INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) AND GLOBALIZATION OF ENGINEERING EDUCATION: THE NIGERIA EXPERIENCE

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Abstract
Information and communication technology (ICT) is a global commodity that could transform traditional educational provision system. The rapid growth of off-campus courses using this technology is an indication that it will almost certainly create a paradigm shift from institution-based, on-campus, teacher-centered education(closed learning) to learner-centered education where students using personal computers, at home or in the office, create their own degrees. The authors discussed the realities and effects of closed learning and were deeply worried about the state of engineering education in Nigeria. The paper also discussed the importance of appropriate engineering education and the role that ICT can effectively play on the quality of instruction. We identify the enabling environment and deficient infrastructures such as poor telephone networks, erratic power supply, as some of the current bottlenecks to the success of ICT and globalization of engineering education in Nigeria. With globalization of engineering education, it is hoped that ICT and globalization of engineering will take decades to achieve if not centuries in Nigeria.

Keywords: ICT, Globalization, PC, CD-ROM, WWW, Internet, Open learning, Closed learning.

1.0   Introduction

Technology today is a global commodity and businesses must find technology and engineers anywhere in the world and put them together to work (Crynes,1999). Worldwide commerce, globalization of business and marketing, sports, entertainment, and cultural exchange are driving globalization of education. Engineering education is not an exception. For years, we have had healthy and significant international exchanges of students and faculties.

The flow of engineering students from one nation to another has varied over the years, as political, cultural, and economic conditions change within sending and receiving countries. An example of globalization of engineering is Boeing's design of 777 aircraft, which was a paperless design, drawing on engineers worldwide, 24 hours a day (Shokralla, 1995). The modern tuition in engineering education is being dramatically changed by developments in microelectronics providing reliable, inexpensive and sophisticated delivery systems.

This together with developments in communications means that highly suitable tuition can be developed at a cost-effective price. The convergence of information and communication technology (ICT) has enabled this to be a reality. There is no doubt the international teaming is on the rise with the growth of international engineering projects and the global market place. Globalization of engineering education must, logically, follow and support this global technology (Crynes,1999).

Close to two decades ago, the use of computers as a teaching and learning tool was limited. Teachers used personal computers (PC) to prepare or store lecture notes, create databases for examination questions or keep up with administrative matters that were formally handled by non-academic staff. As with many other inventions the PC looked, and was used like, the thing it had replaced – the electric typewriter. In university settings, and particularly in the faculty of humanities, it became a sophisticated word processor. Academics only use a fraction of the modern PC capacity. After barely a decade of its development the power of the PC is extraordinary. Linked to powerful servers (super computers) the PC has the capability to send and receive high quality sound, pictures, diagrams, animations and text.

The Internet acts not only as a clearing house for the data that is generated but also as a potential challenger to older forms of transmitting and developing knowledge ad skills. In the West, governments and companies are committing huge amounts of money to digital systems that use fibre optic cable. Such system speed up and improve the quality of Internet connectivity. Because of this, a modest PC coupled to a small camera can do the job of a sophisticated video conferencing facility. The revolution in PC development and the Internet is matched by related developments in other forms of ICT including mobile telephones. Already these can send and receive text, and are now able to access the Internet (Christines, Jaun, Jonsson, 2001). Based on the foregoing, the authors believed that there is the need to introduce open and distance learning in Nigeria especially for engineering education.

2.0   History of Open and Distance Learning in Nigeria

In the past century off-campus instruction has undergone considerable changes, not the least of which has been its name: correspondence became external studies, distance education, open learning and then flexible delivery. A constant throughout its history, however, has been concern with opening up educational opportunities (Commonwealth of Learning, 2000). In this paper, the authors discuss the theory and practice of distance education and explain the main issues involved in planning, developing and managing distance engineering education. Almost all open distance learning institutions and organizations include distance learning within the definition of open learning.

According to (National Open University of Nigeria, 2002 & Mead J. 1987), they define the open learning system as based on a matrix. On the horizontal axis is a measure of the degree of

flexibility of each of these dimensions from close to open. On the vertical axis, dimensions are listed i.e. characteristics that may be ascribed to any learning system. The matrix is as shown in Figure 1.
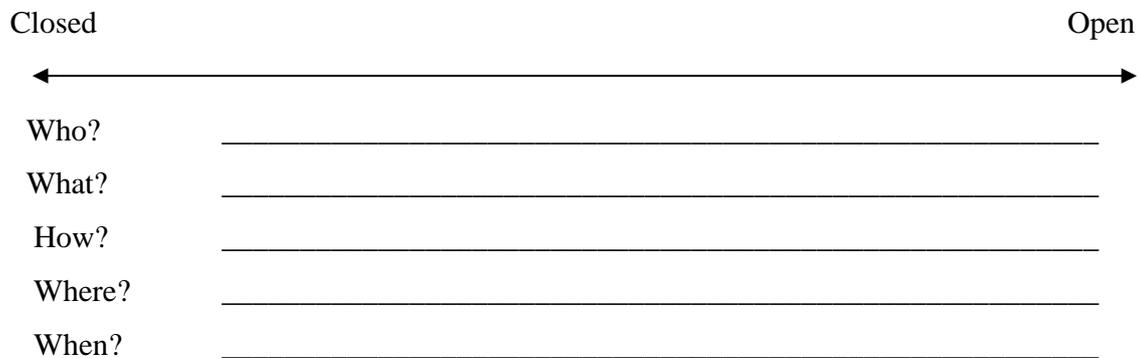
Closed   Open

