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THE ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGY IN TERTIARY EDUCATION IN AFRICA

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ABSTRACT

Information and Communication Technology (ICT) plays an essential role in all sectors of an economy including education. In the higher education sector, the usefulness of ICT cuts across all disciplines of study from mathematics to social science. ICT transforms the educational system by replacing traditional ways of teaching and learning with modern, computer-based infrastructure. This paper highlights the role of ICT and its ability to increase the quality of education in higher institutions of learning in Africa. The paper further discusses the advantages of having ICT infrastructure such as: e-learning/virtual library, access to quality education through special tools for physically challenged students in tertiary institutions across Africa. The study concludes that government funding of ICT infrastructure is important so as to improve the quality of education in tertiary institutions.

Key words: Information Communication Technology (ICT), Tertiary Institution, Africa.

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1. INTRODUCTION

Education is a powerful instrument in the development every nation. According to Adeoye et al (2013), the pervasive influence of ICT has brought about rapid technological, social, political and economic transformation, which has paved the way for societal networking. Information and Communication Technologies (ICTs) are broadly defined as technologies used to convey, manipulate and store data by electronic means. These include e-mail, SMS, text messaging, video chat (e.g., laptop, desktops and smart phones) that carry out a wide range of communication and information functions (Mathevula and Uwizeyimana, 2014, p. 1087).

Information and Communication Technology (ICT) serve as a change agent in the method and quality of teaching and learning in educational institution all over the world. However, it

should be noted that, ICT is not merely restricted to primary and secondary educational levels; it extends to the tertiary. In the estimation of Kaka (2008), ICT is not just a bloom of educational activities, but also it will be a viable means to improve the academic standard of African institutions of higher learning. Information and Communication Technologies potentially offer increased possibilities for proliferation of knowledge which brings about innovation, (Larsen and Vincent-Lancrin, 2005). Lubega (2017) reports that Bill Gates raised a critical question which expresses his vision for ICT oriented education when he asked universities and colleges "how can we use technology as a tool to recreate the entire college experience? How can we provide a better education to more people for less money?" These questions served as catalyst for increased efforts toward equipping schools with ICT infrastructure. Gates' comment raises two important points which summarizes the essence of ICT based education. These are: first provision of quality education. Secondly, having access to such an education with less resource.

Over the past few decades, there have concerted effort to achieve Gates vision all over the world. However, it is regrettable that there has been little transformation in the educational sector in Africa especially in tertiary education. Butcher (2003), illustrates that the use of 'new' ICTs is limited in many tertiary institutions because of infrastructural constraints, lack of instructional materials, lack of skilled faculty, and because ICT- based pedagogy is still new for many. In light of the above, this research investigates the role of ICT in tertiary institutions in Africa.

2. THE ROLES OF ICT IN TERTIARY INSTITUTIONS

ICT is an essential element in the development of every area of any nation, in this era of globalization. Barakabitze et al (2019) refers to ICT as a shorthand for computers, software, networks, satellite links and related systems that allow people to access, analyse, create, exchange, and use data, information, and knowledge in ways that were formally unimaginable. Researchers agree that education is an important instrument in the development of social, economic, political sector of every nation, without it, no society can attain growth. In some African Countries, the roles of ICT in education have been utilized to a large extent, whereas some countries still lack unlike the developed countries, where ICT form an integral part of the educational system. Adams (2003) notes that in developed countries, governments play a key role in creating conducive environment for the flow of knowledge. Such overwhelming fact cannot be said for many African countries whose governments bluntly neglect this aspect of education. Note that negligence indirectly or directly puts up barriers that makes it harder for ICTs and knowledge diffusion to thrive. This has greatly affected the knowledge economy in Africa except in a few nations like, South Africa, Kenya, Nigeria and Uganda where significant change has been witnessed in the higher education sector especially as relates to the use of ICT. This is confirmed by Murgor (2015) who argues that universities in countries like Tanzania, Uganda, South Africa, Mozambique, Nigeria, Ghana, Kenya and Rwanda are increasingly emphasing the need for the use of ICT and taking steps to usher that both the resources needed and the environment required for profitable engagement with ICT is made available.

