

ISSUES AND CHALLENGES IN THE USE OF INFORMATION COMMUNICATION TECHNOLOGY (ICTs) IN EDUCATION

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Abstract

ICT has given rise to a host of legal and ethical issues and challenges in the use of ICT for education. Pre-service and in-service teachers as well as students need to know to a reasonable extent about the issues and challenges in the use of ICT for education. As teachers or potential teachers and students, they need to be above reproach. Teachers and students should understand the basic issues (effectiveness, cost, equity, and sustainability), as well as the challenges (infrastructure related challenges, capacity building challenges, challenges related to financing the cost of ICT use, to mention but few) surrounding the use of ICT in education and then apply those issues as principles in practice.

Keywords: Challenges, ICTs, Education, Use of ICT, Nigeria.

Introduction

Rapid developments in information and communication technologies (ICTs) in recent years have resulted in significant changes in the way the world operates and communicates. This in turn has had an impact on educational and training needs, both in terms of the content and the delivery of educational and training services, but also there has been increasing pressure on decision makers to acquire new technologies. Simultaneously, forms of ICT are multiplying with an increasing array of ICT options for decision makers to choose from when integrating ICT into education and training.

Faced with this situation, policy makers in many countries worldwide thought that to simply equip educational and training institutions with Personal computers and train teachers in their use would prepare learners for the demands of the 21st century. However, simply providing access to ICT is not going to radically change education systems for the better. A clear picture of what education should be seeking to achieve is the need for ICT to be utilized to their full potential within education systems. In order to make successful use of ICT in enhancing the reach and quality of teaching and learning, policy makers need to be aware of how ICT can be of best value in their country's education system, and need to develop a supportive policy environment and framework at the national level for the integration of ICT into their education systems.

The potential of each technology varies according to how it is used. Haddad and Draxler (2002) identify at least five levels of technology use in education;

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presentation, demonstration, drill and practice, interaction, and collaboration. Each of the different ICTs print, audio/video cassettes, radio and TV broadcasts, computers or the Internet may be used for presentation and demonstration, the most basic of the five levels. Except for video technologies, drill and practice may likewise be performed using the whole range of technologies. On the other hand, networked computers and the Internet are the ICTs that enable interactive and collaborative learning best; their full potential as educational tools will remain unrealized if they are used merely for presentation or demonstration.

Radio and television have been used widely as educational tools since the 1920s and the 1950s, respectively. There are three general approaches to the use of radio and TV broadcasting in education (Perraton & Creed, 2002):

- **Direct class teaching**, where broadcast programming substitutes for teachers on a temporary basis;
- **School broadcasting**, where broadcast programming provides complementary teaching and learning resources not otherwise available; and
- **General educational programming over community**, national and international stations which provide general and informal educational opportunities.

Perraton and Creed further noted that the most notable and best documented example of the *direct class teaching* approach is Interactive Radio Instruction (IRI). This consists of “ready-made 20-30 minute direct teaching and learning exercises to the classroom on a daily basis. The, radio lessons, developed around specific learning objectives at particular levels of maths, science, health and languages in national curricula, are intended to improve the quality of classroom teaching and to act as a regular, structured aid to poorly trained classroom teachers in under-resourced schools. IRI projects have been implemented in Latin America and Africa. In Asia, IRI was first implemented in Thailand in 1980; Indonesia, Pakistan, Bangladesh and Nepal rolled out their own IRI projects in the 1990s (TechnKnowLogia as cited in Tinio, 2002a). What differentiates IRI from most other distance education programs is that its primary objective is to raise the quality of learning and not merely to expand educational access and it has had much success in both formal and non-formal settings. Bosch (2002) observed that extensive research around the world has shown that many IRI projects have had a positive impact on learning outcomes and on educational equity. And with its economies of scale, it has proven to be a cost-effective strategy relative to other intervention (Bosch, 2002).

