

# THE ROLE OF INFORMATION AND COMMUNICATION TECHNOLOGY IN EDUCATION: SCOPE AND CHALLENGES

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## **Abstract**

To date, the main application of Information and Communication Technology (ICT) in the business sector focuses on aiding access and processing of larger quantities of information for employees and management with the principal aim of increasing productivity. In the case of education, however, little or no information is being used to improve student performance, mainly because education managers are largely illiterate in information management tools. Likewise, despite schools having more and more access to ICT, new technologies are still scarcely used as part of the teaching methodology. Once again, it is the lack of training that creates difficulties. Many teachers do not have the necessary IT skills and feel uncomfortable, nor do they have the specific training needed to be able to use the new resources in the classroom. In the university sector, ICT has already made impact whether in terms of teaching, research or administration. However, despite some exceptions, there are few real examples with educational models that are based on this technology and there is still an important social preference for traditional education models. The paper reviewed critically the role of information and Communication Technology (ICT) in education. It finally made some recommendations that would help in making the Information and Communication Technology (ICT) functional in the educational system.

## **Introduction**

It is expedient that we quickly peruse the definition or description of some common terminologies associated with this term “information and communication technology” (ICT). It is a diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information. These technologies include computers, the internet, broadcasting technologies (radio and television), and telephony. Communication and information are at the very heart of the educational process. Consequently ICT use in education has a long history. ICT has played an educational role in formal and non-formal settings. In programs provided by governmental agencies, public and private educational institutions for profit making organization and non-profit groups, secular and religious communities. For more than forty years, innovative educators have been optimistic about computer uses in schools. Their vision for computers, their multiple visions- have not been realized to nearly the extent thought possible. Despite a rapid fall in the price of hardware, the exponential increase in computing power, and the development of the internet, has opened a host of new possibilities not conceived a decade ago. The main obstacles in education to incorporating ITC into the teaching-learning process are not obvious. In this paper, the authors try to understand better where the problems lie.

Four independent trends have run through the vision of educational computing since its inception. The first, computer assisted instruction (CAI), grew out of early work on self-scoring tests and mechanical teaching machines by S.L. Pressey in the 1920s (Smith and Smith 1966). Computer science, and specifically programming as a school subject, became a second major trend spun by proponents of computer use in school subject; Carlson, .S. and C. T. Gadio 92002. Luehrmann and Peckham (1984) felt that students could not properly use a computer without learning to program it. This made programming and computer literacy synonymous – a reasonable position at a time when application programs were virtually non-existent outside business data processing. The third trend is cognitive development and problem-solving skill.

The final, and most recent, trend is internet use for gathering information, and the role of information itself as a tool for cognitive development and improving problem-solving skill. The internet can be used as a major medium for accessing learning software, and for networking with other learners and teachers. Through in the Web, teachers and students can access curricular, teacher training, and other learning materials, some provided by their own central or state government administrations, and others through private providers. ICT is being used in distance education is to replace earlier correspondence school and educational television. The new distance education is to replace earlier correspondence school and educational television. Which is usually Web-based.

### **What is e-Learning?**

Although most commonly associated with higher education and corporate training, e-learning encompasses learning at all levels, both formal and non-formal, that use an information network - the Internet, an intranet (LAN) or extranet (WAN) - whether wholly or in part, for course delivery, interaction and/or facilitation. Others prefer the term *online learning*. *Web-based learning* is a subset of e-learning and refers to learning using an internet browser (such as Netscape or Internet Explorer).

### **What is Blending Learning?**

Another term that is gaining currency is blended learning. This refers to learning models that combine traditional classroom practice with e-learning solutions. For example, students in a traditional class can be assigned to both print-based and online materials which have online mentoring sessions with their teacher through chat, and are subscribed to a class email list. Or a Web-based training course can be enhanced by periodic face-to-face instruction. “Blending” was prompted by the recognition that not all learning is best achieved in an electronically-mediated environment, particularly one that dispenses with a live instructor altogether. Instead, consideration must be given to the subject matter, the learning objectives and outcomes, the characteristics of the learners, and the learning context in order to arrive at the optimum mix of instructional and delivery methods.

### **The Open and Distance Learning**

Open and distance learning is defined by the Commonwealth of Learning as “a way of providing learning opportunities that is characterized by the separation of teacher and learner in time or place, or both time and place; learning that is certified in some ways by an institution or agency; the use of a variety of media, including print and electronic; two-way communications that allow learners and tutors to interact; the possibility of occasional face-to-face meetings; and a specialized divisions of labour in the production and delivery of courses.”