The integration of ICT into higher education institutions in Africa is slowly taking shape with several institutions appreciating its potential to offer a widespread teaching and learning to both teachers and students. The integration has taken a form of use of computers and internet: TV, radio, video conferencing and mobile learning (Lubega, 2017). The following gives specific illustration of areas that if strengthened with ICT, would enhance academic productivity. Onasanya et al (2010) adding to this explains that ICT has had more impact on administrative services in higher education such as: admissions processing, course registration,

fee payment and purchase of academic materials. This means that with the introduction of ICT in tertiary institutions, administrative services are faster and better implemented thereby boosting efficiency.

3. IMPROVING ACADEMIC RESEARCH AND COLLABORATION

The UNESCO report of 2018 concedes that ICTs can be used as leverage to accelerate the achievement of the 2030 education target Agenda, by combining the views of policy makers, academics, and the private sector (Barakabitze et al, 2019). Researchers regard the use of ICT in tertiary institution as a source of information and a reliable means of gathering research materials that will be of assistance to students in their study; by expanding the frontiers of learning from traditional classroom studies. ICT opens up the opportunity to collaborate with other scholars in different tertiary institutions globally (Yusuf & Onasanya, 2004). Onasanya, et al (2010) testified to this development when they wrote that ICTs provides more opportunities for research collaboration and networking among scholars all over the world, thus; national and international dimensions of research issues can be studied as they can allow for communication with experts. Accordingly, Beebe (2005) observes that researchers are no longer faced with a lack of information, but with a glut of information. Data sharing, peer review and developing a network of contacts are no longer constrained by distance as access to e-mail services, web-based files, data sharing, web logs and collaborative workspaces have become widespread. This means that the use of ICT makes academic research easier and more interactive among other scholars.

4. TRANSFORMING TEACHING AND LEARNING PROCESSES.

The introduction of ICT in universities is expected to change obsolete teaching and learning methods that do not reflect contemporary realities. Hamilton- Ekeke and Mbachu (2015) posit that, the introduction of ICT into universities clearly changed the way education is enacted. It paves the way for a new pedagogical approach, where students are expected to play more active roles than before (i.e. getting more involved in the learning process, being active participants of knowledge creation and not mere recipients). Adams (2003), in his words argue that ICT have not only increased opportunities for rapid information exchange that facilitates teaching, research and lifelong learning, but also leads to the globalization of higher education. With the advent of ICT, there is a quick accessibility to learning for tertiary school students.

Rivers, Rivers, and Hazell, (2015) confirm this when they argue that ICT is of primary importance to the higher education project in Africa. The state that;

The use of ICTs in Africa for the purpose of education is widespread, with a number of initiatives and projects currently being undertaken, and new developments taking place across the continent every day. Countries in all parts of Africa have established some form of connectivity to computer-based networking. One of the successful initiatives that has incorporated ICTs into higher education is the African Virtual University (AVU). Since its beginnings in 1997, AVU has established connections to 27 African countries and 53 institutions of higher education and is currently the leading Pan-African e-learning network. AVU seeks to use ICTs to increase Africans' access to high quality education and training and accomplishes this through delivering degrees, diplomas, and certificates through ICTs, managing a digital library, developing African-based educational materials in multiple languages, and training staff in ICTs and e-learning methodologies. Thus, the above examples demonstrate that Internet connectivity is on the rise in African nations. However, it should be noted that accessibility exists mostly in urban areas (Rivers, et al, 2015, p. 22).

Murgor (2015) confirms this by noting that in the area of accessibility, ICT via the web has opened opportunities for access to distant learning education program in Africa for those who are unable to attend school or college for economic or cultural reasons. Many countries of the world including Africa now have Open Universities which provides education via the internet and other telecommunication devices for students. In Nigeria and Kenya, Open Universities offer students the opportunity of study with or without supervision from teachers. Larsen and Vincent – Lancrin (2005), suggests that with the use of ICT in tertiary institutions, there is full participation in the process of learning. Their study shows that with ICT based learning increases students' (young and old) participation in the learning process unlike traditional teaching methods, because of its flexibility. In the same breath (Barakabitze, et al 2019), states that ICT is likely to motivate teachers and students by clarifying difficult concepts. The largest university in Africa; the University of South Africa is an open and distance learning education establishment only made possible through ICT capabilities like learning management systems, the internet and other educational applications.

