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Problems and Prospects of Utilizing ICT Tools in Science Education

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ABSTRACT
Information and Communication Technology (ICT) has been celebrated and lauded to be allowed a pride of place in the teaching/learning environment, yet there exists a missing link. Hence, the main focus of this research is to highlight the use of ICT as a tool to promote education. Therefore, this research work examines the problems and prospects of utilizing ICT tools in science education. The work considered the students the end products of any educational process. Hence, out of the sample size of one hundred and twenty, the student/lecturer ratio was one hundred ratio twenty. Survey research design was employed and as a result primary source of data collection was adjudged apt. The research hypotheses and questions were resolved using chi-square as an instrument of data analysis and expectedly conclusions made.

Keywords: ICTs, Utilization, Students, prospects, problems.

1. INTRODUCTION

Information and communication technology (ICT) has become, within a very short time, one of the basic building blocks of modern society. As pointed out by Etim et al (2011) ICTs embody the various services and applications associated with them, such as videoconferencing and distance learning and they are often spoken of in particular contexts, such as ICTs in education, health care, or libraries. Therefore inherent in the concept are sharing, expansion of otherwise limited services, innovation and networking by technological means. According to Egwali and Osunbor (2011) the explosion of information and communication technology (ICT) has created immense opportunities to enhance the educational process.

Bayo et al (2003) assert that Information and communication technologies have changed the face of the world we live in. ICT enables people to communicate with family, friends and colleagues around the world instantaneously, gain access to global libraries, information resources, and numerous other opportunities. As contained in Nirupama (2011) ICTs offer immense possibilities for reducing poverty; improving governance and advancing gender equality provided they are made more accessible and consciously applied towards the achievement of these objectives. Smeets, et., al., (1999) observed that ICT contains lots of educational tools that are assisting educators in the teaching and learning process.

ICT adds value to the processes of learning, and in the organization and management of learning institutions (UNESCO 2002). ICT has greatly facilitated access to knowledge information and in the space of time it has changed the global macroeconomic landscape and has opened new possibilities for establishing and delivering advance learning.

ICT has also had constructive impacts on students learning, knowledge construction and thinking (Angeli and Valanides, 2005). ICTs serving as powerful tools can, when used appropriately as part of an overall development strategy, play a key role in the development process (Clement, 2010).

2. RELATED WORKS

According to Blurton (1999) ICTs are a diverse set of technological tools and resources used to communicate, and to create, disseminate, store and manage information. Bayo et al (2003) define Information and Communication Technology as one of the driving forces of globalization. ICT encompasses the broad spectrum of communication technologies from radio, film, television, press, and telephone along with more participatory forms such as theatre, video or story telling. It also focuses on the electronic end of the spectrum such as e-mail, the Internet, mobile phones and digital video.

ICTs “refers to technologies people use to share, distribute, gather information and to communicate through computers and computer networks” (Ogunsola & Aboyade, 2005). Information and Communication Technologies (ICTs) cuts across a variety of technologies including: computers, microelectronics/microprocessor-based technologies; multimedia and other information processing technologies and systems; telecommunications technologies and infrastructure (fixed line, wireless, satellite based and mobile infrastructure); and communication network technologies and infrastructure (including local and wide area communications and computer networks for voice, data and video).

Information, knowledge and technology are increasingly becoming the key drivers for socio-economic development world-wide. A nation’s capability and ability to accelerate its socio economic development process and gain competitive advantage depends very much on the extent to which it can develop, use and sell, information, knowledge and technology in one form or another (Clement, 2010). The World Bank defines ICTs as “the set of activities which facilitate by electronic means the

processing, transmission and display of information" (Rodriguez and Wilson, 2000). ICTs can be described as a complex varied set of goods, applications and services used for producing, distributing, processing, transforming information-(including) telecoms, TV and radio broadcasting, hardware and software, computer services and electronic media" (Marcelle, 2000).

