
ICT Education in a Developing Society: A Global Challenge to Facilitate Data Processing in the Computing Industry

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Abstract

ICT education helps to transform lives, banishing poverty and improving opportunities. In many societies where unemployment has afflicted millions of people, ICT becomes the most effective and positive focus in the reduction of poverty. Information and communication technology (ICT) in developing countries is suggested as an effective way to improve the population's life and well-being. In particular, ICT applications in the educational system might change the future of the underdeveloped world fundamentally through the connections to 'the flat world'. However, there are some challenges which the developing world faces when they adopt ICTs in the education and computing sector. These challenges are limitations on cost, internet access, trained staff and adequate policy. This paper focuses on these hurdles and their corresponding solutions and includes practical examples from all around the world. Some criticism and considerations are also presented. To this end the researchers recommend that: Imported ICT equipments may be tax free and every division of Education in our society be automated to facilitate and to create avenue for effective services.

Understanding how technology fits into the complex realities of computing industries has been a critical Factor in creating real change in the industrialized nations. Berman (1998) noted the role of computers as essential component of development that has been strongly promoted by international development agencies which have accepted whole-heartedly the premise that information technology must be applied and developed in Third World countries if they are not to be left behind. Edward (1997), believes that a computer is an achievement of high technology. It is one of the possible wayward devices of which we speak. In just few decades, it has moved from a mysterious electronic marvel in Science and Engineering laboratories, to a workday machine which simply cannot be avoided by anyone having even casual contact with the major institutions of our society. "Computers have come to be the standard tools of the exact sciences".

This paper examines the influence of information and communication technologies (ICT)-focused professional development program on computing industry. Over the years, program evaluations have found that industrial workers across a variety of countries value their experience in the Essential Computer Course and report using ICT and/or making changes in their places of work. However, the evaluations have also suggested that the ways in which industrial workers in different countries follow up vary, depending largely on factors in their companies contexts. For Oyedemi (2011), Computer is an electronic device capable of following an intellectual map by which it can perform arithmetic and logical operations. To Bamidele (2004), Education gives adequate solutions to all the problems in every aspect of life and the negligence of education by any community will lead to an automatic economy and social paralysis of such a community. Computer education being one of the most versatile aspects of education is greatly capable of fulfilling all the aims and objectives of education, one of which this paper is set to portray

Statement of the Problem

Considering the enormous benefits that are experienced through the impact of ICTs Worldwide, developing societies still experience some obstacles or hindrances in the effective and efficient use and management of the ICTs resources like System software and other programs such as Swamp server, Dreamweaver, flash 8, solar shirts, self- healing automatic machine (Microcapsule) and I-limb; this research work was conducted to show that proficiency in ICT education and resources may improve opportunities and reduce poverty in our society.

Objectives of the Study

1. To ascertain the level of computerization/ automation in the computing industry
2. To prove that: ICT education can reduce poverty in a developing society.
3. To determined the usefulness of ICT resources in a society.

4. To determine the challenges associated with the application of ICT resources in our society.

Research Questions

1. To what extent has ICT education and resources been employed in our society?
2. To what extent will ICT reduce poverty and improve opportunities in our society?
3. What is the usefulness of ICT resources in the computing industry?

Purpose of Study

To ascertain the impact of ICT education and resources in the computing industry and to banish poverty and improve opportunities through ICT education and resources in our society.

Significance of the Study

This study will induce ICT educators to use a better approach in the teaching of computer science in the global world.

The finding from this study will stimulate further researchers to make ICT education more meaningful, interesting and attractive to students worldwide.

Discussion

Information and communication technologies (ICTs) comprise a complex and heterogeneous set of goods, applications and services used to produce, distribute, process, and transform information. They include the outputs of industries as diverse as telecommunications, television and radio broadcasting, computer hardware and software, computer services and electronic media (e.g. the internet, electronic mail, and electronic commerce and computer games).

ICT's Three Main Components

1. Computers; used to process data into information,
2. Communications networks; transmission of information,
3. Know-how; the technology used for the transmission

Computers: A computer is an electronic system that can be instructed to accept, process, store, and present data and information. It is made up of two component parts: hardware and software. - **Hardware:** The computer and its associated equipment.

1. **Software:** The general term for a set of instructions that controls a computer or a communications network.
2. **Program:** A set of instructions that directs a computer to perform certain tasks and produce certain results.
3. **System:** A set of components that interact to accomplish a purpose.