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In Asia, the 44 radio and TV universities in China (including the China Central Radio and Television University), Universitas Terbuka in Indonesia, and Indira Ghandi National Open University have made extensive use of radio and television both for direct class teaching and for school broadcasting, to reach more of their respective large populations. For these institutions, broadcasts are often accompanied by printed materials and audio cassettes. Japan's University of the Air was broadcasting 160 television and 160 radio courses in 2000. Each course consists of 45-minute lectures broadcast nationwide once a week for 15 weeks. Courses are aired over University-owned stations from 6am to 12noon. Students are also given supplemental print materials, face-to-face instruction, and online tutorials (Iwanaga, 2002).

Richmond (2002) indicated that there are three general approaches to the instructional use of computers and the Internet, namely:

- Learning about computers and the Internet, in which technological literacy is the end goal;
- Learning with computers and the Internet, in which the technology facilitates learning across the curriculum; and
- Learning through computers and the Internet, integrating technological skills development with curriculum applications.

Richmond further indicated that learning about computers and the Internet focuses on developing technological literacy. It typically includes:

- Fundamentals: basic terms, concepts and operations
- Use of the keyboard and mouse
- Use of productivity tools such as word processing, spreadsheets, database and graphics programs
- Use of research and collaboration tools such as search engines and e-mail
- Basic skills in using programming and authoring applications such as Logo or HyperStudio
- Developing an awareness of the social impact of technological change
- Learning with the technology means focusing on how the technology can be the means to learning across the curriculum. It includes: Presentation, demonstration, and the manipulation of data using productivity tools;
- Use of curriculum-specific applications types such as educational games, drill and practice; simulations, tutorials, virtual laboratories, visualizations and graphical representations of abstract concepts, musical composition, and expert systems; and

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- Use of information and resources on CD-ROM or online such as encyclopedia, interactive maps and atlases, electronic journals and other references (Richmond, 2002).

Technological literacy is required for learning with technologies to be possible, implying a two-step process in which students learn about the technologies before they can actually use them to learn. However, there have been attempts to integrate the two approaches. Learning through computers and the Internet combines learning about them with learning with them. It involves learning the technological skills ‘just-in-time’ or when the learner needs to learn them as he or she engages in a curriculum-related activity.

Tinio (2002a) observed that many higher educational institutions offering distance education courses have started to leverage the Internet to improve their programme’s reach and quality. The Virtual University of the Monterrey Institute of Technology in Mexico uses a combination of print, live and recorded broadcasts, and the Internet to deliver courses to students throughout Mexico and in several Latin American countries. Similarly, the African Virtual University, initiated in 1997 with funding support from the World Bank, uses satellite and Internet technologies to provide distance learning opportunities to individuals in various English-speaking and French-speaking countries throughout Africa.

At the University of the Philippines Open University, course materials are still predominantly print-based but online tutorials are becoming a convenient alternative to face-to-face tutorials especially for students unwilling or unable to go to UPOU’s various physical learning centres. About 70-90% of UPOU’s degree courses offer online tutorials as an option, while in several of its non-degree courses tutorials are conducted only online. But even in Korea, where infrastructure is among the best in the world, and government has put considerable financial and other resources behind an ambitious ICT-based re-tooling of its educational system, challenges to online education persist.

Issues in the use of ICT in Higher Education

Tinio (2002a) indicated that effectiveness, cost, equity, and sustainability are four broad intertwined issues which must be addressed when considering the overall impact of the use of ICTs in education.

(A): Effectiveness

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The educational effectiveness of ICTs depends on how they are used and for what purpose. And like any other educational tool or mode of educational delivery, ICTs do not work for everyone, everywhere, and in the same way. Effective could be viewed in the following manner.

Enhancing access: In higher education and adult training, there is some evidence that educational opportunities are being opened to individuals and groups who are constrained from attending traditional universities. Each of the 11 so-called mega-universities, the biggest and most well-established open and distance institutions in the world (which include the Open University of the United Kingdom, the Indira Gandhi National Open University of India, the China TV University System, the Universitas Terbuka of Indonesia, and the University of South Africa, among others) has an annual enrollment of more than 100,000, and together they serve approximately 2.8 million. Compare that with the 14 million combined enrollment of the 3,500 colleges and universities in the United States (Potashnik & Capper, 1998).

