

THE IMPLICATIONS OF THE INTERNET AND ASSOCIATED INFORMATION AND COMMUNICATION TECHNOLOGIES (ICT) ON SCIENCE, TECHNOLOGY AND MATHEMATICS (STM) EDUCATION IN NIGERIA

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Abstract

All the nations of the World are embracing Technological Innovations and Integrating them into their Educational Systems for advancement and development. ICT is relatively a new area in human development that combines the technology of various electronic devices. The use of them and the distribution of these facilities with reference to the geographical location were made known. The paper highlighted the state of science, technology and mathematics education so far in Nigeria, the implications of ICT for science technology and mathematics education, and the future of the internet. The paper then concludes with adequate recommendations to ensure that professional training should be provided for teachers to equip them with the required skills for ICT— integrated teaching and learning process

Keywords: Implications, ICT, Internet, Science, Technology, Mathematics.

The Internet technology often called the NET, the Information superhighway or Cyberspace is an offshoot hard effort made by the United States Military in the 1960s. The U.S. Department of Defense Advanced Research Projects Agency (ARPA) funded a research project that created a packet switching network known as the ARPANET. ARPA also funded research projects that produced two satellite networks. In the 1970s ARPA was faced with a dilemma: Each of its networks had advantages for some situations, but each network was incompatible with the others. ARPA focused research on ways that networks could be interconnected, and the Internet was envisioned and created to be an interconnection of networks that use TCP/IP protocols.

The early 1980s a group of academic computer scientists formed the Computer Science NETWORK, which used TCP/IP protocols. Other government agencies extended the role of TCP/IP by applying it to their networks: The Department of Energy's Magnetic Fusion Energy Network (MFENet), the High Energy Physics NETWORK (HEPNET), and the National Science Foundation, (Microsoft Encarta 2008).

In the early days, uses of the networks were restricted to military personnel and the researchers who developed the technology. The technology was administered by the National Science Foundation (NSF) thus gave access to a handful of researchers working on Internet research in Universities. NSF created a network called NSFNET in the 1980s to allow schools and universities to use the Internet for research and scholarly activities. As the network became so large, NSFNET in 1987 made an improvement to allow more transfer of information. By 1995, however, the NSF ceased its administration of the Internet. The Internet was privatized, and commercial use was permitted. This move coincided with the creation of the World Wide Web (WWW) by British physicist and computer

scientist Timothy Bemers-Lee at the European laboratory for Particle physics to allow researchers work together on projects and make results available. Companies, individuals, and institutions use the new technologies in many ways to facilitate Scientific, social, economic and technological developments.

All over the world and Nigeria in particular, the use of information and communication technologies (ICT) is fast gaining prominence and becoming one of the most important elements defining the basic competencies of students. According to World Bank report, ICT consists of the computer hardware, software, networks, and media for the collection, storage, processing, transmission, and presentation of information. In modern technologies, this is done through a global network of computers linked over large distances and this is called the internet.

Science Technology and Mathematics Education

Science, Technology, and Mathematics Education (STME) have been referred to as a meta-discipline, and the creation of a discipline based on the integration of other disciplinary knowledge into a new whole. This interdisciplinary bridging among discrete disciplines is now treated as an entity, known as STME (Morrison, 2009). Thus, STM Education offers students one of the best opportunities to make sense of the world holistically, rather than in bits and pieces. It should be noted, however, that STM Education is an interdisciplinary approach to learning; where rigorous academic concepts are coupled with real world lessons as students apply STM in the context that make connections between schools, community, work and the global enterprises, enabling the development of STM literacy and self reliance

skills, and with it, the ability to compete in the new economy (Tsupros, and Hallinen, 2009). Science and Technology have been instrumental in shaping and improving the life of humankind. While science tries to explain things, technology is what has enabled humankind to improve its standard of living, not only to build houses, supply food, health, travel and communications but arts, sculpture, music and literature (Mutasa, and Nwachuku, 2009). Thus, the purpose of technology is the application of human knowledge for the improvement of human life. Hence, technology, therefore, seems to be a cultural activity and every society is technological and scientific in varying degrees and mathematics is the vehicle for doing science and a tool for technologies (Wasagu, 2009).