5. ICT AS A LIBRARY TOOL

Unlike the traditional library where students go to seek information, ICT offers students the opportunity to access libraries anywhere in the world at any time. ICT e-libraries are accessible to students from anywhere in the world. This takes away all the rigors of carrying out research in a conventional library. Bebee (2005) writes that ICTs are altering the functions of libraries and changing the role of librarians. Due to the wealth of learning resources on the Internet, some of which are freely available, librarians are becoming information managers or cybrarians. These cybrarians will be computer experts and information brokers. Butcher (2003), adds that libraries and librarians will be central in efforts to improve higher education quality. With ICT, hard copy textbooks are neglected, and soft copy materials have been embraced, which makes it easier for students to move around without these materials. ICT have become a suitable tool for the modernisation of education. It is worth mentioning that African governments are eager to use ICTs as a way of making their nations players in the advent of the fourth industrial revolution and champion it so that they are at the forefront of technological change (Barakabitze et al (2019).

6. E- LEARNING /VIRTUAL LEARNING

Mikre (2011) defines eLearning as a learning program that makes use of an information network- such as the internet, an intranet (LAN) or extranet (WAN) whether wholly or in part, for course delivery, interaction and or facilitation. eLearning enables students to gain more knowledge and also improve the quality of education at a reduced cost by exposing students to inter disciplinary studies. Mahlangu (2018) explained that the use of eLearning systems can provide great opportunities for learning for individual students globally, by helping in educating and providing training opportunities on different topics. Olusanya and Oluwasanya (2014) note that application of e-learning includes: computer-based learning, virtual classroom, video-conferencing and digital collaboration where contents are delivered via the internet, intranet/extranet, audio/video tape, satellite TV, CD-ROM. With eLearning, students have more learning aids which enhances access to information resources.

More so, the introduction of ICT affords teachers the opportunity to deliver their lectures in absentia, via audio or video tape which makes it easier for students to get these notes in the comfort of their homes. Information Communication Technology (ICT) encourages collaboration by teachers who are domiciled in different parts of the world with the use of webcam or videoconferencing. This is why Mikre (2011) asserts that ICT supported learning

encourages interaction and cooperation among students, teachers, and experts regardless of where they are. Apart from modelling real world interactions, ICT-supported learning provides opportunity to work with students from different cultures, thereby helping to enhance learners' communication skills.

In addition to global awareness, ICT explores the creation of virtual teaching and learning. Virtual learning creates an environment for delivery of learning materials to students. Virtual learning environment allows participants acquire knowledge by cooperation. The environment includes course syllabus, pre-requisites registration, instructor, and distant learning applications (Deka & Jena, 2017). Also, virtual learning makes it possible to explore the mathematical environment through the use of the virtual learning community in tertiary institutions. Miranda (2007) informs us that virtual learning environment acts as a support resource to student learning for the three areas that integrate mathematics programme: plane and spatial geometry 1, functions 1 and statistics. With the use of a virtual mathematic environment, students are able to gain more understanding of mathematics rather than the use of the traditional teaching methods thereby changing the narrative that mathematics is a difficult subject.

Essentially, virtual library serves as a means of gathering data, access research materials and facilitate communication between students and teachers. Koganuramath (2007) asserts that virtual library provides ICT based access to a range of digitally available publications for educational purposes; available in the public domain and from other sources. Students, lecturers and other researchers have the opportunity to communicate easily with colleagues in other institutions and make the possibility of having a smooth research possible. Researchers agree that publication of many international journals have been achieved with the use of virtual libraries.

7. EXPANDING ACCESS TO EDUCATION

As we have said, ICT makes it possible to interact and collaborate globally with other students. It gives access to online courses that are tailored to broaden the knowledge base of students. Oliver (2002) registers that the communication capabilities of modern technologies provide opportunities for many learners to enrol in courses offered by external institutions rather than those situated locally. These opportunities provide advantages in form of extended course offering and eclectic class cohorts comprised of students with different backgrounds, cultures and perspectives. This means that ICT allows teachers/students have the opportunity to gather knowledge from all over the world which enhances effective teaching, learning and research by reducing distance (Murgor, 2015). In other words, ICT makes it possible for collaboration globally between researchers which can also yield positive impact in the educational sector.

