology is a very useful tool in vocational technical education and in education in general, but it has at the same time given rise to some issues.

1. Can ICT be effectively used without strong teacher training programmes to facilitate its application?
2. In using ICT in pedagogy, there are questions to be addressed. These questions are:
 - a. How easy is it to use the equipment?
 - b. Is it interesting and motivating to use it?

- c. Will the use of ICT lead to improved learning results? If yes, in what way?
- d. Is it possible to transfer and use what you have learned through ICT's in other areas of education?
- e. What are the advantages of using ICT compared to other pedagogical methods?
- f. How can the teacher ensure that the students or learners look in the right place and don't get lost on the Net and spend a lot of time without finding what they search for?
- g. Do learners have the ability to evaluate the knowledge they find on the Net; do they have the necessary techniques to adapt the information they obtain in a meaningful way?

The foregoing are the issues to be pondered upon with respect to ICT usage in vocational technical education.

While high technology-enhanced education holds promise, its widespread implementation also poses some immediate challenges. These challenges anchor on:

1. Capital outlays hardware and software
2. Equal access to ensure that there are no technological "haves" and "have-nots".
3. Appropriate strategies for integrating technology across curricula.
4. Copyright issues: Copyright offense is a crime punishable by law in Nigeria and elsewhere.
5. Availability of pedagogically sound materials
6. Teacher training and development.
7. The Dynamism of ICT – the average lifecycle of key technologies is now less than an average man's lifetime. Retraining to meet the changing technologies remains an ongoing problem or challenge.

Given all the foregoing challenges, it is critical to assess the worth of technology-based learning before its adoption and implementation. It may be necessary at this stage to recall the advent of hand calculator and its effect on learning. Educators in the U.S.A believed that closing the access gap to calculators would close the performance gap in mathematics of underachieving learners. Research evidence has indicated that students who were using calculators at the highest rate had the lowest performance on standardized test (Light, 2001). There is a gospel belief about the efficacy of ICT's in respect of cognitive and psychoproduative skills acquisition. What of the affective skills development in the whole business of vocational education training through the application of ICT method?

Conclusions

In the light of the foregoing write-up, it may be concluded that ICT's are recognized for teaching and learning. The effective use of the new high-tech in education can be attained if the attendant issues and challenges are properly addressed. The constantly changing nature of ICT's must always necessitate the retraining of teachers for successful management. ICT is, in fact, superior to the traditional method of learning but certainly more costly.

Recommendations

In the face of the emerging importance of ICT's in education and training, the following recommendations are proffered:

1. ICT should be integrated in teaching and learning at all levels of education. For this approach to yield the expected results, teachers should be properly trained and retrained in the art and science of ICT.
2. The application of ICT to vocational education and training should be seriously considered and funded by the government.
3. While new entrants into the teaching profession are trained in this high-tech method, the older practitioners should be retrained to cope with the new pedagogical technology.
4. Research in ICT should be encouraged so that the third world nations including Nigeria may make their contributions to the sustainability and success of ICT in the business of vocational education and education in general.

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