### **A Learner-Centered Environment**

The National Research Council of the U.S. defines learner-centered environments as those that “pay careful attention to the knowledge, skills, attitudes, and beliefs that learners bring with them to the classroom.” The impetus for learner-centeredness derives from a theory of learning called constructivism, which views learning as a process in which individuals “construct” meaning based on prior knowledge and experience. Experience enables individuals to build mental models or schemas, which in turn provides meaning and organization to subsequent experience. Thus knowledge is not “out there”, independent of the learner and which the learner passively receives; rather, knowledge is created through an active process in which the learner transforms information, constructs hypothesis, and makes decisions using his/her mental models. A form of constructivism called social constructivism also emphasizes the role of the teacher, parents, peers and other community members in helping learners to master concepts that they would not be able to understand on their own. For social constructivists, learning must be active, contextual and social. It is best done in a group setting with the teacher as facilitator or guide.

### **Information and Communicational Technology (ICT) in Education**

Most analyses of ICT in the educational sector focuses on the impact it has had on pupil in teaching/learning situation. However, I would like to analyze the role of ICT in education in three parts:

- Changes in the management of the educational sector associated with ICT.
- Changes in the work process in education associated with ICT.
- Changes in the training of educational personnel and of students associated with ICT.

### **ICT and Management of the Educational Sector**

As in business, ICT has contributed greatly to networking among schools and universities and among individuals in the school system. This has been true especially in the developed countries, and is now spreading to developing countries. For example, Enlaces - the Chilean government’s educational ICT system has made a priority of connecting rural schools to the internet and thereby integrating them more tightly into the larger educational system, and hooking them up to the outside world. Many school districts and almost all universities now communicate internally and externally largely through e-mail. Educational administrative offices in most developed countries have ICT, and data collection which is universally computerized. As in developed countries, such ICT systems have been used mainly for collecting enrolment data, student attendance, basic information on teachers, and basic information on schools. In other words, ICT mainly helps administrators get a better idea of the size of the educational system, student dropout and repetition, and the number of students per teacher. In some cases, this can be characterized as measuring the efficiency of the educational system and as a first step in improved resource allocation. Certainly, good school administrators do use data to improve student’s performance, but there is very little evidence that ICT is widely used even in countries where schools have ample computer hardware and software to use available information in this way. Some schools are using special prepared software package that allow teachers and the school to measure student gains on tests and compare test items missed by individuals and the sum of individuals in classroom against the required curriculum.

Table 1: Enabling and Constraining Features Affecting ICT Implementation

<b>Factors</b>	<b>Enabling Features</b>	<b>Constraining Features</b>
<i>Policy framework and implementation plans</i>	Most countries have developed, or are in the process of developing, a road map for the incorporation of ICT in their education systems. Some have detailed implementation plans with priorities and timetables and measurable indicators in place.	The predominant focus is more on the development of ICT operational skills than on the integration of ICT in pedagogical practice.
<i>Advocacy leadership</i>	Progress in the development of policies and implementation plans has typically had champions for ICT in education from various sources: the office staff, and senior staff, and from civil society such as women's and country-based school net organizations.	Advocacy needs to be both visionary and practical in the sense of not raising expectations beyond what is possible in the near term.
<i>Gender equity</i>	A few policies promote gender equity in terms access to ICT and the development of ICT competencies	A larger number of policies do not consider gender equity issues at all and many implementation strategies have not considered the promotion of gender equity.
<i>Infrastructure and access</i>	Cyber cafes in urban areas provide public access for those who can afford to pay. Access for secondary and tertiary education institutions is growing rapidly in urban areas through wireless networks. Growth in mobile phone technology is also growing rapidly.	The major constraints are inconsistent or unavailable supply of electricity, lack of ICT equipment, overcrowding of computer labs, and lack of affordable access to connectivity with acceptance bandwidth.
<i>Collaborating Mechanisms</i>	Collaboration models are emerging at national levels to involve stakeholders in policy development and implementation, to encourage investment in ICT development, and to share access to, and cost of, network accessing.	The notion of international collaboration on matters of content development, training, support services, etc. being explored aggressively.
<i>Human resource Capacity</i>	The need to train teachers in the use of ICT. To develop the user skills among education administrators, and a capacity to provide local support for ICT users is recognized in the policies and plans.	The shortage of skills limits the implementation process
<i>Fiscal resources</i>	Government are starting to recognize the need for investment and many now have ICT.- related	The lack of resources is a serious limitation in all countries. There is a general dependence on donors for the

	line items in their annual budgets.	implementation policy.
<i>Learning content</i>	Initiative to develop on-line content repositories of freely available learning materials are becoming commonplace in the global world of education. These basis in Africa.	The lack of local digital content is a general problem. There is currently substantial reliance on content from the private sector. There is a need to develop materials in indigenous languages. The predominant use of English on the Internet is also constraining.
<i>Procurement regulations</i>	A lot of ICT equipment is normally imported to the country with their accessories.	While a few countries have modified their policies to eliminate or reduce import duties on ICT equipment and software, this is yet to be adopted as widespread practice.
<i>Attitudes</i>	Unlike many parts of the developed world, staff and teachers appear to be more welcoming of the prospect of ICT in education.	Government can encounter inter-ministerial jurisdiction issues regarding the control and management of ICT applications.
<i>Sustainable</i>	There are many examples of schools with ICT equipment and connectivity to the Internet developing services for the wider community on a cost-plus basis in order to generate revenue	Meeting the ongoing costs of maintaining equipment, staff training, connectivity, content materials acquisition, and development and consumables is a major challenge. Some government are allowing an ICT surcharge to be levied on students, but that is discriminatory. Planners need to improve their analysis of the true cost of ownership of the ICT models they adopt.

