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**The Role of ICT in Enhancing Instructional Delivery in Tertiary Technology Education
Programme in Nigeria's Dwindling Economy**

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Abstract

The paper examined the role of Information and Communication Technology (ICT) in enhancing instructional delivery in tertiary Technology Education programme in Nigeria's dwindling economy. The paper explained the conceptual overview of a dwindling economy as well as Information and Communication Technologies. The specific role and applications of ICT in enhancing instructional delivery in technology education programmes in advanced nations were reviewed. Similarly, specialized use of ICT in instructional delivery in technology education programmes. The guidelines for using ICT in instructional delivery in Technology Education programme were unveiled. The barriers to the utilization of ICT in Technology Education programmes in Nigeria were highlighted. It was concluded that ICT plays a vital role in enhancing instructional delivery in tertiary technology education programmes in advanced countries and can also be useful in achieving success in instructional delivery in tertiary Technology Education programmes Nigeria's dwindling economy. It was recommended among others that there should be adequate funding of Nigeria Technology Education programmes, ICT training institutions and ICTs related departments in tertiary institutions by the various governments, private sector and other stake holders.

Keywords: ICT, Instructional delivery, Technology Education, Dwindling economy

Introduction

A dwindling economy connotes an unstable economy with uncertainties in economic activities, high rate of unemployment, economic hardship and poverty. A dwindling economy can also be referred to as a recessed economy where the economy slows down, and the level of sales and production orders start declining (Onyenekenwa,2010). During economic recession, production facilities become underutilized, and companies respond by reducing the work rate. Workers who had been hired on casual basis are laid off, and this reduces their disposable income. The prospects for growth become gloom; banks increase interest rates to counter the rise in risk of default of loans. Idle capacity of production facilities reduces the output, and most companies are forced to reduce prices of products in an attempt to increase demand. Profit margins of companies' starts decreasing and the gross domestic product also start to decrease.

According to Prince and Odia (2010), the some features or characteristics that can be observed in a dwindling economy include : high unemployment rate, high level of corruption among

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the ruling class, fragile political environment, high inflation rate, low average real income, low saving ratio or high consumption ratio, low level of technology including local technology, low levels of productivity, low per capita income and downward trend of living, high poverty rate of a large proportion of the population, low economic growth rate, poorly developed financial and stock markets as well as high level corruption and instability and insecurity of lives and property. The economic hardship experienced in a dwindling economy has negative effects on instructional delivery by teachers in Technology Education programmes in Nigeria's Technical and Vocational Education and Training (TVET) institutions.

The National Policy on Education (FRN, 2013) described TVET as a comprehensive term referring to those aspects of the educational process involving, in addition to general education, the study of technologies and related sciences and the acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of economic and social life. Technology Education (TE) according to FRN (2013) was described as a tertiary level TVET programmes designed to equip individuals with required technology-based knowledge and skills in specific occupation or trade as a way of preparing students to function efficiently in the world of work upon graduation. The specific goals of Technology Education at the tertiary level according to FRN (2013) shall be to:

- a) Provide courses of instruction and training in engineering, other technologies, applied science, business and management, leading to the production of trained manpower.
- b) Provide the technical knowledge and skills necessary for agricultural, industrial, commercial, and economic development of Nigeria.
- c) Give training and impart the necessary skills for the production of technicians, technologists and other skilled personnel who shall be enterprising and self reliant;
- d) Train people who can apply scientific knowledge to solve environmental problems for the convenience of man; and
- e) Give exposure on professional studies in the technologies.

Tertiary Technology Education encompasses TVET programmes offered in Universities, Polytechnics, Monotechnics and Colleges of Education (Technical) and other specialized post-secondary institutions. Achieving successful and functional Technology Education programmes in Nigerian tertiary institutions in this current era of dwindling economy demand effective instructional delivery by lecturers in the Technology Education programmes.

Instructional delivery refers to the process of teaching a lesson. Instructional delivery is a vital component of curriculum implementation which encompasses teaching methods and strategies

adopted to teach a course of instruction or subject. Effective instruction delivery is most schools in advanced nations have been achieved through the application of Information and Communication Technology (ICT) in the teaching process. According to Nwabueze and Ozioko (2011), in today's complex and fast changing world, Information and Communication Technology (ICT) is an indispensable tool for achieving effective instructional delivery in schools. This according to the authors is because of the interactive nature of ICT-enhanced teaching methods as well as the ease of teaching and learning through ICT at a convenient pace. It is on the basis of these facts that the researchers deem it necessary to unveil the role of ICT in enhancing instructional delivery in tertiary Technology Education programme in Nigeria's dwindling economy.