4. **Data:** Raw facts, figures, and details.
5. **Information:** An organized, meaningful, and useful interpretation of data.
6. **Knowledge:** An awareness and understanding of a set of information and how that information can be put to the best use.
7. **Information System:** A business information system designed to produce the information needed for successful management of a structured problem, process, department, or business.
8. **Computing:** Is the theory, design, manufacture and use of computers. It includes all activities relating to computers. Terms such as 'informatics' and 'information technology' are also used for this purpose. The computing industry has grown to become one of the world's largest single industries. Computing industry includes: computer companies, Research institutes, Education industries, Government and Non Governmental Organizations.

System Software and Computing Industry

System software (or **systems software**) is computer software designed to operate and control the computer hardware and to provide a platform for running application software.

System software includes the following:

The **operating system** (prominent examples being z/OS, Microsoft Windows, Mac OS X and Linux), allows the parts of a computer to work together by performing tasks like transferring *data* between *memory and disks* or rendering output onto a display device. It also provides a platform to run high-level system software and **application software**.

Utility software helps to analyze, configure, optimize and maintain the computer.

Device drivers such as computer **BIOS** and device **firmware** provide basic functionality to operate and control the hardware connected to or built into the computer.

Window systems are components of a **graphical user interface** (GUI), and more specifically of a **desktop environment**, which supports the implementation of **window managers**, and provides basic support for graphics hardware, pointing devices such as mouse, and keyboards. The mouse cursor is also generally drawn by the **windowing system**. In some publications, the term *system software* also includes **software development** tools (like a **compiler**, **linker** or **debugger**). In contrast to system software, software that allows users to do things like create text documents, play games, listen to music, or surf the web is called **application software**.

The Functions of Information Technology

1. **Capture:** The process of compiling detailed records of activities. This could be by recording of data from an event or occurrence, in some form such as sales slips, personnel forms, purchase orders, meters, course registration forms, etc.
2. **Verifying:** Is the operation for checking or validating of data to ensure it was captured and recorded correctly.
3. **Processing/Manipulation:** The process of converting, analyzing, computing, and synthesizing all forms of data or information.
4. **Classifying:** Is the operation for placing data elements into specific categories such as size, type, customer, etc.
5. **Arranging (Sorting)** this is placing data elements in a specified or predefined sequence. **Calculating:** This entails the arithmetic and /or logical manipulation of data e.g. computations to derive employee's pay, customer's bills etc.
6. **Summarizing:** Reducing data in logical sense. For example the school principal may only be interested in the total amount of the development levies collected out of the total school fees. **Storage:** This entails placing data onto some storage media such as magnetic disk, etc where it can be retrieved when needed.
7. **Retrieval** this entails searching out and gaining access to specific data elements from the medium where it was stored for further processing or for transmission to another user.
8. **Data Update:** This involves making changes to the stored data. Such changes may be to insert new records or modify some data items of the existing record. However, this is usually the exclusive preserve of a class of authorized data users.
9. **Reproducing:** This entails duplicating data from one medium to another or into another position in the same medium. Example a file of data stored on a magnetic disk may be reproduced onto another disk or onto a magnetic tape for further processing or for security reasons.
10. **Transmission/Communication:** The computer process of distributing information over a communications network. This entails transfer of data from one place to another e.g. data can be transferred from a device to a user in form of a report or a display on the screen of a computer controlled terminal. - Electronic Mail, or E-Mail."
- Voice Messaging, or Voice Mail.
11. **Generation:** The process of organizing information into a useful form, whether as numbers, text, sound, or visual image.

Benefits of ICT

Instant responses, accurate results, Rapid communication between individuals and organizations, Improves a company's/organization's or institution's image.

All of these provide organizations and individuals with rapid access to high quality information that they can be used in planning and decision making. Twenty years ago, it might well take a fortnight to make an enquiry and get an answer. Now it can be done in a few minutes.

ICT is very effective in allowing instant feedback on levels of commodities, e.g. Funds in bank accounts, Availability of seats in aero planes, Stock levels in a chain of supermarkets, Keeping track of books borrowed from a library. In a library, the system can provide information on: Borrowers' names and addresses, what books they have which are overdue, Location in other libraries of books that readers order. The computer can also: Issue overdue notices, Provide information for borrower enquiries. Provide the necessary information for auditing, planning, and purchasing. Provide better security. Save staff time by releasing them from repetitive paper based tasks. Word-processing to produce students notes and worksheets with a much more professional appearance.

