INFORMATION AND COMMUNICATION TECHNOLOGY IN EDUCATION

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Abstract

ICT stand for Information and Communication Technologies and defined as a diverse set of technological tools and resources used to communicate and to create, disseminate, store, and manage information. These technologies include; computer, internet, broadcasting technologies such as; radio, television etc. However, the technological change and globalization have created new economy with Information and Communication and Technology (ICT) occupying a complex position in relation to globalization. The emergence of this new global economy has serious implications on the nature and purpose of the educational institutions. Education is the stepping stone for every human to build a successful life and career and this applies to everyone, hence, ICT has become one of the building blocks of education in this modern society. ICTs in education deal with the use of ICTs within education technology. Information and Communication Technology (ICT) in education is the mode of education that utilizes information and communications technology to support, enhance, and optimize the dissemination of information. Worldwide research has shown that ICT can lead to an improved student learning and better teaching methods in the learning institutions.

However, the objective of this paper was to acquire a general understanding of the critical roles of the Information and Communication Technology in the education systems. The methodology employed in this desk study was the extensive literature review focusing on the relevant work undertaken by the specialists in Information and Communication Technology in the education sector.

Keywords: *Information, communication, Technology, Technologies, Education.*

1.0. Introduction

Information and communication technologies (ICTs) is a term which is currently used to denote a wide range of services, applications, and Technologies, using various type of equipment and software, often running over telecom networks ICTs include well known telecom service such as telephone and fax. Telecom service used together with computer hardware and software from the basis of a range of other service, including email, the transfer of files from one computer to another, and in particular, the internet, which potentially allows all computers to be connected, thereby giving access to source of knowledge and information stored on computers worldwide (Papert, 2018). Its Application includes video-conferencing, teleworking, distance learning, management information system, stock taking; technologies can be said to include a broad array ranging from 'old' technologies such as radio and Television to 'new' ones such as cellular mobile.

Moreover, Munesh (2014) opines that education has over the years been a vehicle by which change takes place both socially and economically. Fifty years down the line, higher education systems have increasingly emerged to meet the demands of quality education for all. Information and Communication Technology (ICT) has played a key role in this growth of higher education worldwide. Arledge (n.d) insists that if society paves way for technology to penetrate into education, then the educational world can move with a kind of speed that has never occurred before this age and time. This means that the use of ICT is fast becoming an everlasting phenomenon (Moonga, 2016). The pace at which technology is transforming lives globally demands that there is a clarion call for nations trailing behind the change to close the gap.

Tomei (2005) stated that educational institutions, acknowledging the impact technology is making on society, are putting a lot of mechanisms in place to ensure that curricula and classroom facilities are set in a manner in order to bridge the existing technology gap in teaching and learning. He reiterated that, this restructuring process demands effectual endorsement of technologies into existing situation in order to offer learners with understanding of precise subject areas, to support significant learning and to augment proficient productivity.

Research has it that the amalgamation of technology conveys radical changes in teaching methodology. Scrimshaw (2004) asserts that the change can only be felt when ICT use is skewed towards students-centered

form of teaching and learning and not necessarily just in its introduction in the school. Integration of ICT provides the tool needed by the information knowledge society. Thus, teachers are tasked more importantly to integrate ICT to equip learners in this digital age. (Alberta & Learning, 2000; Kearns & Grant, 2002; Loveless & Dore, 2002).

Steketee, (2006) maintains that, integrating ICT into regular classroom instruction supports teacher trainers to present a realistic clarification to the trainees the inventive means of teaching and learning. Thus, the application of technology in Colleges of Education in Ghana will not merely augment classroom practices, but also empower trained teachers to use these technologies in their own classrooms to enrich their lessons and also empower the young ones they impart knowledge into (Papert, 2018). Although some countries such as United States, Australia, Japan, Malaysia and Philippines have made great strides in ICT integration in education, others are still striving to do same. Bitter and Pierson (2005) indicated that various countries have even fashioned proficiency principles for technological use. Nonetheless, integrating ICT in education is a multifaceted procedure of educational change and the degrees of integration in many countries is tremendously diverse and, in most cases, very restricted (Kirschner & Selinger, 2003, Loveless & Dore, 2002, Scrimshaw, 2004). Different factors account for this limitation.