Information and Communication Technologies in Nigeria

The first Information and Communication Technology (ICT) initiative in Nigeria started in the 1950s with focus on print and electronic media. No major policy or other outcome was achieved because of strict government control. The full awareness of the importance of ICTs was absent (Chiemeke & Longe, 2007). Only the private sector demonstrated ICT initiatives (Bayo et al, 2003). The oldest Telecommunication service named, Nigeria Telecommunication Limited (NITEL) available was run by Federal Government. It operated Public Switch Telephone Network (PSTN). The major challenge was that the history of development of telecommunications is characterized by unfulfilled objectives (Ogunsola & Aboyade, 2005). However, the story has changed since a decade ago (Oladejo & Oguntunde, 2011).

Ajayi (2003) observed that ICT Revolution started in Nigeria after return to democratic rule in 1999. The country had gone through an extended period of military dictatorship prior to this time. This came with an attendant apathy for the development of a platform for developing ICT in the country. In some cases, it was even believed that ICT would pose a security threat! It dawned on the government that the digital divide would only continue to widen except the issue of developing ICT in the country was given the priority attention is deserved.

Effects of Information and Communication Technologies

Governments and people around the world have started appreciating the ability of Information and Communications Technology (ICT) to stimulate rapid development in all sectors of the economy. ICT is redefining the way we do almost everything and it is a ready tool for all strata of society- it is as much a tool to the President of any nation in governance as it is a tool for the housewife in her daily chores! Thankfully, Nigeria is exploring the benefits of ICT as well (Ajayi 2003). ICT is part of the fabric of daily life, supporting activities at home, work and school. ICT allows companies and families living in different locations to stay in touch with each other.

The help of telecommunications helps in sending text (SMS) message through-out the country. The internet and the ICT revolution have created empowerment for individuals and in the area of learning opportunities to sell their own ideas services and products in the society. Moreover, the convenience and the anonymity provided by the internet have led some people to turn to the internet for psychological and emotional, (Anyasi and Yesufu, 2007).Today ICT is being used as a tool for improving the quality of life by improved efficiency and enhanced effectiveness. Different types of ICT tools assist the people with disabilities by providing them with learning opportunities, capabilities and also increase potential of the disabled in different walks of life. ICT makes them capable by providing the ability to access knowledge with the help of suitable digital media.

ICT is playing very important role in communicating with peers, thereby promoting collaborative and social learning environment. ICT also helps disabled students in reading, writing, hearing and seeing process (Mishra et al 2010). ICT creates jobs in all sectors of the economy, and as jobs are created, labour markets adjust to their demands. The increase in both the wages and relative supply of educated workers are consistent with the idea that ICT allows skilled workers to perform more functions and produce things that previously were in the domain of less skilled workers, (Anyasi et al., 2008).

ICT have the potential for reducing discrimination and providing more opportunities to engage people (Mishra et al 2010). Abubakar et al (2011) stated that Information communication technology (ICT) initiatives can advance solutions to many elements of poverty and hunger thereby improves on community development. Their effective implementation would be best achieved by the combined resources and capabilities of all sectors: public, private, civil society, and others. ICT education and training also appears to have tremendous scope and a major source of empowerment of people especially the socially and economically backward in Africa. Adebayo (2011) opined that the revolutionary potential of new ICTs lies in their capacities to instantaneously connect vast network of individuals and organizations across great geographic distances at very little cost.

As such, ICTs have been key enablers of globalization, facilitating worldwide flows of information, capital, ideas, people and products. They have transformed businesses, markets and organizations, revolutionized learning and knowledge sharing, empowered citizens and communities and created significant economic growth in many countries. ICTs have amplified brain power in much the same way that the 19th century industrial revolution amplified muscle power.

2.1 ICT in Education

The potentials for information and communication technology to improve the quality of instruction, transform the school, improve school management, increase access to education and improve in teacher education, among others, have been emphasized in several studies (Haddad 2003). Citing Mishra et al (2010), ICT has become a very important part of the educational delivery and management processes. ICT to a great extent facilitates the acquisition and absorption of knowledge, and hence can provide extraordinary opportunities to developing countries for enhancing their educational systems particularly for the underprivileged constituency, and thereby for raising the level of quality of life of their people. Blurton (1999) stated that Communication and information are at the very heart of the educational process, consequently

ICT-use in education has a long history. ICT has played an educational role in formal and non-formal settings, in programs provided by governmental agencies, public and private educational institutions, for-profit corporations and non-profit groups, and secular and religious communities.