Source; [www.infodev.org](http://www.infodev.org)

### **ICT and Changes in the Work Process in Education**

ICT can change student and teacher's work around teaching and learning. When computers are readily available for use, students and teachers can do a major part of their school work using web resources. For distance, preparing written work on their computers, and consulting special databases and learning software to help with their math. Teachers can also consult databases for lesson plans, interact with other teachers to share teaching ideas, and help students become more self-sufficient and creative in their schoolwork. A good example of changes in work practices is the United States America that introduced laptops for all students and has trained teachers to organize teaching around students' doing all their written assignments on their laptops.

Therefore, beyond putting computers into classrooms or into computer labs and employing them for training pupils in computer use; some add-on Web-based activities; or having pupils use student-centered individualized learning games, changing teaching practices around ICT requires a major investment in developing new teacher ICT skills and in training teachers to teach differently using ICT. The downside of this proposition is that in many countries teachers lack adequate content

knowledge to teach even basic academic skills to primary school pupils. Thus, providing this kind of training to teachers is a tall order. The upside is that as a new generation of teachers, raised as children on ICT use, enter the schools, ICT training costs will fall substantially. Indeed, eventually, as training and hardware costs fall, we can assume that teachers will use ICT as easily as they use books today. Nevertheless, unless teacher content knowledge also increase substantially, we may see little, or no increase in students' achievement beyond the improvements facilitated by computer-assisted drill and practice.

### **The Academic Benefits of Using ICT in Education**

Research on cognitive impacts addresses the effect of ICT both on what students think (intellectual content) and on how students think (intellectual competence). Studies of the effect on intellectual content focus on the relative advantages of ICT in the delivery of instruction in traditional subject areas, and measure the effect in terms of standard subject area achievement examinations. Studies of how students think, researchers are primarily concerned with postulated side-effects of ICT on students' reasoning skills. Thus, contrary to idealistic notions of changes in student thinking, particularly the enhancement of problem-solving skills through ICT in schools, there is little or no evidence that this occurs. On the other hand, ICT may be rather effective in increasing student performance on standardized tests by employing CAI, especially in conjunction with teacher- student interaction around imaginative drill and practice software (improving what students learn). Without ICT as a supplement to improve test score results may however, be seen to be more effective than traditional teaching alone hence is much more applied. Similarly, using computers to teach middle and high school students to become familiar with standard ICT business applications is also fairly ubiquitous for the obvious reason that it contributes directly to students' ability to earn a livelihood.

However, an important caveat in all these conclusions is that there is relatively little research on the academic effects of students' Internet use, and this is becoming the dominant form of ICT in schools. There is little doubt that the Internet allows for more student independence in learning. But does this benefit all students in similar fashion? Are the effects on learning significant? These are important questions for future research.

### **Flexibility of Use**

Previously, ICT-use required students to be grouped together in a controlled environment at a specific time and location. With some technologies, for example radio and television, use was rigidly tied to schedule developed by people far removed from the day-today functioning of the classroom. New ICT applications have given rise to the term "any-time-any-place," a reflection of the flexibility possible in using ICT to support teaching and learning. One outgrowth of this flexibility has been the development of "virtual" educational experiences. A virtual experience refers to educational situations in which distance and time separate the teacher and students, who use ICT to interactively share resources. Virtual education allows students to study at their own pace, time, and pace. In essence, a virtual education means having educational transactions accessible from the home, workplace, or anywhere that the student chooses to be. Virtual classrooms, schools, colleges, and universities offering classes by email, computer-mediated conferencing (CMC), videoconferencing, or websites, or combinations of these technologies, are proliferating.

### **Connectivity**

Perhaps the most powerful feature of new ICTs is connectivity. Prior to the 1990s, computers in educational settings were seldom connected to local area networks (LANs) or the Internet. With the

widespread adoption of LANs, decreasing telecommunications costs, increasing bandwidth, and the invention of the World Wide Web (www), and educational access to the Internet is becoming commonplace. If equipped with a computer, appropriate software, and Internet access, students and teachers have access to every other person on the planet that has an Internet account, hundreds of thousands of information archives, and millions of WebPages of educationally relevant content (cf.<http://www.classroom.net/grades>). These four dimensions – integration of multiple media, interactivity, flexibility of use, and connectivity – distinguish digital ICT from previous technologies. Because of these differences, educators are finding power new ways to integrate digital ICTs into the curricula.