Raising quality: The impact of educational radio and television broadcasts on the quality of basic education remains an under-researched area, but what little research there is suggests that these interventions are as effective as traditional classroom instruction (Hannafin, & Savenye, 1993). Perraton and Creed (2002) supported this view by stating that, of the many educational broadcast projects, the Interactive Radio Instruction has been the most comprehensively analyzed. Findings provide strong evidence of the projects effectiveness in raising the quality of education as demonstrated by increased scores on standardized tests as well as improved attendance.

In contrast, assessments of the use of computers, the internet and related technologies for distance learning have been equivocal. Russell (1999) in his comprehensive review of research claims that there is “no significant difference” between the test scores of learners taking ICT-based distance learning courses and those receiving face-to-face instruction. Fouls (2002) however, claim that such generalizations are inconclusive; pointing out that the large number of articles on ICT-based distance learning does not include original experimental research or case studies. Similarly, Merisotis and Ronald (1999) argued that dropout rates are much higher when instruction is delivered at a distance via ICTs.

(B): Cost

Broadly speaking, educational television broadcasts and computer-based and online learning are more expensive than radio broadcasts (Blurton as cited in Tinio,

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2002a) Blurton further said that there is disagreement, however, over whether television broadcasts are cheaper than computer-based and online learning. That said, categorical assessments of cost-effectiveness are difficult to make because of lack of data, differences in programs, problems of generalization, and problems of quantification of educational outcomes and opportunity costs. Speaking specifically of computers and the Internet, Blurton argues that when considering whether ICT is “cost-effective” in educational settings, a definitive conclusion may not be possible for a variety of reasons. However, when considering the alternative of building more physical infrastructure, the cost savings to be realized from sharing resources, and the societal price of not providing access, ICT as a means of enabling teaching and learning appears to be an attractive and necessary alternative (Blurton as cited in Tinio, 2002a).

A common mistake in estimating the cost of a particular ICT educational application is to focus too much on initial fixed costs: purchase of equipment, construction or retrofitting of physical facilities, initial materials production, and the like. But studies on the use of computers in classrooms, for example, show that installation of hardware and retrofitting of physical facilities account for only between 40% to 60% of the full cost of using the computers over their lifetime, or its *total cost of ownership* (<http://ctp.fcoe.k12.ca.us/ctap/dhs3.4/tc02classpdf>). In fact, while at first glance it may seem that the initial purchase of hardware and software is the costliest part of the process, the bulk of the total cost of ownership is spread out over time, with annual maintenance and support costs (known as variable or recurrent costs) constituting between 30% to 50% of the total cost of hardware and software. The cost of professional development, another variable cost, also accumulates over time. For computer-based approaches the total cost of ownership therefore includes:

FIXED COSTS

- Retrofitting of physical facilities
- Hardware and networking
- Software
- Upgrades and replacement (in about five years)

VARIABLE OR RECURRENT COSTS

- Professional development
- Connectivity, including Internet access and telephone time
- Maintenance and support, including utilities and supplies

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In order to determine cost efficiencies, fixed costs must be distinguished from variable costs, and the balance between the two understood. If the fixed costs of a technology project are high and its variable costs are low, then there will be cost advantages to scaling up. This is the case with general educational radio and television broadcasting. Programs such as Sesame Street and Discovery are more cost-efficient; the larger their audience, since the high cost of production is distributed over a largerviewer base while no staff expenditures are made for learner support.

(C): Equity

Given the wide disparities in access to ICTs between rich and poor countries and between different groups within countries, there are serious concerns that the use of ICTs in education will widen existing divisions drawn along economic, social, cultural, geographic, and gender lines. Ideally, one wishes for equal opportunity to participate. But access for different actors—both as users and producers is weighted by their resources. Hence, initial differences are often reproduced, reinforced, and even magnified. A formidable challenge, therefore, continues to face planners of international education on how to define the problem and provide assistance for development (Hernes, 2002).