Krishnaveni and Meenakumari (2010) have said that, "Information and Communication Technology (ICT) plays a vital role in supporting powerful, efficient management and administration in education sector. It is specified that technology can be used right from student administration to various resource administration in an education institution. Egwali and Osunbor (2011) stated that utilizing all that ICT has to offer in the educational sphere will not only help in reforming the industrial, administrative, social, commercial and ecological status of a nation, it will also affect the capital status. Using ICT tools effectively will require that lecturers become comfortable with existing new technologies, but more importantly, with the innovations that appear with increasing rapidity.

Abubakar et al (2011) stated that today, Information and Communication Technologies (ICT) and wireless technologies makes it possible to provide instantaneous access to knowledge and information that was not possible 60 years ago. Haddad (2003) observed that Information and communication technology has the potential for enhancing the tools and environment for learning as it: allows materials to be presented in multiple media, motivates and engages students in the learning process, fosters inquiry and exploration, and provides access to world wide information resources, among others.

Egwali and Osunbor (2011) opined that the explosion of information and communication technology (ICT) has created immense opportunities to enhance the educational process at all levels, but particularly at the tertiary level. The deployment of ICTs in higher education means a traditional system is being revamped. It means the integration of something new into the existing system; that is, as Van Melle, Cimellaro & Shulha (2003) describe it, "the use of internet-based and computer-based applications in class environment to help establish communication and reach information and thus to support student learning." Unluer et al. (2009) cited Jonassen, Peck & Wilson (1999) and Kearney & Treagust (2001) to show that "the effective integration of ICT into the learning environment engages students in higher-order thinking" (p. 41).

It is for these reasons that a number of developed countries have increasingly invested in the integration of ICT in schools (Gulbahar, 2007) and educational institutions, especially universities, are increasingly looking to ICT as a technical aid in the development of new models of teaching and learning (Zandvliet & Straker, 2001). There have also been a variety of international assistance programmes for African countries as they have battled to join the ICT-connected world for the purpose of, among other things, uplifting the quality and value of higher education. However, the integration of ICT into curriculum and instruction is a long and rather slow process (Roblyer, 2006). The reason is that the integration of ICT is a comprehensive process that should be taken into consideration in various aspects.

ICT is changing processes of teaching and learning by adding elements of vitality to learning environments including virtual environments for the purpose. New technologies make it possible for complicated collaborative activities of teaching and learning by dividing it in space and time, with seamless connectivity between them. Due to its capability to offer anytime and anywhere, access to remote learning resources, ICT is a potentially powerful tool for offering educational opportunities, both to previously underserved constituencies including persons with disabilities, as well as all others who for reasons of cost or because of time constraints are unable to register for on campus programs (Mishra et al 2010).

Unlier et al. have cited many recent research studies (Bauer & Kenton, 2005; Reynolds, Treharne & Tripp, 2003), which suggest that, in spite of this global recognition of the great potentials of ICTs in higher education, many institutions are failing to integrate technology into existing context. These studies reveal that although teachers were "having sufficient skills, were innovative and easily overcome obstacles, they did not integrate technology consistently both as a teaching and learning tool" (Gulbahar, 2007).

Nwachukwu (2006) asserted that in a complex society like Nigeria, many factors affect its ICTs use and integration. The 2006 study investigated "the relationships between funding, ICT, selection processes, administration and planning and the standard of teacher education in Nigeria." The results suggested that the use and integration of ICT in both the state-owned and federal government-owned institutions of higher education in general and into teacher education programme in particular were "sluggish."
Many studies and experiences continue to suggest that even as "ICT is having a revolutionary impact on educational methodology globally ... this revolution is not widespread and needs to be strengthened to reach a large percentage of the population".