Computer application areas: Here we again consider the computer in: Medicine, Agriculture, Government, Education, Research, Business and professional office, office management, transport and communication, recreation, amusement and gaming.

Social impact of ICT: Internet: Marriages, businesses and transactions through Face book, 2go, Pinging, Yahoo messengers and Yahoo mails. I - limb, Solar T-shirts, Micro capsule, Presentations using PowerPoint, Multimedia and Internet resources are used widely for research. **Hazards of ICT Systems:** Introduction of ICTs can lead to a lot of extra work, especially if the system is not-so-reliable (as in the early days), manual back up records have to be kept. Displacement of jobs by computers and computerized devices- Employees find themselves redundant. Crimes that can be committed with the computer are super crimes. Faults in the software can lead to chaos, which can bring the organization to a halt. This is often a problem in bespoke or specialist software written for the particular organization. Inadequate hardware can cause communication logjams. Failure of a computer system means a catastrophic loss of investment. Major failures of ICT hardware and software have damaged the public image of organizations and led to not a few scandals. Fraudulent / criminal activities are carried out on the internet. Dehumanization: Persons are Persons and Machines are machines, computers can diagnose illness but a Doctor's smile goes a long way in uplifting the patient psychologically. Depositing a virus or Trojans to computers in an organization can make it to lose her integrity.

Challenges and Solutions to Implementing ICT in Developing Countries: Many researchers agree with the idea that ICT's role is to be a reliable tool to improve the quality of life and this reduces the economic gap between developed and developing countries. Applying ICT to schooling is an urgent task for developing countries to implement (Parliamentary Office of Science and Technology 2006). However, there are challenges that the developing world is facing and these make the 'Digital Divide' continue not only between countries but also within countries (Parliamentary Office of Science and Technology 2006). The hurdles are mainly divided into four categories; a lack of financial resources, poor access to the internet, limited trained teachers, and lack of policy (Gulati 2008; Kosmas 1999; Oliveira 1989; Parliamentary Office of Science and Technology 2006; Ruth & Shi 2001).

Financial issues: The first issue, which almost all developing countries face, is how to deal with the scarcity of financial resources (Oliveira 1989). Resources in the developing world are always scarce so that they have to be spent mostly on basic supplies such as food, housing and roads. In a sense, investing in ICT for schooling might be regarded as a long term issue which means adopting ICT in the education system is relatively not an urgent issue considering the serious poverty in many African countries. This results in a vicious circle between scarcity of funds and under development. When it comes to the controversy of priority of investment between basic services and ICT, both might be linked in the case of education (Parliamentary Office of Science and Technology 2006). One piece of good news about cost is that the cost of hardware is decreasing rapidly. The price of PCs and peripherals is reduced to half of the original price every two years. Because of this, the salary of the IT professionals who can teach the new technology is the biggest burden on education budgets and it is followed by software related costs (Oliveira 1989).

Many world organizations such as the United Nations and other independent groups are working on projects to deal with the financial scarcity of developing countries. For example, the One Laptop per Child (OLPC) Project at the Massachusetts Institute of Technology is working to deliver an affordable PC to every child in the developing nations at low cost. This project is being worked together with corporate organizations such as Google and Newscorp.

Limited internet access: Access to the internet is highly limited in remote areas, and relatively poor infrastructure in developing nations such as supply of electricity makes this worse (Gulati 2008). Low infrastructure is the fundamental problem for developing countries to deal with and it might take a long time and huge funding to improve. Low literacy rates also hinder locals in remote areas from accessing information through the internet and due to the dominance of English on the internet; non-English speaking

local people are isolated from the benefits of using internet (Parliamentary Office of Science and Technology 2006).

To address these limitations, correspondence courses can be applied (Ruth & Shi 2001). Typical correspondence courses mainly use the printed study materials and exchange assignments between students and tutors through the postal service, so that the students living in poor countries do not need the internet service or computers, which are relatively expensive for them. Distance learning through broadcasting on TV might be another alternative for developing countries with limited internet access (Ruth & Shi 2001).