The State of Science, Technology and Mathematics Education so far

In Nigeria educational sector the Federal, State and even Local governments have tried in embracing the new technology into the school system at primary, secondary and tertiary levels by setting up Ministries and Directorates of Science and Technology to Manage the technological welfare of the nation. State governments have also separate ICT projects to oversee education. Science, Technology and Mathematics Education in Nigeria is characterized by inadequacy of content and ineffective methodology by teachers, dearth of facilities, equipment and materials in our laboratories, as well as dominated socio-cultural lapses (Oriafo, 20012). The present scourge of unemployment in Nigeria clearly reveals that the STME taught in schools at all levels do not prepare Nigerian graduates to function well as expected (Nwachukwu, 2009). The courses which should be taught as hands-on and minds-on practical courses are basically taught theoretically; this makes the learners not to benefit maximally from their education.

However, Although a negligible few tertiary and secondary schools have integrated the new trend-ICT and the Internet, its application is still sparse in knowledge delivery. ICT in STM is therefore

expected to lead to the evolving transformation of teaching and learning resources which now include the use of desktops or laptop computers, compact discs, digital video discs (DVDs), satellite communication, the internet and other networks; (see figure 1

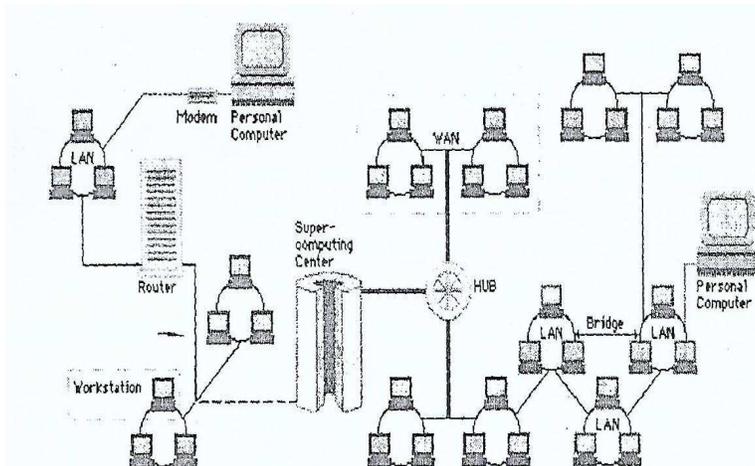


Figure 1: satellite communication, the internet and other networks.
Source: Microsoft corporation (2008).

The use of ICT in teaching is a relevant and functional way of providing education to learners that will assist in imbuing in them the required capacity for the world of work. Only very few jobs today do not require the use of skills in computer technology, collaboration, teamwork, and information technology; all of these can be acquired through teaching with ICT. It fundamentally changes the way we live, learn, and work. Various researchers have identified the importance of ICT in education and it has been found that ICT can promote students' intellectual qualities through higher order thinking, problem solving, improved communication skills, and deep understanding of the learning tool and the concepts to be taught.

Thus, there is no doubt that adaptability of ICT in STM education initiatives are most likely to successfully enhance the Millennium Development Goals of increasing access through distance learning, enabling a knowledge network for students, meeting teacher training targets, increasing the availability of quality materials, and enhancing the quality of administrative activities. ICT deployment in education knows no age boundary, distance limitations and of course no time constraint.

There are two major areas of application of ICT in the teaching and learning processes in secondary schools. They are the computer Assisted Instruction (CAI) and Computer Managed Instruction (CMI). Beside these, the use of internet electronic mail, tele-conferencing, web site hosting, topic searching and file transfer have provided access to information that covers a wide range of topics and interests in medicine, research, science and technology. As means of facilitating teaching and learning processes in schools. CAI is not just a means of transforming knowledge, but more importantly it can be an extension of both the teacher and the chalkboard. In this case topics covered in the syllabus or

the curriculum is encoded in various computer programmes in a self-instructional mode which makes it easy for students to use with minimal assistance.