The true status of ICTs deployment in the education in terms of academics is reflected in Onasanya's (2002) study of Internet usage among the university's undergraduates which found that "much as student's awareness level of the internet is quite encouraging the student have not tapped the information available for academic use." The study revealed that majority of the students see the internet as a mere communication medium. Binuyo (2010) confirmed this tendency when he found that undergraduates in the university "use Facebook for personal relationships, surveillance and personal identity" rather than "as a useful tool for complementing academic studies."

Information and communication technologies (ICTs)—which include radio and television, as well as newer digital technologies such as computers and the Internet—have been touted as potentially powerful enabling tools for educational change and reform. When used appropriately, different ICTs will no doubt help to expand access to education, strengthen the

relevance of education to the increasingly digital workplace, and raise educational quality by, among others, helping make teaching and learning into an engaging, active process connected to real life. Using ICT applications, a number of educational institutions are not only able to run courses concurrently, but lectures can also be received simultaneously, as they are being delivered, in different lecture rooms that are located in places far away from the actual point of delivery.

The Internet has also become a Universal Library, where books, journals, articles and other materials can be sourced right within the confines of individual's homes in any part of the Globe. Education today no longer begins and ends with school and university. Internet indeed has limitless potential for education and access to information.

At many Nigerian Universities, Polytechnics and secondary schools, students, lecturers, etc, can be afforded the benefits of constant and easy access to updated information on different subjects via the internet (Ndukwe 2004). The effective integration of ICTs into the educational system is a complex, multifaceted process that involves not just technology but also curriculum and pedagogy, institutional readiness, teacher competencies, and long-term financing, among others. In this regard, as pointed out by Ndiaye (2001) the tool of computer science must be perceived and considered as a 21st century universal language. With this consideration, its introduction in the educational system and other aspects of national economy must and will be increasingly early and its use will tend to be generalized. In the opinion of Yusuf and Yusuf (2009) information and communication technologies will assist in ensuring the achievement of the goals of the educational reforms in Nigeria.

3. THE CHALLENGE SCENARIO

Despite the numerous advantages of introducing Information and Communications Technology (ICT) in education, it was observed that there has been steady decline in the application of Information and Communications Technology (ICT) in the teaching and learning. The researcher effort is therefore directed at examining the problems and prospects of utilizing ICT tools in science education.

Purpose of the Study

Nigeria's ability to realize its vision of becoming one of the twenty largest economies in the world by the year 2020 is largely dependent on its capacity to transform its population into highly skilled and competent citizens capable of competing globally. The Education Sector is consequently pivotal to the actualization of current national and global government policy objectives. Regrettably, many of our educational institutions still do not have Information and Communications Technology (ICT) facilities that they require to access up to date information to enable them push the frontier of knowledge, exchange ideas with peers, teach and learn well. Hence, the fundamental purpose of this research is to appraise the suitability of Information and Communications Technologies (ICTs) in the teaching and learning of selected science courses to further enhance its application.

3.1 Research Questions

This paper wishes to provide answers to the following research questions:

1) Does the application of ICT have significant influence on the teaching and learning of science courses?
2) Does ICT induced learning environment have effect on teaching and learning of science courses?
3) Does ICT usage proficiency influence effective teaching and learning of science courses?

3.2 Hypothesis

The following hypotheses would be tested in this study:

Ho_1: *There is no significant relationship between ICT usage and efficient teaching and learning of science courses.*

Ho_2: *There is no significant relationship between ICT induced learning environment and efficient teaching and learning of science courses.*

Ho_3: *There is no significant relationship between the Lecturer's ICT usage proficiency and effective teaching and learning of science courses.*

3.3 Population of the Study

The work considered the students the end products of any educational process. Hence, out of the sample size of one hundred and twenty, the student/lecturer ratio was one hundred ratio twenty.

3.4 Sample and Sampling Technique

The sample of the study comprised one hundred and twenty students and lecturers drawn from a selected science courses namely; Mathematics, Biology, Chemistry, Physics, PHE and Integrated Science. Stratified sampling technique was adopted to allow for adequate representation of the entire population.