Kosmas (1999) presents global scale movement, called World Links for Development (Worlds Program), which is launched by the World Bank Institute aiming to link secondary school students and teachers for improving education. This program provides total support including interconnection, training, partnership, policy advice and evaluation. Uganda is the first country to apply this program and it has spread to 26 countries resulting in better responses from both students and teachers. Teachers in this program use more email, bulletin boards and the internet in school than others who do not belong to Worlds program.

Lack of trained staff: Another challenge of developing nations to adopt ICT in education systems is a lack of trained teachers (Gulati 2008; Kozma 1999). When it comes to practically applying ICT, which is new to traditional teachers, many may not know how to deal with it and sometimes they are reluctant to accept new technologies in their classrooms. Thus, tutors who can train these teachers about new technology and IT professionals who can technically install and maintain the system are needed.

To address this issue, distance learning might be a useful alternative which is relatively affordable and does not require hiring of human resources in remote countries. However, due to the limited access to the internet, distance learning can only be based on text books and possibly satellite TV programs. This is not the case for the distance learning programs of many developed countries. For example, China adapted distance learning to cover its broad territory by slowly leveling up the applied technology from the TV-based to the internet-based depending on the region's level of infrastructure development. This step-by-step approach was successful.

Lack of policy: Gulati (2008) argues that inappropriate policy and funding decisions may hinder equal educational development in some developing countries. He also asserts that elitism is the most common driver for improper policy. For example, India focuses mostly on the higher education system so the poor do not have enough opportunities to get adequate education even though there is certain technology-

enhanced education such as satellite TV learning programs (Gulati 2008). Pressure from industry might be another source of improper policy (Oliveira 1989). Industry lobbyists distort the policy of ICT and education for the purpose of their favour. The governments in developing nations need to liberalize markets and cut taxes on the ICT industries. For the reasonable and affordable pricing, market liberalization should be accomplished. Cutting taxes will also help in increasing affordability resulting in spreading ICT accessibility (Parliamentary Office of Science and Technology 2006). When it comes to policy advice, Gulati (2008) especially focuses on investing in infrastructure. These actions will help boost sustainable technology enhanced schooling.

Considerations: Although some argue that applying ICT will improve the quality of life in the developing world, critics question whether basic services such as clean water or libraries should be prioritized (Parliamentary Office of Science and Technology 2006). A delegate from an African country argued in a world meeting of the United Nations that clean water and schools are more important than ICT adoption such as OLPC program which cost US\$199 per child contrasting the cost for building library, hosting 400 children, which is only US\$2 per child.

Oliveira (1989) argued that given limited resources in developing nations, investment on ICT should consider cost and effectiveness so that policy makers can properly select the most effective parts out of many areas such as building library, improving teacher's quality and adopting distance learning. The governments of any developing nation need to decide to what extent they will invest in ICT, because in some countries it requires only simple technology due to the low level infrastructure. This means that developing countries should focus more on strategy than on products.

Conclusion

The role of ICTs in developing countries is significant and critical for their rapid economic success which might lead to closing the gap between the developed and developing world. When implementing the ICTs in the education sector, there are considerable challenges such as cost, internet access, training and policy issue. But, each issue has its own ways of addressing it which is effective practice around the world. However, all these changes for development through applying ICTs to the education sector must consider the environment each country faces, because the situation of each nation is totally different from the other. It might be different from region to region within the country and it changes as time goes by.

References

- Gulati, S. (2008). Technology-enhanced learning in developing nations; A review', *International Review of Research in Open and Distance Learning*, vol. 9, no.1, viewed 5 April 2010, [http://www. Distanceandaccessto education.org/ contents/IRRODL-Gulati.pdf](http://www.Distanceandaccesstoeducation.org/contents/IRRODL-Gulati.pdf).
- Kosmas, R. (1999). ICT and educational reform in developing and developed countries', *Center for technology on learning: SRI International, CA*, viewed 19 March 2010, <http://web2.udg.es/tiec/orals/cl7.pdf>.
- Oliveira, J. (1999). Computer education in developing countries: Facing hard choices', *Education & Computing*, vol.9, no. 2, pp. 301-311.
- Buchmann, M. & J. Schwille (1993) Education, experience, and the paradox of finitude', in M. Buchmann & R. Flodends, (nd) *Detachment and Concern: 'Continuations in the Philosophy of Teaching and Teacher Education*, New York: Teachers College:
- Oyedemi, J. (2011). A computer based simulation and modeling performances on academics. Unpublished Ph.D Thesis, Springfield University, Hampton U.S.A