Tandon (1998) noted that the introduction of ICTs in education, when done without careful deliberation, can result in the further marginalization of those who are already underserved and/or disadvantaged. For example, women have less access to ICTs and fewer opportunities for ICT-related training compared to men because of illiteracy and lack of education, lack of time, lack of mobility, and poverty. Boys are more likely than girls to have access to computers in school and at home. Not surprisingly, boys tend to enjoy working with computers more than girls. As the American Association of University Women reports, “Girls have narrowed some significant gender gaps, but technology is now the new ‘boy club’ in our nation’s public schools (Mark, 2002). While boys programme and problem solve with computers, girls use computers for word processing. (AAUW Education Foundation, 1998).

Providing access to ICTs is only one facet of efforts to address equity issues. Equal attention must be paid to ensuring that the technology is actually being used by the target learners and in ways that truly serve their needs. A nICT-supported educational programme that illustrates this holistic approach is the *Enlace Quiche*: Bilingual Education in Guatemala through Teacher Training programme (<http://www.enlacequiche.or/english/vision.htm>). The programme seeks to

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establish and maintain bilingual education technology centres for educators, students, teachers, parents, and community members in Quiche and neighboring areas. The technical teams for each centre are composed of three students, two teachers, and the centre administrator, with at least one female student and one female teacher. Another objective of *Enlace Quiche* is the creation of multimedia bilingual educational materials that are anchored on the Mayan culture and that reflect a constructivist approach to learning. As the project website notes, this “demonstrate that the technology can be used to know, to conserve, to disclose and to value local knowledge.” The project thus illustrates a model for bridging the digital divide arising from the monopoly in Internet content provision by Western and English-speaking groups and from uneven capacities to make purposeful, relevant and critical use of digital resources.

The Gobi Women’s Project of Mongolia Portfolio another example of a holistic approach to ICT integration in education is a radio instruction project in Mongolia called the Gobi Women’s Project. It seeks to provide literacy and numeracy instruction built around lessons of interest to around 15,000 nomadic women, and to create income opportunities for them. Among the programme topics are livestock rearing techniques; family care (family planning, health, nutrition and hygiene); income generation using locally available raw materials; and basic business skills for a new market economy

(D): Sustainability

One aspect of development programs that is often neglected is sustainability. The long history of development aid has shown that too many projects and programs start with a bang but all too soon fade out with a whimper, to be quickly forgotten. This is true for many ICT-based educational projects as well. In many instances, these projects are initiated by third party donors such as international aid agencies or corporations and not enough attention is paid to establishing a mechanism by which the educational institution or community involved can pursue the project on its own or in partnership with other stakeholders after the initiating donor exits. But cost and financing are not the only barriers to sustainability. According to Cisler (2002), the sustainability of ICT-enabled programs has four components: social, political, technological, and economic.

Economic sustainability refers to the ability of a school and community to finance an ICT-enabled programme over the long term. Cost-effectiveness is key, as technology investments typically run high and in many cases divert funds from other equally pressing needs. Planners should look to the total cost of ownership

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and build lucrative partnerships with the community to be able to defray all expenses over the long term. The need to develop multiple channels of financing through community participation ties economic sustainability closely to social and political sustainability.

Social sustainability is a function of community involvement. The school does not exist in a vacuum, and for an ICT-enabled project to succeed, the parents, political leaders, business leaders and other stakeholders is essential. Innovation can happen only when all those who will be affected by it. Whether directly or indirectly, know exactly why such an innovation is being introduced, what the implications are on their lives, and what part they can play in ensuring its success. ICT-enabled programs must ultimately serve the needs of the community. Thus community-wide consultation and mobilization are processes critical to sustainability. In short, a sense of ownership for the project must be developed among all stakeholders for sustainability to be achieved.

Political sustainability refers to issues of policy and leadership. One of the biggest threats to ICT-enabled projects is resistance to change. If, for instance, teachers refuse to use ICTs in their classrooms, then use of ICTs can hardly take off, much less be sustained over the long term. Because of the innovative nature of ICT-enabled projects, leaders must have a keen understanding of the innovation process, identify the corresponding requirements for successful adoption, and harmonize plans and actions accordingly.