3.5 Instrument

Questionnaire is considered a veritable instrument to obtain data from primary sources and it was accordingly adopted in the study. The questionnaire has five sections; the first section contains items on respondents' personal data while other sections present items that address the hypotheses of the study.

3.6 Validity and Reliability

The research instrument is validated with the aid of expert review, this requires the experts in Test and Measurement examining the items and pass comments as to the strength of the items to measure what they purports to measure while reliability is established for the test through test re-test method.

3.7 Method of Data Collection

The researcher himself administered the questionnaire and this afforded him ample opportunity to further engage lecturers in discussions bordering on their shared view about the thrust of the study.

3.8 Method of Data Analysis

The data collected on the study was analysed using chi-square. The questionnaire designed for the study was sectionalized in line with the relevant hypothesis and this provides sufficient justification for the use of chi-square. There are three hypotheses in all, with each being analysed with the aid of chi-square having processed the obtained responses into numerical values.

4. DATA PRESENTATION AND ANALYSIS

	Hypothesis (Ho)	Observed χ^2 value	χ^2 Critical Value	df	P
Hyps I	There is no significant relationship between ICT usage and efficient teaching and learning of science courses.	196.35	21.03	12	0.0001
Hyp II	There is no significant relationship between ICT induced learning environment and efficient teaching and learning of science courses.	16.85	21.03	12	0.1561
Hyps III	There is no significant relationship between the Lecturer's ICT usage proficiency and effective teaching and learning of science courses	39.97	21.03	12	0.0001

5. FINDINGS

From the table above the observed value of $\chi 2$ falls within the rejection region for hypothesis I i.e. > at 0.05 significant level, hence we reject the null hypothesis and accept the alternative hypothesis. This implies that there is a significant relationship between the ICT usage and efficient teaching and learning of science courses. As for hypothesis II the observed value of $\chi 2$ falls within the acceptance region i.e. < at 0.05 significant level, hence we accept the null hypothesis. It implies therefore that there is no significant relationship between ICT induced learning environment and efficient teaching and learning of science courses.

It is evident in the hypothesis III that the observed value of $\chi 2$ (39.97) is greater than the critical value (21.03) i.e. > at 0.05 significant level. This establishes the basis for the rejection of null hypothesis and the acceptance of the alternative hypothesis that Lecturer's ICT usage proficiency is statistically related to effective teaching and learning of science courses.

6. CONCLUDING REMARKS

The significant role of Information and Communication Technologies (ICTs) in the business of education cannot be downplayed. Hence, this study has successfully examined the problems and prospects of Information and Communications Technologies in Science Education in an empirical manner. This is carried out against the background of continued scepticism held by the stakeholders about the strength of Information and Communications Technologies. It appears immensely astonishing, to find out that with the far reaching effects of Information and Communications Technologies in the teaching and learning process, its usage is still precluded by a number of factors which ordinarily could have been eliminated had stakeholders muster the necessary policy thrusts.

The promising benefits of Information and Communications Technologies need be accentuated and institutionalized such that our schools will be better for it. It can thus be concluded that Information and Communications Technology as it were

has not been optimally appreciated and optimized in teaching and learning process and this provokes mind boggling questions which this work sets out to reconcile.

Following the findings of this research work that the role of Information and Communications Technologies in the teaching and learning process cannot be downplayed and the identification of a number of attendant challenges that are stifling the realization of its utter fruition, the following recommendations are made:

- The policy makers should endeavours to intensify efforts geared towards the introduction and integration of Information and Communications Technologies in all the levels of education, this will undoubtedly enhance performance.

- The stakeholders in the sector should demonstrate concern and readiness in terms of pecuniary assistance for the schools in the procurement and maintenance of Information and Communications Technology kit.
- The government should provide a ladder of opportunity for the students by increasing access to personal computer which will further motivate and reinforce them to achieve academic excellence.
- There should be incentives for teachers to enable them embrace seminars and symposia aimed at sharpening their horizons and make them altogether proficient in the use of teaching aids.
- Computer application courses should be made an integral part of any course of study and should be taken throughout a course of study. The content of these computer courses should include practical works to give the students the requisite practical knowledge.

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