Overview of Information and Communication Technology (ICT)

In today's complex and fast changing world, Information and Communication Technology (ICT) is an indispensable tool for achieving sustainable national development. This is because the development of any nation is usually measured by the degree and extent of the socio cultural, socioeconomic and political improvement that are brought to bear through the activities of Information and Communication Technologies (ICTs). It is the extent of utilization of (ICTs) in a nation that defines a nation as developed or underdeveloped. Margaret (2005) defined Information and Communication Technology (ICT) as an umbrella term that includes any communication device or application encompassing: radio, television, cellular phones, computers and network hardware and software, satellite systems as well as the various services and applications associated with them, such as video conferencing and distance learning. Information and Communication Technology was also defined by Nwabueze and Ozioko (2011) as a broad based technology (including its methods, management and applications) that supports the creation, storage, manipulation and communication of information.

Information and communications technologies (ICTs) cuts across a variety of electronic-based technologies including: computer, microelectronics, microchip and microprocessor-based technologies; multimedia, information processing technologies and telecommunication systems. and related technologies including microchip and microprocessor-based technologies; multimedia and other information processing technologies and systems as well as other instructional delivery technologies (World Development Report,2009). The revolutionary potentials of ICT lie in their capacities to instantaneously connect vast networks of individuals and organizations across great geographic distances at very little cost. As such ICTs have been key enabler of globalization, facilitating worldwide flows of information, capital, ideas, people and products. They have transformed business, market, and

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organizations, revolutionized learning and knowledge sharing, empowered citizens and communities and created significant socio-economic growth in many countries. There is no doubt that ICT has found its niche in every sphere of Nigeria economy.

The ICT industry according to Nworgu (2007) appears to be making significant in road into the Nigeria society but public awareness on the capability of ICT and its application appears to be low due to the factor of “digital divide” prevalence in Nigeria and other developing countries. The concept of digital divide is the disparities in the availability and utilization of ICTs between people living in different parts of the world due to their level of technological development. The digital divide, a disparity in access to ICTs between countries and communities is caused by many factors such as: inadequate infrastructure, high cost of access, inappropriate or weak policy regimes, inefficiency in the provision of telecommunication network, language divides (language differences), poor economy and lack of locally created content (Mutula, 2004). The digital divide is a disadvantage and reduces access rate at which Nigerians and other developing nations can contribute and benefits from the information age and global communities.

This was buttressed by Al-saadi, (2006) who lamented bitterly on the over dependent of Nigeria and other developing countries on ICT consumption instead of ICT production which consequently keeps them in perpetual bondage of underdevelopment and poverty. Al-saadi broadly divided ICT into two components namely. ICT production and ICT consumption. According to him ICT production is the creation of hardware and software components of ICT, provision of ICT infrastructure, ICT consultants and trainers, web designers, internet service providers (ISPs) and data service providers (DSPs), while ICT consumption is the use of ICT amenities in applications like e-learning, e-medical, e-commerce, e-government, e-environment among others.

It is obvious that ICT has come to stay because it is the hub and bedrock for global and national development in the 21st century. It is a paramount and indispensable tool for global recognition and accomplishment in research and instructional delivery in institutions of learning at all levels of schooling. It is the king pin for Research and Development (R & D) activities in industries to improve productivity and industrialization. The relevance of ICT to the development of Nigeria nationally and globally cannot be underestimated. It is on the basis of this premises that it becomes necessary to examine the roles of ICTs in enhancing instructional delivery in tertiary technology education programme in Nigeria’s dwindling economy.

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The Role of ICT in Enhancing Instructional Delivery in Technology Education

Effective instructional delivery that can led to national technological development is impossible without ICT because ICTs is a major enabler or catalyst of educational technology in all levels of schooling the economy. This is evidence in the continuous innovation in ICT which has dramatically changed our way teaching a lesson. A change from analog to digital, a change from uni-media to multi-media, a change from copper wire communication system to either fibre optics or wireless cellular and even the satellite systems; a change from mono-component to hybrid component of telephone, TV and computer all in one and a change from manual to robotics. All these changes are due to innovations in ICT which serves as the primary indicator of progress and technological development of any nation.