Technological sustainability involves choosing technology that will be effective over the long term. In a rapidly changing technology environment, this becomes a particularly tricky issue as planners must contend with the threat of technological obsolescence. At the same time, there is the tendency to acquire only the latest technologies (which is understandable in part because these are the models which vendors are likely to push aggressively). Generally, however, planners should go with tried and tested systems; stability issues plague many of the latest technologies. Again, the rule of thumb is to let the learning objectives drive the technology choice and not vice versa—the latest technologies may not be the most appropriate tools for achieving the desired educational goals. When making technology decisions, planners should also not just consider cost factor but also the availability of spare parts and technical support.

Challenges Associated with Use of ICT in Education

There are so many factors that hinder the effective utilization of ICT in education. These factors have been grouped into the following categories.

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- **Infrastructure related challenges**

A country's educational technology infrastructure sits on top of the national telecommunications and information infrastructure. Before any ICT-based programme is launched, policymakers and planners must carefully consider the following:

In the first place, are there appropriate rooms or buildings available to house the technology? In countries where there are many old school buildings, extensive retrofitting to ensure proper electrical wiring, heating/cooling and ventilation, and safety and security would be needed.

Another basic requirement is the availability of electricity and telephony. In developing countries large areas are still without a reliable supply of electricity and the nearest telephones are miles away. Experience in some countries in Africa point to wireless technologies (such as VSAT or Very Small Aperture Terminal) as possible levers for leapfrogging (Hawkins, 2002). Although this is currently an extremely costly approach, other developing countries with very poor telecommunications infrastructure should study this option.

Policymakers should also look at the ubiquity of different types of ICT in the country in general, and in the educational system (at all levels) in particular. For instance, a basic requirement for computer-based or online learning is access to computers in schools, communities, and households, as well as affordable Internet service.

In general, ICT use in education should follow use in society, not lead it. Education programmes that use cutting-edge technologies rarely achieve long term success. It is cheaper, and easier, to introduce a form of technology into education, and keep it working, where education is riding on the back of large-scale developments by governments or the private sector. Television works for education when it follows rather than precedes television for entertainment; computers in schools can be maintained once commercial and private use has expanded to the point where there is an established service industry (Perraton & Creed, 2002).

Capacity Building Challenges

MacDougall and Squires (1997) noted that there are various competencies that must be developed throughout the educational system for ICT integration to be successful.

(a) Teachers: Teacher professional development should have five focuses.

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- Skills with particular applications;
- Integration into existing curricula;
- Curricular changes related to the use of IT (including changes in instructional design);
- Changes in teacher role; and
- Underpinning educational theories.

Ideally, these should be addressed in pre-service teacher training and built on and enhanced in-service. In some countries, like Singapore, Malaysia, and the United Kingdom, teaching accreditation requirements include training in ICT use. ICTs are swiftly evolving technologies, however, and so even the most ICT fluent teachers need to continuously upgrade their skills and keep abreast of the latest developments and best practices. While the first focus skill with particular applications is self-evident, the four other focuses are of equal, if not ultimately greater, importance. Research on the use of ICTs in different educational settings over the years invariably identify as a barrier to success shows the inability of teachers to understand why they should use ICTs and how exactly they can use ICTs to help them teach better. Unfortunately, most teacher professional development in ICTs is heavy on “teaching the tools” and light on “using the tools to teach.” Teacher anxiety over being replaced by technology or losing their authority in the classroom as the learning process becomes more learner-centered an acknowledged barrier to ICT adoption can be alleviated only if teachers have a keen understanding and appreciation of their changing role.

(b) Education administrators: Leadership plays a key role in ICT integration in education. Many teacher- or student-initiated ICT projects have been undermined by lack of support from education administrators. For ICT integration programs to be effective and sustainable, administrators themselves must be competent in the use of the technology, and they must have a broad understanding of the technical, curricular, administrative, financial, and social dimensions of ICT use in education.