Who?   _____

What?   _____

How?   _____

Where?   _____

When?   _____

Figure 1   Relationship between Open and Closed Learning System

A scenario in which all dimensions were closed would be the standard classroom approach. If the traditional classroom is considered as the closed case, then open learning can be defined as any learning situation in which at least one of the dimensions is open. That is to say if, for example, the *where* dimension is made more open, say, via the use of narrow-band technology transmissions to a variety of receiving stations, by definition, the learning has become *open.*

Conversely, the term distance education is generally given to a form of education and training delivery in which students are remote from the institution, and rarely, if ever, attend formal teaching sessions.   Some tutorial sessions may be scheduled by phone, and a compulsory residential seminar is sometimes specified, particularly where practical skills are being developed and assessed as in the case of engineering education. Essentially open learning incorporates other methodologies in addition to distance education.

The history of instructional design (ISD) has been traced to a modest beginning triggered by John Dewey's Presidential address to the American Psychological Association in 1899, when he called for the development of a Linking Science between learning theory and educational practice (Jegede 2001). (Jerome, 1963) at the 1963 Conference of Association for Supervision and Curriculum Development (ASCD) also called for a Theory of Instruction. Almost all instructional design theoreticians, practitioners and professionals subscribe to the use of systems approach to developing instructions. A system is an aggregate of components; each interacts with and influences others. They together works towards achieving a common goal.

In Nigeria, the history of open and distance learning system can be traced to the pre-independence era (i.e. pre-1960) when some universities and colleges (mostly from the United Kingdom) established study centres and even conducted examinations in few of our cities like Lagos and Ibadan. Few of our elites earned their degrees through correspondence education. In fact, the premier university in Nigeria i.e. University of Ibadan was a former extension of University College, London, until 1948 when it became autonomous. Oxford University, in 1947, established extra-moral studies at the then University College of Ibadan in Nigeria.

In 1960, the first distance education course by Radio was inaugurated by the National Broadcasting Corporation (NBC). The then National Television of Nigeria (NTV) aired Educational Television Programmes in all their stations. In 1972, the Ahmadu Bello University launched her University of Air. In 1975, it established Teachers In-Service Education Programme (TISEP). Also in 1976, the Federal Government of Nigeria established the National Teachers' Institute (NTI). In 1987, the University of Lagos also established the Correspondence and Open Studies Unit (COSU).

It should be noted that the Federal Government of Nigeria muted the idea of establishing a National Open University in 1983, during the Second Republic, but the military intervention later that year crushed this hope. Successive governments only paid lip-service to this great idea. It was not until 1990 that the University of Abuja established the Centre for Distance Learning (CDL) and in the mid 90's; many universities, polytechnics, the colleges establishes part-time, sandwich, and outreach programmes to cater for those not in a position to attend regular schools especially the work force.

In the year 2001, the Federal Government of Nigeria established the National Open University of Nigeria (NOUN) to run some courses. Though, the new university is yet to take off, but the authors believe that the government is serious this time around from some indications. In March, 2002, the National Open University invited experts from universities, polytechnics, colleges, and industries for a one-month Structural Design and Course Materials Development in Lokoja, Nigeria. Some of the authors were privileged to be part of the Course Materials Development Meeting.

3.0   Realities/Effects of Closed Learning System

According to the census figures released by the National Population commission in 1987, Nigeria has an estimated population of about 90 million. Although, the United Nations estimates is about 120 million. Irrespective of the discrepancies in the two figures, the authors believe that the population of the country is high. With average annual population growth of 2.38%(2006 estimates), 42.3% of the population of the country under 15 years, functional literacy of 51%, high unemployment rate -2.9%(2005 estimates) and under employment rate of 18.5%, extreme poverty (rural – 67.8%, urban- 57.7%), high HIV/AIDS prevalence rate of 5.4%(2003 estimates); all these led to the lowest measure on the development diamond with GNP per capital of $310, life expectancy of 47.08 years(2006 estimates.), gross primary enrolment of 18million, and access to improved/portable water at 39%. The combined effect of spiralling population growth as a result of high birth rate (40.43 births/1000 pop.), high population doubling rate, high rate of illiteracy, poor economy especially within the rural communities, and abject poverty has exerted untold stress on education.

4.0   Our Concerns and Challenges

In this paper, the authors are deeply worried about the state of engineering education in Nigeria. This is because the formal education system cannot cope with admission requests. Only about 20 percent of applicants are admitted into universities, polytechnics and colleges of education. There is therefore the need to enhance engineering education for all and life-long learning initiatives. We believe that the government should bridge the gap between demand for and supply of engineering education and training at all levels of education. It should be noted that, for many years now, the government only allotted less than 10% of the total budget to education as against the minimum of 26% suggested by the United Nations. This is grossly inadequate as engineering education is capital-intensive.