In addition, ICT has turned the whole world into the global village which has influenced all spheres of life positively (Papert, 2018). Research scholars are of the opinion that ICT as well as more computer traditional-assisted instructional applications are positively influencing pupils and students learning processes and outcomes. Gaible (2009) in his study stated that ICT has comprehensively impacted its benefits on every society as the utmost change agent of human development. It is difficult world over today to think of any aspect of human life such as; education, medicine, communication, research, banking, trade, culture among others that are not ICT driven. In the education sector, particularly, the application of the ICT has become the critical part of the learning processes for university students both outside and inside the classroom setting (MOGE, 2013). The government and other stakeholders in the education sector such as university management and researchers have invested millions of dollars to adopt ICT in the education system during the last two decades (Lawrence, 2015). Most universities that have fully adopted ICT have recorded immense advancement in the application of the ICT for the improvement of the learning methods, teaching, research and development.

2.0. Concept of Information and Communication Technology in Education

The ICT is a term which is currently used to denote a wide range of services, applications and technologies using various types of equipment and software, often running telecom networks ICTs which include well known telecom service like; telephone and tax (Agyei, 2013).

Furthermore, the literature reviewed informs that ICT is concerned with any device or system that allows storage, retrieval, manipulation, transmission and receipt of digital information (Doley, 2008). The hardware such as computers, scanners, digital cameras, mobiles, tablets etc. are part of this technology. The software used in ICT include system software, word processors, data bases, spreadsheets application etc. In addition to computers, digital televisions, digital, radios, e-mail, internet, broadbands, networks (wired and wireless), mobile phones, Global Positioning System, video conferencing, instant messaging, fax etc. are all examples of ICT. Research reviews indicate that governments across the globe are bent towards implementation of technology in various parts of life including education (Webb, 2013). Large and complex technologies are being procured for educational purposes, but this does not imply that the personnel working in educational field are well versed with the use of these ICT equipment and technologies.

The ICT in Education essentially refers to the incorporation of technology in education, communication, data processing and data storage to transmit knowledge on to learners Thus, that is how ICT can facilitate, enhance, promote and project instruction (Lembani, 2019).

3.0. Role of ICT in Education

ICTs are relevant in education to meet the challenges at the core of teaching and learning process; and challenges to the system such as monitoring teacher attendance, transfer and payment of salaries and the mapping of student populations and the educational resources meant to serve them (Webb, 2013). ICTs have the potential for increasing access to and improving the relevance and quality of education in developing countries.

World Bank (1998) reports: [ICTs] greatly facilitate the acquisition and absorption of knowledge, offering developing countries unprecedented opportunities to enhance educational systems, improve policy formulation and execution, and widen the range of opportunities for business and the poor. One of the greatest hardships endured by the poor, and by many others who live in the poorest countries, is their sense of isolation. The new

communications technologies promise to reduce that sense of isolation, and to open access to knowledge in ways unimaginable not long ago.

According to Dodo (2013), ICTs are potentially powerful tools for extending educational opportunities, both formal and informal, to those previously underserved in rural areas, groups traditionally excluded from education due to cultural or social reasons such as ethnic minorities, girls and women, persons with disabilities, and the elderly, as well as all others who for reasons of cost or because of time constraints are unable to enroll on campus.

ICTs have the ability to transcend time and space (Lembani, 2019). They make possible asynchronous learning or learning characterized by a time lag between the delivery of instruction and its reception by learners. Lembani (2019) in agreement with UNESCO, (2002) posited that ICT-based educational delivery also dispenses with the need for all learners and the instructor to be in one physical geographical location.