8. QUALITY EDUCATION FOR DISABLED STUDENTS

There are physically challenged students in tertiary institutions that are termed as students with special needs, that is, students with chronic forms of visual impairment (the blind), mobility impairment (people who have difficulty in moving around) or hearing impairment (people who are deaf or partially deaf). ICT creates the environment to attend to the academic needs of these group of people by creating special application packages and customized tutorials. Martinez puts it best when he writes that ICT is very important as it plays an essential role in supporting high quality education for learners with disabilities (Martinez, 2011). Jagannathan et al (2008) present lists of ICT products that are available for various disabilities such as:

- Quail world: software for accessing computer without conventional keyboard and mouse.

- Qualikey, look keys, adaptive keyboard: virtual keyboard, intel keys, head/ mouth stick keys
- Frog-pad: keyboard for persons with one hand, 15 keys, with three different level overlays
- Foot pedal KB: programmable 3 keyboard
- Quail- click software: programmable mouse click
- Eye-tracking software: on screen cursor is controlled by simple body movement. A standard USB Webcam captures user movement and software translate it into mouse movement.
- Speech recognition: allows operation of any application and full control over computer/device.
- Magnification S/W: 1.1x to 36x, bulls' eye for aiming, screen spilt, large print keyboard, change in background colours, inversion of colour for persons with –ve vision, network based system are available.
- WYNN/Kurzweil 3000: for persons with dyslexia, provide audio and visual support for learning.
- Braille Embossers: hardware device used for printing computer generated text in Braille format
- JAWS: the most popular screen reader worldwide, JAWS for Windows works with your PC to provide access to today's software applications and the Internet and also supports 17 languages.

The use of all these will enable every student with special needs study with the least amount of difficulty. The introduction of all these will make teaching easier for the lecturers thus, learning processes will also be easy for those involved.

Butcher (2003) argues that the role of education is expected to play in the society is in a flux and this has been aggravated by the way education is offered especially across Africa. This has been made worse by the progression of the forces of globalization, the pace of technological change, the ever-increasing centrality of information and knowledge, and the importance of skills to access and use both new technologies and information more effectively. Kandiri and Mtebe (2013, p. 19) argue that "higher education institutions in Africa have been adopting and integrating educational technologies into teaching and learning in a bid to reap some of the benefits to be had. Specifically, such benefits include expanding access, reducing costs, and improving quality as well as providing access to a wide range of educational resources electronically to supplement face-to-face delivery". This means that the proper use of educational technologies in African higher education institutions can reduce the knowledge, technology, and economic gaps between Africa and the rest of the world. The central role of education in development is now widely acknowledged. Several authors also argue that distance education, in particular, is fundamental to addressing many of the educational challenges faced in the developing world. It is in the context of focus on distance education and open learning that information and communication technologies (ICTs) in education are especially important. The increasing importance of ICT in the global information society both creates new challenges and provides solutions to old educational problems (Butcher, 2003). Muianga, Hansson, Nilsson, Mondlane, Mutimucuio, and Guambe (2013, p. 112) adding to this argue that "the use of ICTs for learning encourages learner-centred learning, active, exploratory, inquiry-based learning, and collaborative work among learners and teachers. Such affordances of ICTs in education support the development of creativity, analytical skills,

critical thinking and informed decision-making. So, the introduction of ICT in education is important because of the changes it can have in different aspects of learning. However, the benefits of ICTs for students can only be achieved if the HEIs ensure access for all stakeholders and the ICT is used in teaching and learning, research and management". From this perspective, ICT is of primary importance in African higher education especially if Africans will play a principal role in the shaping of the future of mankind in the advent of the fourth industrial revolution.