Implications of ICT for Science Technology and Mathematics Education

Technology is reshaping our economy and ICT has introduced a new paradigm for doing science, which is now developing not only in science but also in technology, and mathematics. The new trend is such that, teaching methodologies now have to change from teacher-based instruction to learner-based learning where teachers facilitate learning. For successful and effective use of ICT-based mode of instruction in STM education, the following notable implications of the deployment of ICT in STM are worth looking at:

- *STM teachers do not only need formal training and retraining in ICT use, but also sustained and ongoing training to help them integrate technology into their teaching and deploying use of ICT infrastructure in classrooms and access to technology and training is a basic requirement for their participation in the global information economy;*
- *ICT resources need to be made available for effective computer- assisted STM teaching and learning in Nigeria school environment. Such facilities should include hardware and software, laptop, LCD projector, and reliable Internet access;*
- *Review of the curriculum to make it compulsory for Science, Mathematics and Technology teacher at all levels of education to employ ICT in knowledge delivery to bridge the digital divide in the teaching and learning. processing the Nigeria environment.*
- *Provision of reliable Internet infrastructure to simplify school connectivity;*
- *Provision of adequate power alternative such as the Solar power system to facilitate the use of ICT resources in teaching and learning and*
- *Provision for steady funding scheme for maintainability of the ICT resources for ready utilization.*

Future of the Internet

Several technical challenges must be overcome if the exploitation of the Internet and its deployment in STM education is to continue growing at the current phenomenal rate. The primary challenge is to create enough capacity to accommodate increases in traffic. Internet traffic is increasing as more people become internet users and existing users send greater volume of data. If the volume of traffic increases faster than the capacity of the network increases, congestion will occur

1. To avoid congestion, researchers have developed technologies, such as Dense Wave Division ‘Multiplexing (DWDM), that transfer more bits per second across an optical fiber. The speed of routers and other packet- handling equipment must also increase to accommodate growth. In the short term, researchers are developing faster electronic processors; in the long term, new technologies will be required. (Microsoft Encarta, 2008).

2. Another challenge involves IP addresses. Although the original protocol design provided addresses for up to 4.29 billion individual computers, the addresses have begun to run out because they were assigned in blocks. Researchers developed technologies, such as Network Address Translation (NAT), to conserve addresses. NAT allows multiple computers at a residence to “share” a single Internet address. Engineers have also planned a next-generation of IP, called IPv6, which will handle many more addresses than the current version.

3. Many domain names that used the simple format [http://www.\[word\].com](http://www.[word].com), where [word] is a common noun or verb, and .com referred to a for-profit business were mostly taken by 2001. Until 2001, only a few endings were allowed, such as .com, .org, and .net. By 2002, however, additional endings began to be used, such as .biz for businesses and .info for informational sites. This greatly expanded the number of possible URLs.

Conclusion

The authors are of the opinion that the internet and information communication technology resources have turned the education sector to globalised electronic library. The implications of the use of information and communication technologies (ICT) on the science, technology and mathematics education (STM) in the Nigerian environment cannot be overemphasized. Some problems associated with the use of computer and its technology on the teaching and learning of science mathematics and technology educations have been identified. For better results in the application of ICT in STM education, the recommendations itemized above are worth giving attention.

Recommendations

Based on the foregoing, the following recommendations are proffered

1. Government need to make concerted efforts to provide the required ICT facilities for secondary schools. Budgetary allocations should be made specifically for this purpose. There is the need for drastic action to improve power supply in the nation.
2. There is the need for government policies to take care of issues such as class size, training of teachers in ICT for teaching, funding, provision of ICT facilities in schools by school proprietors (state or private), and the inclusion of ICT-integrated activities into the curriculum.
3. Professional training should be provided for STM teachers to equip them with the required skills for ICT-integrated teaching and learning. Parents, NGOs, industrial sector, ICT producing companies, all employers of labor, and the international community must not leave the job of making schools ICT integrated to the government, but rather all hands must be on deck to ensure the technological change.
4. Efforts must be made by the teachers to allay the fear and apprehensiveness of students to using a computer. They should be encouraged to feel comfortable using computers and guide them to realize the advantage of such use.

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