(c) Technical support specialists: Whether provided by in-school staff or external service providers, or both, technical support specialists are essential to the continued viability of ICT use in a given school. While the technical support requirements of an institution depend ultimately on what and how technology is deployed and used, general competencies that are required would be in the installation, operation, and maintenance of technical equipment (including software), network administration, and network security. Without on-site technical support, much time and money may be lost due to technical breakdowns.

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In the Philippines, for example, one of the major obstacles to optimizing computer use in high schools has been the lack of timely technical support. In some extreme cases involving schools in remote areas, disabled computers take months to be repaired since no technician is available in the immediate vicinity and so the computers have to be sent to the nearest city hundreds of kilometers away (Tinio, 2002b). Similarly, in Nigeria technicians are not within the country, and this poses as a threat in times of systems breakdown.

(d) Content developers: Content development is a critical area that is too often overlooked. The bulk of existing ICT-based educational material is likely to be in English or of little relevance to education in developing countries (especially at the primary and secondary levels). There is a need to develop original educational content (e.g., radio programs, interactive multimedia learning materials on CDROM or DVD, Web-based courses, etc.), adapt existing content, and convert print based content to digital media. These are tasks for which content development specialists such as instructional designers, scriptwriters, audio and video production specialists, programmers, multimedia course authors, and web-developers are needed. Like technical support specialists, content developers are highly skilled professionals and are not, with the exception of instructional designers, historically employed by primary and secondary schools. Many universities with distance education programs, and those who otherwise make use of ICTs, have dedicated technical support and content development units.

Challenges Related to Financing the Cost of ICT Use

One of the greatest challenges in ICT use in education is balancing educational goals with economic realities. ICTs in education programs require large capital investments and developing countries need to be prudent in making decisions about what models of ICT use will be introduced and to be conscious of maintaining economies of scale. Ultimately it is an issue of whether the value added of ICT use offsets the cost, relative to the cost of alternatives. Put another way, is ICT-based learning the most effective strategy for achieving the desired educational goals, and if so what is the modality and scale of implementation that can be supported given existing financial, human and other resources?

Whyte as cited by Cisler (2002) suggested the following potential sources of money and resources for ICT use programs:

- Grants
- Public subsidies
- Private donations, fund-raising events

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- In-kind support (e.g., equipment, volunteers)
- Community support (e.g. rent-free building)
- Membership fees
- Revenues earned from core business:
- Connectivity (phone, fax, Internet, web pages)
- Direct computer access to user
- Office services (photocopying, scanning, audiovisual aids)
- Revenues earned from ancillary activities:
- Business services (word-processing, spreadsheets, budget preparation, printing, reception services)
- Educational services (distant education, training courses)
- Community services (meeting rooms, social events, local information, remittances from migrant workers)
- Telework and consulting
- Specialized activities (telemedicine)
- Sales (stationary, stamps, refreshments, etc.).

Ilaonisi and Osuagwu (2010) indicated that many factors limit the infusion of ICT in educational institutions in Nigeria. These include paucity of ICT infrastructure and lack of access; high enrolments, inadequate funding and absence of funding allocation to technology; high cost of ownership and cost to the consumer and policy implications of the mismatch between the advertised capabilities of ICT technology and the aims of individual educational institutions.

Paucity of ICT Infrastructure and Lack of Access

The underlying assumption for ICT in education is universal access to the network. Although some progress has been made in this front, there is urgent need to break the crippling access barrier confronting institutions of higher learning in Nigeria. The profile is vastly different from campus to campus. Some have Campus Area Networks (CAN) backed by wireless narrowband or fibre-optic backbone; some have only Internet cafes with grossly insufficient computers for the user base with a 50:1 ratio being typical and others have departmental LANs. The expected quality and performance will correspondingly be low. Web based education in the form of online, mobile and distance education requires reliable computer networks, broadband connectivity, fibre-optic backbones for all the bandwidth hungry applications and to interconnect offices, departments and centres to the public Internet via the campus area network. High student enrolment, inadequate funding

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of universities and lack of technology budget exacerbate the problems of ICT infrastructure.