However, despite the progress made so far, Rivers, et al (2015, p. 26) argue that "the main factor that impedes the adoption and use of ICTs in higher education in Africa is infrastructural constraints. Without the infrastructure to support the use of ICTs, it will be impossible for African countries to implement these technologies and improve their education systems. Limited financial resources also play a major role in the lack of infrastructure to support ICTs". Most countries in Africa only apportion small portions the national budget to education in general and higher education in particular and very little of this is invested in the enhancement of ICT capabilities of these institutions. If a greater portion of such budget were to be devoted to establishing and maintaining this infrastructure, then small changes could lead to major gains. Unwin (2005) confirms this when he argues that the establishment of partnerships with donors and agencies in the developed world can aid in the establishment of infrastructure, as well as the implementation of ICTs. Such partnerships doesn't however negate the role African governments must play to ensure that the needs of the targeted African community are assessed at the outset and that communities and governments are involved at all stages of the implementation process (Gebremichael & Jackson, 2006). They continue that if this is done, initiatives will more likely be implemented in a cost-effective manner, because governments are in the position to ensure that activities are coordinated, and efforts are not duplicated. Rivers, et al (2015, p. 27) further argue that "by obtaining community and governmental input, ICT initiatives will reflect the needs and culture of the people and not be steeped in colonialist values and ideas. Finally, more cost-effective options must be sought and utilized in the establishment of ICT infrastructure. For example, initiatives such as KENET are providing cheaper options for the establishment of ICT infrastructure". Physical and human resources to support ICTs are also lacking in Africa. Gebremichael and Jackson (2006) concur with this when they argue that African countries can take advantage of developed countries' recycling programs, where old computers are provided to developing countries. This way, Africans will have a cost-effective method of obtaining and accessing computers and ICTs, even if they are considered to be obsolete to developed countries; especially since most part of Africa neither have the infrastructure (power and internet) to utilise these high-end machines. In terms of human resources, educators need to develop ICT skills and experience in order to more effectively use and maintain ICT technology (Gebremichael & Jackson, 2006), as well as learn how ICTs can be used to enhance teaching practices (Unwin, 2005). Rivers, et al (2015, p. 28) argue that "such training can be included in traditional teacher training. Once a handful of educators have developed these skills, they can pass down these skills to other educators, who can pass on these skills to even more educators, in a cascading manner.... Educators can then pass these skills on to students, and these skills will eventually be transmitted to the general community in a similar manner. This method of transmitting ICT skills ensures that educators and students are taught in a culturally relevant manner and ensures that colonial dominance is not implicit in the teaching methods".

In terms of educational software, a number of options are available, many of which are cost-effective. For example, open-source software is free software that can be freely distributed to any individual (Fuchs & Horak, 2008). This software provides Africans with the opportunity to adapt the programs to meet the needs of the community, particularly by including local

content in native languages (Gebremichael & Jackson, 2006; Unwin, 2005). This feature provides Africans with the ability to break free of Western colonialism by developing educational software that meets their specific needs, and in this way, decreasing their dependence on developed countries to provide them with a means to educate their citizens. Another potential solution, although a less cost-effective one, is learning management systems, such as Blackboard. Educators can use this program to provide distance education to part-time and distance learners, as well as organize and deliver course content in a locally intuitive way, provide access to freely available electronic resources, and provide opportunities for group learning (Unwin, Kleessen, Hollow, Williams, Oloo, Alwala, & Muianga, 2010).

CONCLUSION

Many countries in Africa like Tanzania, Uganda, South Africa, Mozambique, Nigeria, Ghana, Kenya and Rwanda have increasingly adopted and implemented national policies on ICT. For example, South Africa's tertiary institutions are highly rated for their ICT dominance. African Universities still struggle in this area as a result of poor funding from national governments. This leaves the brunt of the burden to private donors and Non-Governmental Organisations (NGOs). Beebe (2008) attests to this as he writes that Cisco Certified Network Professional (CCNP), in partnership with African universities and donor programmes, such as the United Nations Development Programme (UNDP) and Leland initiative of USAID, has established several Regional Networking Academics- in: Central African Republic, Chad, Cote d' Ivoire, Congo, Ghana, Kenya, Mali, Malawi, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, South Africa, Togo and Uganda.

In sum, ICT increases the access to modern learning techniques which improves knowledge in this highly competitive era of globalization. ICT in its crucial role in African Tertiary Institutions brings learning closer to students by offering virtual services. As has been noted elsewhere in the paper, ICT creates an abundance of opportunity for students who do not have access to the classroom to also learn. Countries in Africa are adapting ICT into their tertiary educational system. Although it is evident that some African nations are behind due to some constraints. The possibility of ICT in tertiary institution in Africa is achievable if each countries government implements ICT policies as well as provide adequate funding for ICT infrastructure. Government's funding will make it easier for students (especially special needs students) to not only learn but also contribute meaningfully to innovation and ground-breaking research. Lastly, national governments must monitor ICT infrastructure in various tertiary institutions in order to be sure that ICT equipment are not abandoned but are in use.

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