In addition, Wallet (2014) in congruity with Tinio (2002) explained that ICTs such as teleconferencing technologies enable synchronous learning. Instruction can be received by multiple, geographically dispersed learners simultaneously. Expanded education is also enhanced through access to remote learning resources. With the Internet and the World Wide Web, a wealth of learning materials can be accessed from anywhere at any time of the day by unlimited number of people. Thus, teachers and students no longer have to rely solely on printed books and other materials in physical libraries which are limited in quantities for their educational needs. ICTs also facilitate access to resource persons all over the world.

ICTs have the capacity to prepare the present generation of students for a workplace where computers, the Internet and related technologies are becoming more and more ubiquitous. Technological literacy, that is the ability to use ICTs effectively and efficiently and it is thus seen as representing a competitive edge in an increasingly globalizing job market. In addition to technological literacy, EnGauge in Tinio (2002) identified other job skills referred to as 21st Century Skills. These include digital age literacy (consisting of functional literacy, visual literacy, scientific literacy, technological literacy, information literacy, cultural literacy and global awareness), inventive thinking, higher order thinking and sound reasoning, effective communication, and high productivity. According to Dodo (2013), ICTs have the potential to promote the acquisition of these skills through using it as a tool for raising educational quality. The acquisition of these skills normally enhance the quality of education in most of the African countries.

Information and Communication Technology empowers teachers and learners to promote change and foster development of 21st century skills. ICT has the potential to make learning more experiential (Lawrence, 2015). Moreover, the large amount of data, vituals available on any topic can be brought to the classroom from all over the world. That is why ICT has been considered as an emerging area with lots of potential for making educational process more meaningful (Lembani, 2019).

The development in the use electronic media have influenced all walks of life in the society. Education is not an exception to this. The use of computers and the computers for enhancing the quality of education by making learning more relevant to life has been seen as ideal by the educational institutions (Pandey, 2014). The students (learners) of tomorrow who are the students now going to live in the age of the electronic media and make use of ICT. The ICT including computers and internet are useful to improve the efficiency and effectiveness of education at all levels and both in formal and informal education. According to Lembani (2019), In Zambia, this combines the use of the print, record video and broadcast radio, television, and audio-conferencing technologies for teacher education.

ICTs supports effective professional development of teachers. Using ICTs as tools for training of teachers is as important as introducing the basics of ICTs to the prospective teachers or tutors (Meijer, 2016). As sources of information and expertise, as well as tools for distance communication, ICTs offers many new possibilities for teacher education. Teachers may through the regular use of these technologies. Use of new media, new rules of communication even a new language have to be learned.

In spite of the fact that education is a social enterprise and teachers are the traditionally the mainstay of teaching learning process, ICTs are very powerful tools for diffusing knowledge and information, a fundamental aspect of the educational process. According to Wallace (2013) posited that ICTs play an enormous role for improving access and equity in education sector in general and in higher education sector in particular, this is because ICT in education provides mass education opportunities, it stimulates learning and re- enforces brilliant ideas (Hargreaves, 2016). This is the more reason the presence of the ICT in education sector is steadily increasing. It is imperative to state that ICT makes learning more effective as the learner uses both seeing and hearing, hence, increasing the acquisition of knowledge and skills, thereby increasing the knowledge base in the education sector.

According to Lucy (2018), ICTs are powerful enabling tools for educational change and reform processes through improving both access to education and the quality of that education. ICTs under the expansion of the access to education, strengthen the relevance to education to the increasingly digital work place and raise educational quality by helping teaching and learning into an engaging, active process which is connected to the real life when used appropriately. According to Lucy (2018) in consonant with Pandey (2014) clearly indicated that learners of tomorrow who are the students now going to live in the age of the electronic media and make use of ICT and that the ICTs which includes computers and internet are instrumental to enhancing the efficiency and effectiveness of education at all levels and both in formal and informal education. This is the reason as to why Blurton (2015) defined ICTs as a diverse set of technological tools and resources used to communicate to create, disseminate, store and manage information. These technologies include computers, internet, (broadcasting technologies) radio and television and telephone. Basically, ICTs in education deal with the use of information and communication technologies (ICTs) within educational technology. This includes e- learning, blended learning and open & distance learning.