ICTs are revolutionizing Technology Education by removing distance from education and making knowledge and skills more accessible to all. ICT-enhanced instructional delivery in Technology Education (TE) will play a crucial role in the development of a lifelong learning culture and has the capacity to empower learners by providing them with multiple pathways that offer choices and channels to meet their education and training needs (Israel, 2014). It is not surprising therefore to see a growing interest in ICT enhanced-TE across the world. ICT enhanced-TE or ICT driven TE may be defined as the array of hardware and software used in the teaching and learning systems that include computer-based training systems, multimedia systems, electronic performance support systems, telecommunications systems, as well as the Internet with World Wide Web systems.

The rate at which the Internet is being accessed keeps increasing at lightning speed. ICT driven TE can enhance instructional delivery and learning in TE programmes; it has the potential to become cost-effective as it offers greater flexibility regarding time and location of training delivery (Khan , Mahbub & Clement, 2012). ICT enhanced learning in TE provides greater flexibility to adapt teaching and learning to meet learners' cognitive and learning styles. Kafka (2013) identified four different major applications of ICTs in in instructional delivery in Technology education programmes, namely: technology as curriculum, technology as a delivery mechanism, technology as a complement to instruction, and technology as an instructional tool. Following is a brief description of each approach.

Technology as curriculum: When using technology as curriculum the focus is on developing ICT literacy skills. There are two types of ICT literacy skill sets. The first is generic ICT literacy skills such as keyboarding, word-processing, using databases, using spreadsheets, desktop publishing and using the Internet for research and communication (Nkanu & Okon

,2010). In this network economy every graduate from TE programmes needs to possess these essential and generic ICT literacy skills. The second ICT skill sets are the occupationally specific ICT literacy skills. Examples of these skills include the ability to use CNC equipment, work with CAD/CAM, and operate equipment with digital system controls.

Technology as delivery mechanism: When technology is used as a delivery mechanism the focus is on packaging course content for digital delivery. Common approaches in current use include: computer-assisted instruction (CAI), computer-based instruction (CBI), and web-based or online instruction. Open and Distance Learning programmes make extensive use of technology as their delivery mechanism.

Technology as a complement to instruction: When technology is used to complement instruction the emphasis is on providing opportunities to practice skills taught and extending learning by working with specific software applications (Kasworm and Londoner, 2000). Simulators are often used in TE to address safety concerns during the initial phase of training and to offset cost in renting equipment for training crane operators and truck drivers. In its simplest form, technology can be used for drill and practice to complement instruction.

Technology as an instructional tool: Human learning is a very complex process. In spite of years of research in education, scholars understanding of how human learn are still limited. For this reason educators strive to use the little that is known about human learning whenever they engage in the act of teaching and learning. Technology is used as instructional tool to enhance more effective teaching and learning in Technology Education. Kafka (2013) revealed that the teaching and learning is more effective when more of the sense organs are involved in the process. Analysis of the retention rate through the various senses indicates that ICTs can be used to create a variety of external conditions that are conducive to learning and retention.

Specialized Use of ICT in Instructional Delivery in Technology Education Programmes

This section provides discussion on the specialized use of ICTs for instructional delivery and learning in Technology Education programmes in advance countries. The discussion is focused on current practices as well as the issues and concerns regarding the use of ICT in teaching: attitudes, practical skills, workplace training, study at home, informal training, virtual internship, and assistive technology for accommodating people with special needs. Due to the various peculiarities associated with using ICT in instructional delivery in Technology Education programmes, there are a variety of different technologies that can be used in TE programmes. Each of these technologies according to Woolley and Booker (2002) has its own

peculiar qualities and limitations, and different situations call for different technologies. For instance:

- i. Interactive Television:** In this context, interactive television refers to instruction occurring over broadcast television. It allows learners in Technology Education (TE) programmes to receive live television instruction remotely, away from the actual instructor. The instructor(s) are located at a broadcast studio and the learners view the instructor(s) on a television monitor. It allows students to ask questions and/or provide feedback to the instructor through a number of mechanisms that can be used either independently or in combination (Stevens, 2001).
- ii. Internet/Web-Based Training:** Internet/Web-Based training provides an environment where students' access and study course materials online. It may involve the use of live e-learning tools such as application sharing, Internet telephony, online whiteboards, break-away rooms, discussion boards, and chat and messaging programmes that allow real-time interaction between instructors and learners. It can also be used to transmit text, graphics, images, animation, or video. The required tools for this form of online learning include a personal computer and an Internet connection. There are several ways a user can connect to the Internet: standard analog modem (for example, 56 Kbps), Digital Subscriber Line (DSL), cable modem, Integrated Services Digital Network (ISDN), Local Area Network (LAN), cellular, and wireless broadband (fixed wireless and satellite).
- iii. CD-ROM and DVD:** CD-ROMs (Compact Disc-Read Only Memory) store information digitally and they can be used on any computer equipped with a CD-ROM drive. DVDs (Digital Video Disk or Digital Versatile Disk) are similar to CD-ROMs and can be used the same way as CD-ROMs but contain more information. CD-ROMs have a large capacity and can support the storage of information in a variety of formats including text, animation, video, audio, and graphics. Thus, instructional materials can be presented in different ways. Since the material is stored digitally on CD-ROM or DVD, it is very durable and the quality does not degrade after repeated use. However, scratching the surface or other abuse of the medium may prohibit it from being read by the CD-ROM drive.
- iv. Videotapes:** Videotapes appeal to both audio and visual senses. Real-life situations can best be presented and described using video as opposed to using text or audio (Nunes & Gailbe, 2002). Videos can be used when introducing a new theme to motivate and contextualize learning, after a topic has been addressed in a few class periods to aid students in applying the knowledge they acquired, or after an entire

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module is completed to show connections to other subjects and disciplines (Nunes & Gailbe, 2002). The learner has the flexibility to replay, pause, and rewind videotapes and can repeat lessons as often as they wish. Videotape can support the teaching of practical skills delivered through open and distance learning (Stevens, 2001).

- v. **Audio-Cassette Tapes:** Audiotapes can be played by any standard cassette player. Through audio, the tapes can convey information that may be easier to illustrate with sound than simply through text or diagrams. It can accompany other means of instruction (print-based material and instruction via classroom teacher) and provide detailed information step-by-step. The advantage of using audio cassette tapes is that tapes are recordable and thus can be reproduced easily and cheaply at any convenient time by the learner.
- vi. **Broadcast Radio:** ICT instructional tool called Broadcast Radio is one of the oldest technologies used for distance education (Stevens, 2001). Radio programmes can be broadcast or interactive. Broadcast radio mirrors the traditional classroom-based model where an instructor lectures through the radio programme and students typically follow with print materials. It can be thought of as “strict” one-way communication where students are not expected to respond and therefore it is hard to gauge the progress of the students (Stevens, 2001). Interactive radio instruction (IRI) can be described as an interactive lesson where an external teaching element is involved in classroom activities via radio. IRI allows the students to participate as the lesson progresses. To be interactive, a lesson can have spaces or pauses where students can think, develop responses, discuss with other students, or have time to let information sink in.
- vii. **Audio conferencing:** Audio conferencing allows two-way, real-time communication between instructors and learners through audio (Stevens, 2001). The main advantage of audio conferencing is that it allows for direct, two-way interaction between participants. Discussions occur in real-time where learners can ask questions and instructors can respond immediately. Another advantage is its low set-up and operating cost.
- viii. **Videoconferencing:** Videoconferencing allows participating individuals in different locations to see and hear each other in real-time through videoconferencing equipment (Stevens, 2001). The main advantage of videoconferencing is that it allows real-time, two-way interaction between individuals in different places. Participating parties may be in remote areas and

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may be separated by large distances. All individuals involved in the educational system from the teachers, students, curriculum developers, and specialists, to the policy makers can participate in a videoconference. It can be used for presentations, teaching sessions, discussion, course delivery (in combination with other media), and student support (Perraton et al., 2002). During course delivery and lectures, instructors can gauge a student's progress and responsiveness immediately. Instructors can answer questions and provide feedback immediately.