5.0   Rationale for a Paradigm Shift

In general, teachers often fear that if they are separated from their students the result will be dramatic drop in effective learning. However, if much of the teaching content is delivered outside the traditional classroom teachers are going to find greater flexibility in the use of their time. More emphasis can be placed on activities like counselling, tutoring and remedial work, as well as on student support activities that can significantly improve the quality of the teaching process. Time can be spent planning and producing learning resources. The authors believe that a good learning system seeks as many ways as possible to present information and ideas to students and to stimulate their thinking. Good teaching practice includes providing opportunities for students to be active learners, taking into account individual encouragement for student to seek solutions independently.

We believe that there is need to move away from the traditional *closed* learning system to open learning system. Such a paradigm shift will assist the engineering education such that:

- There is going to be a change from elitist-based to mass higher engineering education,
- We will witness exponential growth in engineering knowledge
- We will view engineering education from post-modernist perspective.

We are of the opinion that the development in ICT has globalized information, and this should be greatly harnessed in favour of engineering education.

6.0   Expected roles of ICT

ICT is as a result of the convergence of two different technologies: computer technology and telecommunication technology. For proper engineering education, its use cannot be over emphasized. In our opinion, the appropriate deployment of ICT will enhance quality and wide-spread use of engineering education in Nigeria. Open learning and distance education relies heavily on ICT. The ICT is so powerful that it could transform traditional educational provision. The rapid growth of off-campus courses using this technology is an indication of things to come. The technology will almost certainly create a paradigm shift from institution based, on campus, teacher-centered education to learner-centered education, where students using PCs at home or in the office, create their own degrees (Koschmaun, 1996). Our universities can collaborate with one another to patch together degrees based on the particular strengths of each participating university.

Such courses are offered via the Internet and use a range of ICT platforms including e-mail, news groups, synchronous and asynchronous text and video conferencing. The WWW and its wide spread can be heartily exploited in this regard also.

Another area where ICT can play a major role is in the use of various media to deliver learning information and to link students and teachers. Some media can be used for both purposes, but they generally fall into two categories:

> ✍ Those which can be used to convey subject content, such as print materials, video tapes, audio tapes, television, computer-based courseware and CD-ROM.
> ✍ Those which permit communication between teachers and students, such as fax, radio teleconferencing, videoconferencing and the Internet.

The telephone offers the opportunity for group links via teleconferencing, and television has led to the development of videoconferencing. It should be noted that recently the Federal Government of Nigeria established many television and radio stations scattered all over the country. We are of the opinion that preferences should be given to engineering education since they are meant for the recently established National Open University. For example:

* If low literacy levels are a factor, audio resources will be useful.
* If students are very isolated, the telephone will help down the distance barrier.
* If the course requires students to develop physical skills, realistic video demonstrations will be helpful.
* If an assessment task requires students to interview a client, they can record their activity on audio tape.

Finally we believe that the ICT offers fascinating credentials that can be used in favour of engineering education in Nigeria.

7.0   Current bottleneck and future directions

The power of ICT to change the structure and provision of appropriate engineering education through open and distance learning is apparent. What is not so apparent is how it will impact positively in Nigerian context. Successive governments, over the years, are not sincere with this

great idea. Suffice it to say that ICT requires huge investments in terms of human and material resources. We believe that the country is not adequately prepared for this project.

A major problem is that of the enabling environment (i.e. policy, legal framework, etc) and heavily deficient infrastructures such as poor telephone networks, regular power outages, very low level Internet connectivity. All these will not boost well for the appropriate engineering education that the authors have in mind. Since engineering education is practical-intensive, another setback to this is how to develop practical skills and competencies. That is, how to contextualize learning about open and distance education to Nigerian situation.

Considering all these problems, one may think that the country is not ready for it. We believe that it is better late than never. The government can immediately jump-start it by having a developmental cum rolling plan for education especially engineering education. This can be augmented by having the appropriate national ICT policy. In the year 2001, the government established the National Information Technology Development Agency (NITDA) to serve as the IT think-tank for the government. The efforts of this agency can be geared towards engineering education. This is because the economy of the world is now technology-driven. Finally, we believe that if the problems raised in this section are addressed by the government, we will have quality engineering education through ICT that is comparable with that of the Western world.

8.0   Conclusion

In this paper, the authors examined the importance of appropriate engineering education to any nation and the role that the ICT can effectively play for quality delivery of instructions. We also examined the role of open and distance education in engineering and how it could assist to train people that cannot be admitted into regular schools. Commercial and business markets are significantly driving the globalization of engineering education. There is convergence, a slow one, towards global engineering standards. Most developing countries, especially Nigeria, do not have the infrastructures to take part as equal partners in the world-wide enterprises of knowledge production and dissemination.

We should work to commit the organisations of the United Nations system to assist developing countries in redressing the present alarming trends. Faced with issues of self-sustainability, while

creating quality of life, globalization of engineering education can only be achieved by first-class educational opportunities for as many people as possible.

We established that a key element, indeed the primary asset to globalization of engineering education, is the use of ICT: the Computer/Internet/WWW.

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