ICT can enhance the quality of education in several ways such as; by increasing learner motivation and engagement, by facilitating the acquisition of basic skills and by enhancing teacher training in universities (MOGE, 2013). ICTs in education are also transformational tools which, when used appropriately, can promote the shift to a learner-centered environment. Lawrence (2015) is in congruence with MOGE (2013) that the use of computers, the internet and related technologies, given adequate teacher training and support, can indeed facilitate the transformation of the learning environment into a learner- centered one. Since technology is a fully integrated into the larger learning system. It is basically very difficult to isolate technology variable and determine whether any observed gains are due to technology use or some other factor or combination of factors.

According to Wallet (2014) ICT-supported education can promote the acquisition of the knowledge and skills that will empower students in learning institutions for lifelong learning. For example, 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-centered 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. According to Meijer (2016), ICT is also presented as enabling teachers and students to engage with learning in new ways, ways that transform their relationships to mathematical problems, history, culture and art, and to innovation and creativity.

Furthermore, the significance for ICTs to help enable and further a variety of educational reform objectives in many African countries like Zambia and Nigeria remain undeniable. ICTs are important tools for educational reforms and can be employed as a knob for organizational change, as a vehicle to introduce new teaching and learning practices and/or as an enabler of restructuring of the educational system (Wallace, 2013). ICTs can also help in anti-corruption efforts in the education sector. ICT has enabled learning through multiple intelligence as it has introduced learning using simulation games, which enables active learning through all senses (Anonymous, 2011). The purchase of computers, for example, provides a useful tangible symbol of a commitment to investment in change, and ICTs themselves can potentially provide important vehicles to help bring about desired reforms.

It must be noted that changes and innovations in technology come much faster than changes in the educational system, and the product cycle of most ICT-related products is much faster than the “life cycles‟ of education change and reform (Meijer, 2016). A lack of congruence between the timeliness for roll out of educational reform efforts and the roll out of supporting ICT tools (hardware, software and training) is a potential area of great challenge, as reforms may be dependent on technologies that are obsolete. Even where reform process is ongoing, the pace of technological innovation outruns the pace of institutional innovation. This disconnect is important.

Porta (2010) argues that ICTs can be used to extend access to educational delivery techniques, to support the ongoing professional development of teachers and to facilitate education-related data collection and processing efforts in ways previously not possible. ICT infrastructures can provide a fundamental building block upon which whole sets of knowledge and information service and activities can be enabled.

Emerging ICT tools offer new opportunities to develop some of the critical early literacy skills, the development of which is fundamental if the large numbers of low-literate learners (especially in rural areas) are to take advantage of the educational opportunities presented to them through expanding access to formal education. The need for ICT in and for education is now seen worldwide as both a necessity and opportunity. ICT permeates the business educational environment, it underpins the success of modern corporations and it provides governments with an efficient infrastructure. Equally, ICT adds value to the processes of learning and in the organization and management of learning institutions. The Internet is a driving force for much development and innovation in both developed and developing countries (Anonymous, 2011).

Technological developments in education lead to changes in work which has necessitated changes in the organization of work and required competencies (Meijer, 2016). To benefit from technological developments, educational institutions must be able to educate a cadre of professionals with sound ICT backgrounds, independent of specific computer platforms or software environments.