- ix. Audio graphics:** Audio graphics is essentially audio conferencing accompanied by visual and graphical aids. "Graphics can be transmitted by facsimile (fax) machine, still video system, computers (text or graphic display), or electronic drawing systems (such as electronic whiteboard) which allow a participant to draw or write on an electronic screen which is transmitted to a remote site where other participants may see it. Audio graphics provide the same advantages of audio conferencing (two-way audio interaction and low set-up and operating costs,) while having an additional benefit of a visual aid for learners.

Guidelines for Using ICT in Technology Education Programmes in Nigeria

Nkanu and Okon (2010) proposed the following guidelines for using ICTs in Technology Education programmes:

- i. Let learning outcomes drive the process of technology choice-Technology is only a tool therefore teachers must use technology as part of a total instructional plan;
- ii. Strive to infuse and/or integrate technology into instruction and curriculum;
- iii. Use the technology to shift the emphasis from teaching to learning;
- iv. Be prepared to modify the role of the instructor- the teacher is not the only source of information; and
- v. Use technology to move the focus away from low-level cognitive tasks to higher order thinking skills.

Barriers to the Utilization of ICT in Technology Education Programmes in Nigeria

Below is a list of some prevailing barriers that can limit the roles of ICT or the extent to which ICT can enhance instructional delivery in Technology Education programmes in Nigeria institutions:

1. Overcrowding in Nigerian institutions hindering effective usage of ICT facilities.
2. Poor maintenance culture in Nigeria hindering full and continuous utilization of ICT facilities.

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3. Inadequate ICT infrastructures and general shortage of skilled ICT experts and instructors in Nigeria.
4. Erratic and inadequate electric power supply in Nigerian institutions.
5. Poor funding and misappropriation of ICT funds allocated to institutions.
6. High cost of purchasing modern ICT facilities and devices in Nigeria.
7. High rate of corruption, poverty and uneven distribution of public utilities in Nigerian institutions.
8. High cost of specialized ICT training in Nigeria.
9. Low access to ICT services due to the factor of “digital divide” and poor availability of ICT facilities and devices.
10. Too much emphasis on ICT consumption against ICT production due to the deplorable state of ICT training institutions and ICT departments in Nigeria tertiary institutions.

Conclusion

From the review, it was concluded that ICT plays a vital role in enhancing instructional delivery in tertiary technology education programmes in advanced countries and can also be useful in achieving success in instructional delivery in tertiary Technology Education programmes Nigeria’s dwindling economy. For Nigeria economy to prosper and attain the goals of Technology Education, the barriers confronting the progress of ICTs in Nigeria Technology Education institutions must be recognized and fought vigorously by governments at all levels, the private sector and other stake holders. We must embrace ICTs and channel adequate financial resources towards ICTs production, mass training and retraining of Nigerian Technology Education students and lecturers to be ICT literate and experts in various sectors of the economy so as to cope with global competition in the world’s global village. Technology Education students and lecturers in Nigerian institutions must be enlightened to be aware that it is ICT that defines the status of development of a nation. It is only ICTs that determines the leaders of our world and those that are perpetual followers. It is only ICTs that will make our country recognized, resilient, sustainable, competitive and diversified. It is only ICT that can enhance effective instructional delivery in Technology Education programmes in Nigeria dwindling economy.

Recommendations

On the basis of this review, the following recommendations were made:

1. Provision of stable and adequate electric power supply.
2. Adequate funding of Nigeria Technology Education programmes, ICT training institutions and ICTs related departments in tertiary institutions by the various governments, private sector and other stake holders.

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3. Government in collaboration with the National Communication Commission (NCC) should purchase relevant ICTs facilities /devices and make them available to the masses for utilization at various ICT training centers.
4. Re-orientation of our value system and creating awareness through various media on the importance of ICTs to instructional delivery in Technology Education programmes.
5. Periodic ICT policies performance review in Technology Education institutions.
6. The government should set up powerful V-SATs and pay for adequate size of bandwidth in all ICT training institutions, federal and state tertiary institutions.
7. Ensuring a stable and friendly atmosphere to attract skilled ICT experts and instructors that can train and retrain Nigerians Technology Education teachers and students on ICT usage and ICT production in Technology Education institutions.
8. Governments at various levels should lay more emphasis on ICT production rather than ICT consumption.
9. The ICT content in Nigeria Technology Education curriculum at all levels of schooling should be increased so that Nigerians can learn to think, love and embrace ICT.

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