### **Effectiveness**

Perhaps the most important question about ICT is how effective is its use in education? To answer this question one must consider three aspects. How effective is ICT-mediated instruction when compared to traditional face-to-face instruction? What does ICT enable that would not otherwise be possible? And is ICT worth its costs?

### **ICT Mediated Instruction**

ICT mediated instruction refers to instruction delivered via a technological channel such as television, radio, or a computer and network. ICT-mediated instruction can be synchronous, with both the instructor and the student participating simultaneously. For example, instruction may be delivered via desktop videoconferencing by a teacher located at a university to employees at widely separated companies. ICT-mediated instruction may also be delivered asynchronously, with the instructor and student participating at different times. Instruction based on teaching materials placed on a website does not require simultaneous participation. Or synchronicity may not matter, as when self-contained instructional materials are packaged on a CD-ROM. In this case, the instructional designer may have developed the materials months or even years before the student uses them and communication between the two is impossible.

### **Enabling Collaboration**

Not all resources are inanimate. ICT enables education between individuals and groups of people. Such collaborations may take place locally or between people in widely separated geographical locations. They may be temporary or long-term. Students may collaborate with peers in other schools community which may serve as mentors to students, scientists in government agencies may work with school children, and so forth. Only educational usefulness and access to ICT limit the possibilities. Email, computer-mediated conferencing, and desktop videoconferencing are all being used to support collaboration between individuals and groups.

### **Online Mentors**

ICT can also enable mentoring programs to provide one-on-one guidance to individuals by well-established members of a particular community. Such virtual collaborations between individuals are an effective ways for senior members of a community to teach, inspire, and support newcomers.

### **Virtual Learning Communities**

ICT makes it possible to engage people in widely dispersed in “virtual learning communities.” Virtual learning communities are learning groups based on shared purpose, not artificial distinctions of the location or age. Through ICT, learners can be drawn together from almost

anywhere, and they can construct their own formal or informal learning groups. Such communities may transverse barriers of time, geography, age, ability, culture, and social status.

### **Lifelong Learning**

Unlike in the past when a person's education took place for a specific period of time during their youth, education is now widely seen as a continuing activity taking place throughout the lifespan. Establishing lifelong learning habits among citizens and providing lifelong learning opportunities have become a major goal of government initiatives worldwide. Lifelong learning is thought to be important for at least two reasons. First, it is no longer possible to master an entire discipline in a few short years. The amount of information available and the speed at which new information is being created makes this impossible. Consider, for example, that printed scientific information has been published in the last 10 years (Odlyxko, 1996). Second, career changes are becoming more frequent as are changing requirements within individual professions. For example, the People's Republic of China is facing changes of unprecedented magnitude in its traditional industries, and a large number of workers are being forced to change careers or take early retirement. In order for these industries to survive and to take advantage of market opportunities, the workforce will need to be upgraded to work at higher knowledge levels with new technology (Wu & Qilian 1998).

### **Conclusion**

Education everywhere in the world, including in the (Organization for Economic Cooperation and Development (OECD), international organization founded in 1961 to coordinate the economic policies of industrialized nations) is largely publicly financed and publicly provided. ICT is rapidly becoming ubiquitous in developed countries' public schools and is spreading in developing countries' educational systems. As is evidenced by the OECD's recent case studies of schools in 23 countries, ICT is being used in many imaginative ways to teach higher order reasoning skills.

### **Recommendations**

- 1) Compulsory re-training programme for teachers/lecturers should be put in place vigorously to update their ICT knowledge. This is only the possible way in which the role of ICT in our educational system can be effective. In fact it is this retracing programme that can remove the negative phobia from the old teacher/lecturers.
- 2) The government at various levels and corporate bodies should as a matter of necessity participate actively and meaningfully in providing ICT based equipment and accessories. This can be in the form of purchasing adequate computers for schools and colleges. Others include building ICT laboratories coupled with their maintenance.
- 3) Laboratory technicians and technologists should be specially trained and deployed to various schools to take care of ICT equipment. This step will sustain adequate maintenance of computers and other accessories which are very sensitive to rough-handling.
- 4) There should be adequate or regular power supply to motivate the ICT gadgets regularly with the recommended voltage. Efforts should be made by the various schools administrators to ensure an alternative power supply to bridge the gap often created by the irregular power supply by power holding company of Nigeria (PHCN). This can be in the form of providing Electricity generating plants.
- 5) Finally, the library in each school should be well equipped with relevant and current ICT related textbooks to facilitate the embracing of the application of ICT in our educational system both on the part of students, and teachers/lecturers.



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