4.0. Challenges

i. Generally, ICT empowers teachers and learners and promote change and foster development of the 21st century skills. However, there is no one singular strategy for the determination of the optimal level of ICT integration in the educational system. Significant challenges confronting the integration of the ICT in education especially in developing countries are in the areas of educational policy and planning, infrastructure, language and content, capacity building and financing.

ii. Implementation of the ICT in educational institutions is one of the big challenges due to high cost incurred for acquiring, instilling and replacing of latest software and addition to that various opportunity cost to institutions for infrastructure development.

iii. Establishment of ICT infrastructure is not sufficient to achieve the goals of successful integration of ICT in educational institutions. Besides, the lack of infrastructure to accommodate the technology, problems in electricity, network availability, lack of awareness towards technology and utilization technology with improper were adding complexities for the successful implementation of ICT in educational institutions.

iv. According to Idowu & Adagunodo, (2004), the Internet has come out as possibly the most noticeable component of the vibrant developments of Information and Communication Technologies (ICTs). The pace of acceptance of the Internet surpasses that of all technologies earlier than it. However, nearly all African countries' basic ICT infrastructures are not enough; a consequence of not having sufficient electricity to power the ICT materials and poor telecommunication facilities. The other aspect is that the erratic power outages in Africa and in Zambia in particular can be a source of worry in connection with the use of technology. If power is not regularly provided, there is no way ICT can be effectively used in the education sector. In a research done in both Nigeria and Mozambique, it was found out that one major limitations of the use of ICT in schools and industry was erratic power supply. It had become a way of life. Interestingly, this was not the case in Mozambique. As a result, students in Mozambique use more internet than that of Nigeria (Idowu & Adagunodo, 2004).

v. Similarly, the internet connectivity of the area is also a key element. It is worth mentioning that when one gets a good connectivity, it facilitates the one's ability to get speed and quality of data transmissions and access in general. A study by Okon (2015) revealed that internet is extensively used by a lot of students in the surveyed universities. According to the study, there was uneven internet access and so most students relied on commercialized internet services for their access and use and this is done on or outside campus. Further, due to unattainable internet infrastructural development and connectivity services in the universities, internet access in the libraries, faculties and the computer laboratory is generally poor.

vi. Lack of electricity in the training centres; The lack of a reliable electricity source made it difficult to use the equipment effectively. In the rural areas like those in Zambia, electricity is only available at a central location, and not all schools or training centres are connected to the grid. Therefore, the trainers had to plan carefully about where to charge the equipment (at the District Education Board Secretary's office and at their own residences). However, solar-powered equipment might have been a viable way of overcoming some of these difficulties.

vii. Lack of staff at the training centres; In some training centers there was not sufficient staffing to effectively utilize ICT in the teacher education program. Lembani (2019) lamentably said that the extremely rural location of Zambia, for example, means that they have trouble attracting qualified trainers that are willing to stay for two and a half months. There were not enough school supervisors available to visit each trainee teacher to review teaching practice during the school-based practicum.

viii. However, speed of change reduces the comprehensive planning and research, the effects of new technologies in the education and society. And it is one of the drawbacks for the successful implementation of the ICT in education in the initial period because the stakeholders are not trained to accept change. According to Agyei (2013), a study on Analysis of Technology Integration revealed 17% of the total number of schools had internet access. In a similar study conducted in Ghana, Mireku et al. (2009) discovered that internet connectivity was non-existent except one school which had only four computers being networked. This is likely to have negative implications on teachers' technology use and more especially on methodology and subjects that depend mostly on the internet applications. Learners in turn are also restricted in their probe to explore the use of internet within and without the classroom to formulate understanding of their own. Therefore, there is the crucial need to make available for use

technology infrastructure in second cycle schools to enable both educators and learners to make use of technology and the internet during teaching and learning or as individuals to access information which are in line with their studies. Colleges of Education are not doing much in this vein. Internet connectivity is scarcely available for use in the classroom though teacher educators could have access to the internet for their personal use.

5.0. Conclusion and Recommendations

Considering the myriad challenges confronting the ICT in education, the following are the recommendations;

The approaches to the use of the ICT in education should be pursued holistically. The success and failure of most ICT in education initiative is based not only on sound implementation practices, but on the nature and quality broader educational policies and strategies in which the use of ICT is embedded. Technology is the only tool to enhance the quality of education. No technology can fix a bad educational philosophy or compensate for a bad practice. Considerations of the potential use of the variety of the ICTs should flow out of the concern for specific developmental challenges and not merely on a desire to introduce of ICTs per se.