High Cost to the Consumer

The cost to the consumer of ICT services is quite expensive. Staff, students and researchers visit on-campus business cyber cafes to use the Internet: In these cafes, the average cost of browsing is 1.0USD (₦156.00) per hour. As a result of the high cost, student and staff browse only when absolutely necessary. One could get a home internet subscription of 100 USD (₦15600.00) of slow and on and off internet connectivity to 350 USD (₦54600.00) of stable and fast access. A fortune could therefore be spent on Internet connectivity.

High Cost of Ownership

There is a realization in Nigeria that the government alone cannot adequately shoulder the high cost of quality education in the 21st century. Partnership between government, industry and stakeholders appears to be the preferred option. In Nigeria a number of organizations for example, Education Trust Fund (ETF), Petroleum Technology Development Fund (PTDF), etc donate ICT laboratories equipped with 20-50 computers to some tertiary institutions. In addition they pay for one year of two years internet subscription and mandate the recipient institution to sustain the facility. Most of these laudable efforts have failed because the recipients were unable to pay for the high cost of equipment renewal, maintenance and bandwidth. This is because network costs in Nigeria consist of not only capital cost but also high operating cost. Thus the cost of ownership is very high.

Unsteady and Inadequate Electrical Power Supply

The irregular supply of electrical power has crippled the Nigerian economy and hindered the progress of research carried out by institutes, groups and individuals in the country. It is maddening for any establishment to start off new projects without addressing the almighty power supply problem. It is even worse to embark on extensive ICT project within an educational institution, without solving power problems first. The Federal government is however, working towards improving the generation of enough megawatts of power in the country. The average power supply in the year 2008 was about 4hrs/day. Alternate sources of power are standby generators, batteries and solar panels. The premier universities cannot foot the bill of maintaining several standby generators that gulp down 10-30 litres of diesel per hour at 0.85USD (₦132.6) per litre; nor can they purchase enough solar panels to go round the campus. Not all local ISPs can maintain their boosters for

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24hrs due to high cost of gas; and many subscribers cannot use the Internet effectively as there is hardly electrical power to do as wished. Sometimes, low voltages that do more harm than good is supplied. When power is rarely supplied, the admirable goals of transforming education with ICT and taking a paradigm shift in education is all a dream; having access to educational resources on demand, anytime, anyhow and anywhere is a story; e-learning would not be sustained either. Also, Mr. Egwu identified infrastructure availability as the bane of e-learning in Nigeria, especially with the erratic power supply situation, compounded by lack of access to technology. “That is why this committee is going to do basic work on infrastructure. It is not just enough to say we want bandwidth, broadband or the connectivity in isolation, for the foundation to be strong, power must be involved” (Sam, 2011).

Brain-drain is another challenge facing the development of the full potential of ICT for education, research and development of any country. Brain drain has resulted in the lack of the critical mass of ICT-engineers and scientists relevant for undertaking ICT-related project professionally. Another major obstacle is the lack of an enabling environment and a sound ICT-roadmap and strategies by policy makers resulting in uncoordinated and unsustainable ICT-development activities. Other problems as noted by Instiful, Okyere and Osae (2003) include:

- High running and subscription costs;
- Lack of good publicity and incentives to attract potential users;
- Identification of information sources that meet the needs of users;
- Poor Quality of Service of the internet and telecommunication services;
- Effective management of network traffic and infrastructure

The solution strategy towards bridging the digital divide demands an aggressive human capacity building in ICT through training workshops, seminars and courses in collaboration with local and international institutions.

Conclusion

The use of ICT in education is now seen worldwide as both a necessity and an opportunity. Issues and challenges of ICT in education deal with the use of ICTs within educational technology. The main issues and challenges of ICT in education mean implementation of ICT equipments and tools in teaching-learning process as a media and methodology. The issues and challenges of ICT in education is generally to familiarize students and teachers with the use and workings of

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computers and related technologies as well as the social, ethical, technological, costs, and electricity challenge to mention but few, of the use of ICT in education.

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