The challenge for ICTs educational systems moving forward, therefore, is to take advantage of the opportunities provided by ICTs to support learning outside of schools while, at the same time, incorporating ICT-related practices and models from daily life in wider society into formal educational structures and processes. Exploring and realizing the potential for ICTs help make schools more productive and efficient than they currently are, transform teaching and learning into an engaging and active process connected to real life, and prepare the current generation of young people for the future workplace may be a key determinant of the future success (or failure) of such initiatives.

The investments in ICTs should not only be used to promote the development of basic ICT skills (such as keyboarding, competencies in operation and office productivity), but also to enable the development of broader set of critical thinking, problem solving and communication skills.

Technology changes very quickly. Thus, utmost care should be taken in making big investments on a singular technology. Over reliance on a particularly promising technology solution today may inhibit an educational system's ability to adopt as new technologies emerge in the future.

The use of the ICTs in education must always be monitored and evaluated regularly and closely to a meet a variety of educational objectives. Educators should be prepared to change direction if required. Success requires meeting all the conditions of innovations and change to occur (Munesh, 2014). This calls for stakeholder engagement, relating to the innovation to the conventional, articulating the added value of ICTs, assessing and mitigating the risks and planning and implementing necessary change management processes.

The national telecommunications and information infrastructure are the foundation for a country's educational technology infrastructure. Before launching an ICT-based program, consideration must be given to appropriate rooms or buildings available to house the technology, the availability of electricity and telephony; and the ubiquity of different types of ICT in the country in general and in the educational system in particular. To enhance computer-based or online learning, there must be access to computers in schools, communities and households, as well as affordable internet service. ICT use in education should follow use in society. It is cheaper and easier to introduce a form of technology into education and keep it working where education enjoys a large-scale development by governments or the private sector.

Language and content are a fundamental challenge confronting ICT integration in education. The dominant language of the Internet is English. Lembani (2021) in congruence with Anzalone (2001) supports this claim by stating that 80% of online content is in English. A large proportion of the educational software produced in the world market is in English. In parts of the country or the world where English proficiency is not high, especially in rural areas, this represents a serious barrier to maximizing the educational benefits of the World Wide Web. It becomes necessary, therefore, that teaching and learning materials that match national curriculum requirements and have locally meaningful content, preferably in the major local languages, be developed. This would ensure multiculturalism and inclusion of isolated, rural population, cultural minorities and women in general in ICT-enhanced education programs.

It is imperative to indicate that balancing educational goals and economic realities is one of the greatest challenges in ICT use in education. ICTs in education programs require large capital investments. Business educators need to be prudent in making decisions about the models of ICT use to be introduced. They should also be conscious of maintaining economies of scale. Decision must be made on whether ICT-based learning is the most effective

strategy for achieving the desired educational goals. The modality and scale of implementation that can be supported given existing financial, human and other resources must be determined.

The success of ICT integration in education depends on the development of various competencies throughout the educational system. This hinges on the teacher professional development, competency of educational administrators in using the technology, available and dedicated technical support specialists to ensure the continued viability of ICT; and content development units to adapt existing ICT-based educational materials for local use.

Proactively, ensure that teachers and academicians have necessary knowledge, skills and tools to respond to, and take advantage of, the challenges and opportunities that technologically advances present to addressing key developmental challenges in the education sector.

The use of ICTs should be monitored and evaluated regularly and closely to meet a variety of educational objectives. ICT educators should be prepared to change direction if required. Success requires meeting all the conditions of innovation and change to occur. This calls for ICT stakeholder engagement, relating the innovation to the conventional, articulating the added value of ICTs, assessing and mitigating risks and planning for and implementing necessary change management processes.

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